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# Engineering Evaluation and Cost Analysis
# Gull Rock Light Station

USCG Civil Engineering Unit Cleveland

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# Executive Summary

As provided in Executive Order 12580 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the U.S. Coast Guard (USCG) is acting as the lead agency in implementing this Non-Time-Critical Removal Action under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) at the USCG Gull Rock Light Station (Site) located in Lake Superior off the Keweenaw Peninsula in Michigan's Upper Peninsula. This Engineering Evaluation/Cost Analysis (EE/CA) was developed in accordance with United States Environmental Protection Agency's (USEPA's) *Guidance for Conducting Non-Time-Critical Removal Actions Under CERCLA* (USEPA, December 1993).

The USCG Gull Rock Light Station property occupies approximately 0.719 acres of land located approximately 2.5 miles east of the Keweenaw Point on the Keweenaw Peninsula, Michigan in Lake Superior. Gull Rock Light Station was built in 1867 on Gull Rock, which is approximately 150 feet wide by 250 feet long and consists of a keeper's dwelling (built as one and one-half story square wood frame brick building with an adjoining light tower), oil house (built 1906), boat house, and a brick privy. The oil house and boat house have since been demolished. A 40-foot long retaining wall was constructed in 1901 around the northeast corner of the keeper's dwelling/light tower to prevent wave damage. The light was automated in 1913 and maintained by the keepers of the Manitou Island Light. The Gull Rock Light Station is listed on the National Register of Historic Places (List #84001751).

A phase I environmental site assessment (PIESA) was performed in 1997 (*Phase I Environmental Site Assessment: Gull Rock Light, Keweenaw County, Michigan*, Woodward-Clyde Federal Services, November 21, 1997), which identified the potential historic use of lead-based paint and asbestos containing material on the structures at the Site. A phase II environmental site assessment (PIIESA), conducted on the Site in 2004 (*Phase II Environmental Site Assessment for the USCG Gull Rock Light in Copper Harbor, Michigan, February 4, 2004)* by ENSR International (now AECOM) indicated total lead concentrations ranged from 120 milligrams per kilogram (mg/kg) to 2,350 mg/kg in soil samples collected from six inches or less below ground surface (bgs). The lead-impacted soils were encountered adjacent to the light tower/keeper's dwelling building. A subsequent site investigation and characterization, performed in June 2015, delineated the lead-impacted soils laterally within approximately 25 feet of the light tower/keeper's dwelling building, around the former boat house and vertically to depths between the surface and one feet bgs. Total lead concentrations ranged between 3.4 mg/kg and 194 mg/kg in the four (4) soil samples collected during this site investigation.

Lead-impacted soils with characteristically hazardous concentrations [greater than 5.0 milligrams per liter (mg/L)], as defined by the Resource Conservation and Recovery Act (RCRA), by the toxicity characteristic leaching procedure (TCLP)] were not encountered in the four (4) soil samples collected June 2015 on the south and west sides of the light tower/keeper's dwelling. TCLP lead concentrations detected in the soil samples ranged between <0.0020 mg/L and 0.013 mg/L.

Because the Gull Rock Light Station has been determined to be National Register of Historic Places (NHRP) eligible by the USCG and the Michigan State Historic Preservation Agency, a Cultural Resource Survey of the Site was conducted in conjunction with the site investigation. AECOM's archaeological field work covered the entirety of Gull Rock, including areas immediately surrounding the lighthouse structure. The field methodology utilized included pedestrian survey methodology on 2- to 5-meter transect intervals. No cultural materials were found as a result of the survey. Therefore, AECOM recommends that a finding of "No Historic Properties Affected" for archaeological resources for the Site as presently designed. As such, the survey found that proposed soil excavations would have no effect on significant cultural or historical resources. However, because of its historical significance, the USCG would implement any proposed removal action in a way that will not adversely affect the Site.

The selected remedial alternative for the Site is no action since the site soils are below the site-specific remedial action objective (RAO) of 9,303 mg/kg. The site-specific RAO is based on the Risk Evaluation completed for the Site, which took in account exposure factors representative of a recreational exposure as opposed to worker exposure. Therefore, exposure is based on the length of time (three months) a receptor would be able to visit the Site over the course of a year due to climatic conditions. Concentrations less than 9,303 mg/kg will not pose a risk to human receptors under current and reasonably anticipated future land use scenarios. However, the default residential value of 400 mg/kg is still the standard for which an unrestricted use/No Further Action (NFA) classification would be issued for the Site by the State of Michigan.

# 1. Introduction

As provided in Executive Order 12580 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the U.S. Coast Guard (USCG) is acting as the lead agency in implementing a Non-Time-Critical Removal Action under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) at the USCG Gull Rock Light Station (Site) located on Lake Superior off the Keweenaw Peninsula in Michigan's Upper Peninsula. This Engineering Evaluation/Cost Analysis (EE/CA) was developed in accordance with United States Environmental Protection Agency's (USEPA's) *Guidance for Conducting Non-Time-Critical Removal Actions Under CERCLA* (USEPA, December 1993). The EE/CA presents a summary of previous investigations at the Site, a streamlined risk evaluation, identification of applicable or relevant and appropriate requirements (ARARs), the objectives of the site characterization and natural and cultural resources surveys, an evaluation of potential remedial alternatives, and a conceptual plan for stakeholder participation.

## 1.1 Site Description

The USCG Gull Rock Light Station property occupies approximately 0.719 acres of land located approximately 2.5 miles east of the Keweenaw Point on the Keweenaw Peninsula, Michigan in Lake Superior. The Site occupies a portion of the southwest quarter of the southwest quarter of Section 18, Township 58 North; Range 25 West (SW ¼, SW ¼, of Sec. 18, T58N, R25W).The Site is predominately rocky, at an elevation of approximately 602 feet above mean sea level (msl). The Site is comprised of discontinuous glacial till over bedrock and is surrounded by Lake Superior. The Site Layout Map is presented as **Figure 1** and site photographs are included in **Appendix A**.

## 1.2 Site History

Gull Rock Light Station was built in 1867 on Gull Rock, which is approximately 150 feet wide by 250 feet long and consists of a keeper's dwelling (built as one and one-half story square wood frame brick building with an adjoining light tower), oil house (built 1906), boat house, and a brick privy (**Figures 1** and **2**). The oil house and boat house have since been demolished. In 1901, a 40-foot long retaining wall was constructed around the northeast corner of the keeper's dwelling/light tower to prevent wave damage. The light was automated in 1913 and maintained by the keepers of the Manitou Island Light. The Gull Rock Light Station is listed on the National Register of Historic Places, with listing number 84001751

## 1.3 Previous Site Assessments

A phase I environmental site assessment (PIESA) was performed in 1997 (*Phase I Environmental Site Assessment: Gull Rock Light, Keweenaw County, Michigan*, Woodward-Clyde Federal Services, November 21, 1997). The results of the PIESA indicated the following:

- Lead-based paint is suspected to be present in the light tower, other structures at the facility, and possibly in soil surrounding the existing and former structures;
- Asbestos-containing material may be present in the keeper's dwelling;

A phase II environmental site assessment (PIIESA) was conducted on the Site by ENSR International (now part of AECOM) in September 2004 (*Phase II Environmental Site Assessment for the USCG Gull Rock Light in Copper Harbor, Michigan*, *February 4, 2005*). The PIIESA included the advancement of seventeen (17) shallow hand auger borings (G-1 through G17) that were advanced around the Gull Rock Light structure. Seventeen soil samples were collected for field screening of lead utilizing x-ray fluorescence (XRF) analyzer. Eleven of the seventeen soil samples were submitted for laboratory analysis of lead. The boring locations are illustrated on **Figure 2**.

The results of the PIIESA (**Figure 3**) indicated lead concentrations measured with the XRF ranged from 115±120 part per million (ppm; G-6) to 2,340±240 ppm (G-10). Laboratory samples for lead ranged from 120 milligrams per kilogram (mg/kg, G-6) to 2,350 mg/kg (G-10). Lead concentrations in 7 (G-1, G-4, G-5, G-8, G-9, G-10 and G-11) of the 11 soil samples are above the Michigan Department of Environmental Quality (MDEQ) Direct Contact Criteria for residential properties of 400 mg/kg. In general, the highest lead concentrations were documented in the soil samples collected from the southeast (downwind) corner of the lighthouse keeper's dwelling. Based upon the results of the PIIESA, lead impact was not delineated and further investigation was recommended.

# 2. Site Characterization

## 2.1 Local and Regional Geology and Hydrogeology

The geology of Michigan spans more than 3.5 billion years, from Late Precambrian bedrock formed from volcanic eruptions to loose, unconsolidated drift left behind by the continental ice sheets of the Pleistocene Epoch. The igneous and metamorphic bedrock of the western Upper Peninsula (UP) of Michigan comprises the Precambrian, or Canadian Shield, the original core (craton) of the North American continent (Sommers 1984) and the largest exposure of Precambrian rock anywhere in the world. The igneous rocks are hard, crystalline, resistant to erosion, and are largely made up of granites; the metamorphic rocks are mainly gneisses and schists.

The higher areas in the UP, such as the Porcupine and Huron mountains in the western UP, are the remnants of ancient peaks that have been worn down over millions of years by the erosive action of wind, water, and moving ice. Across the UP, bedrock is overlain by unconsolidated material deposited during continental glaciation. Pleistocene glaciation moved down, and sometimes across, the Lake Superior Syncline, scooping out earlier deposits and exposing Precambrian rock. Consequently, in the western portion of the UP, a considerable amount of bedrock is visible. As the glaciers retreated, morainal deposits were left at the southwest end of Lake Superior, one of the very few non-Precambrian deposits in this location. The more resistant underlying rocks were left as prominent hills, including Isle Royale and the islands around it. After the glaciers melted, the Lake Superior Syncline filled with water. Presently, Lake Superior is 602 feet (0.18 kilometers) above sea level. Old, wave-cut terraces or beach terraces are considerably above the modern lake level, which are the product of isostatic rebound. The weight of the glaciers had depressed the rock beneath it. Once the weight was removed, the land began to rise, and continues to do so today, in a process called “glacial rebound” (Warburton 2000). Today, elevations throughout the UP range from approximately 600 feet (.18 kilometer) along the Great Lakes to 1,900 feet (0.58 kilometer) inland (Jerome 2006).

The western UP is located in the Superior Upland Province, a physiographic region that is the only portion of the Canadian Shield in the United States (US). This geological province is the southern extension of the Laurentian Upland Province (USGS 2014).

The Keweenaw Peninsula is on the margin of the Lake Superior segment of the Midcontinent rift system, which extends northeasterly from Kansas to Lake Superior and then southeasterly through Lower Michigan. In the Late Precambrian, basalt flows were extruded from the rift system. Up to 30,000 feet (9.14 kilometers) thick, about 400 distinct lava flows and minor clastic rocks covered a large area and now comprise the Portage Lake Volcanics (Albert et al. 1994). Post-volcanic Precambrian sedimentary rocks include 20 to 30 interbedded conglomerate and sandstone layers, comprising the Copper Harbor Conglomerate and Freda Sandstone, respectively (Huber 1975).

The mass of the thick Keweenawan rocks caused a general sinking of the land, and formed a very large geosyncline, referred to as the Lake Superior Syncline. Some faulting also was associated with the downward sagging (Warburton 2000). The Project Area lies near the Keweenaw Fault (Sommers 1984).

Soil samples collected on the Site consisted of approximately six inches or less of decaying organic matter and weathered bedrock, which was sparsely located across the Site. The soil overlaid a sandstone conglomerate, which was largely exposed across the Site. No groundwater was encountered nor is anticipated to be encountered at the Site. Water encountered at the Site is likely surface water infiltration from Lake Superior.

## 2.2 Source, Nature and Extent of Contamination

AECOM conducted a site investigation in June 2015 (**Figure 3**). Laboratory analytical samples were collected to horizontally and vertically delineate the extent of lead-impacted soils observed during the investigation. In addition, soil samples were collected to characterize the soil for hazardous concentrations of lead and for potential disposal in a licensed landfill. Surface water samples from around the Gull Rock Light property were also collected to evaluate potential impacts to the aquatic environment at the Site. A site-specific Health and Safety Plan (AECOM, 2010) was developed prior to mobilization to the Site by AECOM that established health and safety procedures to minimize any potential risk to AECOM. The Site activities were completed in accordance with AECOM's Field Sampling Plan (FSP; AECOM, March 18, 2015), included in **Appendix B**, and Quality Assurance Project Plan (QAPP; AECOM, March 18, 2015).

### 2.2.1 Soil Sampling Locations and Methods

Four boring locations (G-21, G-22, G-25 and G-26) were sampled utilizing a hand auger. Due to the abundant rock present and the absence of soil encountered during the field investigation, AECOM field personnel were unable to collect more than four (4) soil samples from the proposed 13 locations outlined in the Field Sampling Plan (FSP). Soil samples were collected from the surface to six inches bgs and screened using an XRF, calibrated to zero parts per million (ppm) for lead. If the XRF measured lead in the soil sample collected at concentrations of 300 ppm (equivalent to 300 mg/kg) or higher, AECOM would attempt to relocate to an area approximately ten (10) feet away from the initial sampling in order to delineate the horizontal extent of the impacted soils.

Soil samples were submitted to CT Laboratories LLC of Baraboo, Wisconsin for total lead analysis and hazardous soil characterization determination. Soils were considered hazardous if laboratory analytical results indicated the soils were characteristically hazardous, as defined by the Resource Conservation and Recovery Act (RCRA), by the toxicity characteristic leaching procedure (TCLP). Lead impacted soil is considered to be characteristically hazardous if the TCLP analysis results in a concentration of 5.0 mg/L or higher.

As indicated above, sampling locations were determined based on the PIIESA analytical, the site investigation field screening results and site constraints associated with the rock surface. Soil sampling locations are presented on **Figure 2**.

### 2.2.2 Surface Water Sampling Locations and Methods

Surface water samples were collected from 25 feet from the shore of Gull Rock in four (4) locations evenly spaced around the perimeter of Gull Rock. One additional sample was collected from the mid-way point (approximately 1,330 feet) between Gull Rock and Manitou Island. Surface water samples were submitted to the laboratory for total lead analysis, pH, alkalinity, and hardness.

### 2.2.3 Soil Sample Handling and Analysis

Soil samples collected for total lead analysis (EPA Method 6010) and lead analysis by TCLP (EPA Methods 6010 and 1311) were containerized in laboratory-provided four ounce plastic sample jars. Each sample container was filled to capacity with the soil from the sampling locations. Following sample collection, each sample container was appropriately labeled, placed in re-sealable plastic bags, and packed on ice in an insulated container. A chain of custody form was filled out upon completion of sampling and accompanied the samples to the laboratory. Samples were transported to the laboratory via overnight courier.

### 2.2.4 Surface Water Sample Handling and Analysis

Surface water samples were collected in laboratory provided 250 milliliter (ml) plastic containers with the appropriate preservative, if required. Total lead and hardness samples were preserved with nitric acid ($HNO_3$) to pH<2. Surface water samples for pH and alkalinity were collected in unpreserved 250 ml plastic bottles. Each sample container was filled to capacity with the surface water from the sampling locations. Following sample collection, each sample container was appropriately labeled, placed in re-sealable plastic bags, and packed in an iced, insulated container. A chain of custody form was filled out upon completion of sampling and accompanied the samples to the laboratory. Samples were transported to the laboratory via overnight courier.

### 2.2.5 Soil Investigation

The results of the soil investigation conducted in June 2015 indicated total lead was below the Project Action Limit (PAL) of 400 mg/kg in all four (4) samples collected. The PAL was derived from the residential land use category values evaluated from the USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites table, dated May 2013, and the MDEQ, Remediation and Redevelopment Division (RRD) Operational Memorandum 1 – Part 201 Generic Cleanup Criteria and Screening Levels/Part 213 Risk-Based Screening Levels table, dated December 30, 2013. Total lead concentrations ranged between 3.3 mg/kg (G-25) and 194 mg/kg (G-21) in the near surface (surface to six inches bgs) samples.

Lead-impacted soils with characteristically hazardous concentrations (greater than 5.0 mg/L) were not encountered on the Site during this phase of the investigation. TCLP lead concentrations in the soil samples ranged between <0.0020 mg/L (G-26) and 0.013 mg/L (G-21). The laboratory analytical report is included in **Appendix C**. Investigation soil sample field screening and laboratory analytical results are summarized in **Table 1** and presented on **Figure 3**. Based on the results of the site investigation conducted in June 2015, lead contamination was not found beyond what was discovered during the PIIESA completed in September 2004.

The results of the PIIESA indicated lead concentrations measured with the XRF ranged from 115±120 ppm (G-6) to 2,340±240 ppm (G-10). Laboratory samples for lead ranged from 120 mg/kg (G-6) to 2,350 mg/kg (G-10). Lead concentrations in seven (7) (G-1, G-4, G-5, G-8, G-9, G-10 and G-11) of the eleven (11) soil samples are above the Michigan Department of Environmental Quality (MDEQ) Direct Contact Criteria for residential properties of 400 mg/kg. Based upon the results of the PIIESA, lead impact is evident around the east, west and south sides of the lighthouse keeper’s dwelling. In general, the highest lead concentrations were documented in the soil samples collected from the southeast (downwind) corner of the lighthouse keeper’s dwelling (**Figure 3**).

### 2.2.6 Surface Water Investigation Results

The results of the surface water investigation indicated total lead was below the method detection limit (MDL) of 2.0 ug/L and the PAL of 4.0 ug/L for all five (5) samples analyzed. The PAL was derived from the residential land use category values evaluated from the USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites table dated May 2013 and the MDEQ, RRD Operational Memorandum 1 – Part 201 Generic Cleanup Criteria and Screening Levels/Part 213 Risk-Based Screening Levels table dated December 30, 2013. Surface water sample laboratory analytical results are summarized in **Table 2** and presented on **Figure 3**. Based on the results of the site investigation, the surface water near Gull Rock has not been impacted by lead.

### 2.2.7 Data Validation

Inorganic data quality was evaluated by reviewing the following parameters: holding times, matrix spikes, initial calibrations, continuing calibration verification standard recoveries, contract required detection limit standard recoveries, laboratory control samples, Inductively Coupled Plasma (ICP) interference check sample recoveries, ICP serial dilution results, field and laboratory duplicates, laboratory blanks, and analyte quantitation. The data validation report is included in **Appendix D**.

For the soil sample set, all data have been determined to be useable for the purpose of assessing the presence/absence and quantitative concentrations of the analytes/compounds in the media tested (i.e., soil) with the qualifications presented on the soil analytical results table (**Table 1**). No data points were rejected. Completeness of 100% was achieved for the soil data set, which is acceptable.

For the surface water sample set, all data have been determined to be useable for the purpose of assessing the presence/absence and quantitative concentrations of the analytes/compounds in the media tested (i.e., surface water) with the qualifications presented on the surface water analytical results table (**Table 2**). No data points were rejected. Completeness of 100% was achieved for the surface water data set, which is acceptable.

## 2.3 Risk Evaluation

Based on the results of the PIIESA, the only chemical of concern at the Site is lead, which originated from the historical use of lead-based paint at the Site. Lead was not detected in any of the five surface water samples collected; therefore, any potential effects from lead in surface water are considered minimal, and it is not evaluated further. The risk assessment report is included in **Appendix E**.

A PAL for lead in soil was established in the USEPA approved Quality Assurance Project Plan (QAPP) (AECOM, April 2015). The PAL was based on the USEPA Regional Screening Level (RSL) and the MDEQ criterion for lead in soil in a residential scenario. The more conservative of the two values (400 mg/kg) was established as the PAL. Although lead concentrations detected in the four soil samples collected in 2015 did not exceed the PAL, several concentrations detected in the locations sampled in 2004 did exceed the PAL (see **Appendix E, Risk Evaluation Table 1**). Because the PAL is conservatively based on protection of human health in a residential scenario, an unlikely occurrence at this site, risk-based Alternate Concentration Limits (ACLs) were identified in order to determine if lead concentrations in the soil on the Site pose a risk to human health or the natural environment. ACLs for both human and ecological receptors are identified in the following sections.

### 2.3.1 Exposure Assessment

Currently, no one resides on the island full-time, and the site is generally unoccupied. Under existing and future land use conditions, receptors with the potential to be exposed to site contamination include a person who visits the site during the warmer months of summer and fall for recreational purposes. This person might visit the site to explore the lighthouse and grounds or fish from the shoreline or picnic on the grounds.

For development of the alternative land use scenario, the assumption is made that each of these individuals might conservatively visit the site one day per week during the three month period of warmest weather, spending one or two hours at most during each visit. Potential pathways for recreational visitors to be exposed to surface soil include incidental ingestion, dermal absorption, and inhalation of particulates. Exposure factors, including exposure frequency, duration, and time, would be similar for both types of recreational visitors.

### 2.3.2 Human Health Risk

USEPA considers lead a special-case chemical and evaluates human exposure to it by the use of blood-lead modeling to relate soil lead intake to blood lead concentrations. For the Gull Rock Light Station, two USEPA models were considered: The Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children (USEPA, 2007) and the Adult Lead Methodology (ALM; USEPA, 2009). The IEUBK model estimates blood lead levels in children exposed to lead, and the ALM focuses on estimating fetal blood lead concentrations in non-resident adults. Based on the location and site characteristics of the Site, an adult visiting the Site to fish or picnic is considered the most likely receptor, and the ALM was chosen as the best model to use in evaluating that receptor.

The ALM model was used to determine a screening level for the Site (see **Appendix E, Risk Evaluation Table 2**). This screening level is the lead concentration in soil that would result in no more than a 5 percent probability of a fetal blood lead level exceeding 10 micrograms per deciliter (µg/dL). Most default values in the model were retained, as they are supported by the most current studies and literature. However, the default values are based on a worker exposure, and several of the exposure factors are not representative of a recreational exposure. Therefore, the default averaging time of 365 days per year was revised to 90 days per year, based on the length of time (three months) a receptor would be able to visit the Site over the course of a year due to climatic conditions. The exposure frequency of 219 days per year was revised to 13 days per year, reflecting one weekly visit to the same Site over the course of three months. Using these factors, the model calculated a lead screening level for soil of 9,303 mg/kg.

This value of 9,303 mg/kg can be used as the ACL for the Site. Any concentrations less than 9,303 mg/kg will not pose a risk to human receptors under current and reasonably anticipated future land use scenarios. However, the default residential value of 400 mg/kg is still the standard by which unrestricted use/No Further Action (NFA) should be measured.

**Table 1** of the **Risk Evaluation** contained in **Appendix E**, presents a comparison of the soil lead concentrations to both the PAL and the ACL for human health. Seven locations have lead concentrations that exceed the PAL, but none exceed the ACL. USEPA's ProUCL software was used to calculate summary statistics for the data set, including the mean, maximum, and 95 percent upper confidence level of the mean (95% UCL). As shown on **Table 1** of the **Risk Evaluation** in **Appendix E**, each of these values exceeds the PAL but does not exceed the ACL.

As mentioned above, seven (7) of the locations (G-1, G-4, G-5, G-8, G-9, G-10, and G-11) have lead concentrations that exceed the PAL (400 mg/kg). However, not all locations will need to be remediated in order to achieve the PAL. A desktop virtual remediation exercise was conducted to determine which locations would need to be remediated in order to achieve the PAL of 400 mg/kg. The rationale for this is based on the potential receptor exposure to site contamination.

The assumption is that a receptor would be equally exposed to contamination throughout the Site and therefore the exposure potential is best represented by a site-wide mean concentration (conservatively estimated based on the 95 percent upper confidence level of the mean [95% UCL]). The desktop virtual remediation was conducted by ranking all Site concentrations from high to low and then removed the highest concentration locations one-by one and re-running the 95% UCL concentrations until the point where the site-wide concentration is below the PAL. This exercise determined that remediation of six (6) of these locations (G-1, G-4, and G-5 along the western wall of the main structure; and G-8, G-10, and G-11 along the southern wall of this structure) would produce a 95% UCL that is below the unrestricted residential level of 400 mg/kg.

### 2.3.3 Ecological Risk Evaluation

Gull Rock Light Station is an irregularly shaped, rocky island with an area of approximately 0.7-acre. The limited soil present generally consists of silt to a depth of approximately six inches bgs. The weathered bedrock is a sandstone conglomerate. The center of the island is covered by the brick lighthouse/former keeper's dwelling and privy. Vegetation on the island is very sparse. In areas where vegetation is present, such as around the lighthouse, the plants species identified were typical of disturbed areas and consist of herbs and a few shrubs.

A rare species review by the Michigan Natural Features Inventory identified no recorded occurrences of federally listed species within 1.5 mile of the island. The state listed or state special concern species within this area include herbaceous plants and the bald eagle. None of these species is known to occur on the Site. A field survey completed on June 9, 2015 found no threatened or endangered species present on the Site. In addition, this survey found no evidence of avian nesting activities.

Ecological receptors on the Site potentially could be exposed directly to the lead contaminant identified in surface soil. Transport of lead from soil to surface water surrounding the island potentially could occur through soil erosion; however, lead was not detected in surface water. The ecological receptors observed on the island are relatively common vegetation species typical of disturbed areas. As such, these few plants are not considered to warrant identification as assessment endpoints. Another category of receptors with the potential to occur on the island occasionally during the summer are birds, particularly piscivorous shorebirds such as gulls and terns. Therefore, these shorebirds are identified as assessment endpoints. Birds have not been observed nesting on the island. Ingestion of soil to obtain grit for digestion is the only pathway by which shorebirds visiting the Site may have the potential for exposure to lead in soil.

USEPA has developed Ecological Soil Screening Levels (Eco-SSLs) to be used as conservative screening levels protective of ecological receptors that commonly come into contact with soil or ingest biota that live in or on soil (USEPA 2005). Eco-SSLs were derived separately for plants, soil invertebrates, mammals, and birds. Only the Eco-SSLs for birds are relevant to the assessment endpoint for the Site. Avian Eco-SSLs were derived for three avian receptor groups: herbivores (dove), ground insectivores (woodcock), and carnivores (hawk).

The Eco-SSL for the hawk is the most relevant SSL to a shorebird. However, there are significant differences between the exposure pathways and frequencies assumed in calculation of the hawk SSL and the potential exposures of shorebirds to lead in soil on the Site. For example, derivation of the hawk SSL assumed a diet consisting entirely of small mammals that are exposed to lead-contaminated soil and 100 percent use of the Site as a source for the hawk’s diet. In contrast, shorebirds feed on fish and other aquatic organisms that are not exposed to soil, and the Site would be expected to provide no more than a small proportion of the soil ingested for grit given the very small area of the island relative to the large foraging ranges of shorebirds and their infrequent use of the island during only a portion of the year.

Thus, the Eco-SSL based on a hawk is an extremely conservative basis for screening lead levels in soil on the Site.

The Eco-SSL for the hawk (avian carnivore) is 510 mg/kg in soil. This SSL is exceeded by the mean lead level in the soil samples collected on the Site (716 mg/kg). Calculation of a hazard quotient (HQ) based on the mean and the SSL yields an HQ of 1.4. Calculation of an HQ based on the maximum detected concentration (2,350 mg/kg) yields an HQ of 4.6. Seven soil samples adjacent to the walls of the lighthouse/former keeper’s dwelling exceed the SSL. None of the eight (8) soil samples from other parts of the island away from the dwelling exceed the SSL. Thus, the mean concentration only slightly exceeds the SSL, and the maximum detected concentration and other exceedances of the SSL occur at locations adjacent to the structure. If the exposure concentrations for a shorebird on Gull Rock were modified by an area use factor that reflects its infrequent use of the island but is still conservative (e.g., 20 percent), the resulting mean (143 mg/kg) and maximum concentration (470 mg/kg) would be less than the SSL. This remains a highly conservative comparison because USEPA’s derivation of the SSL assumes a diet 100 percent contaminated by lead from the site. In reality, lead was not detected in surface water around the island, and the aquatic organisms (fish and invertebrates) consumed by shorebirds would not come in contact with lead in terrestrial soil on the island. Thus, the food consumed by shorebirds would not be expected to contain elevated levels of lead from island soil.

In summary, the potential for exposures of ecological receptors to the small area of contaminated soil on the Site is minimal. The avian receptors evaluated as assessment endpoints have a very limited potential for exposure to lead-contaminated soil on the island and would be present for only the warmer portion of the year. The results of the screening of soil concentrations and consideration of the basis of the SSLs indicate that the lead concentrations in soil on the Site do not pose significant risk to ecological assessment endpoints. Remedial activities would not need to be conducted to be protective of ecological receptors.

# 3. Remedial Action Objectives

As provided in Executive Order 12580 and the NCP, the USCG is acting as the lead agency in implementing a Non-Time-Critical Removal Action under CERCLA for the Gull Rock Light Station. The primary objective of the proposed remedial actions is to protect the public health, welfare and the environment. MDEQ and the USEPA established a residential direct contact criterion and screening level for lead of 400 mg/kg, which was identified as the most stringent cleanup goal applicable to the Site. Therefore, an initial PAL of 400 mg/kg was established as a cleanup goal for lead in soil at the Site. However after the completion of a Risk Evaluation (Section 2.3) by AECOM, a value of 9,303 mg/kg was established as an ACL or the Remedial Action Objective (RAO) for the Site.

As indicated in Section 2.3, the only COC identified at the Site is lead in soil. The 9,303 mg/kg total lead concentration as the RAO for soil is expected to be protective of all potential exposure pathways for the current and anticipated future land use as a recreational area/point of interest and will eliminate the need for land use restrictions.

Lead was not detected in soil above the ACL or RAO and appears confined to the near-surface soil near the existing historical structures at the Site. No other potential sources of soil or groundwater contamination have been identified at the Site.

## 3.1 Scope and Justification

The USCG is proposing to remove soils, if needed, impacted by lead above the RAO and dispose of the impacted soil at an appropriately licensed landfill. **Figure 3** illustrates the proposed extent of soil above the RAO. The purpose of the assessments, investigations, evaluations, and future actions completed by the USCG is to minimize threats to and provide protection of public health, welfare and the environment by:

- Preventing risk of exposure through dermal contact, ingestion or inhalation of lead-impacted soil during future recreational use of the Site or potential construction activities on site; and
- Preventing risks due to the migration of lead from soils to groundwater or surface water at concentrations above state and federal drinking water or groundwater/surface water criteria.

## 3.2 Identification of ARARs and TBCs

As required under Section 121(d) of CERCLA, as amended by the 1986 Superfund Amendments and Reauthorization Act (SARA), and Section 300.415(i) of the NCP, on-site removal actions conducted under CERCLA are required to meet federal and state environmental laws or regulations that are applicable or relevant and appropriate requirements (ARARs) “to the extent practicable, considering the exigencies of the situation.” Federal ARARs are to be considered in formulating a removal action. State requirements that are promulgated and more stringent than federal requirements are also to be considered to the extent practical, given the exigencies of the situation.

ARARs can include cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a site. Non-promulgated advisories, criteria or guidance issued by federal or state governments are not legally binding, but can be referenced as to be considered (TBC) if they are useful in interpreting ARARs and in evaluating and selecting removal action criteria. The ARARs and TBCs are typically divided into three categories: chemical-specific, action-specific, and location-specific.

Federal statutes, regulations, criteria and guidance were reviewed to identify ARARs and TBCs for the removal action. In addition, the USCG submitted a letter to the MDEQ on September 8, 2015, requesting identification of ARARs to address potentially impacted soil at the Site (See **Appendix F**).

The USCG was provided a general list of state ARARs from the MDEQ on September 28, 2015 that should be considered for cleanup projects. The listings were assessed to identify requirements that are considered to be ARARs or TBCs for the planned site-specific removal action.

### 3.2.1 Chemical-Specific

Chemical-specific requirements, criteria and guidance set health- or risk-based concentration limits or ranges for specific hazardous substances in various environmental media. These ARARs or TBCs provide site cleanup levels or a basis for calculating cleanup levels. The following chemical-specific ARARs and TBCs were identified for the Site:

- Federal
  - ARARs
    - Clean Water Act of 1972 (Title 33 U.S.C. Section 1252 et. Seq.), as amended
    - Water Quality Standards (Title 40 CFR Part 131), as amended
    - Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (USEPA, 1994) and Clarification to the 1994 Revised Interim Soil Lead (Pb) Guidance for CERCLA Sites and RCRA Corrective Action Facilities (USEPA, August 1998)
    - Ecological Soil Screening Levels (Eco-SSLs), OSWER Directive 9285.7-70 (USEPA, 2005)
  - TBCs
    - User's Guide for the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK), EPA-9285.7-42 (USEPA, May 2007)
    - Update of the Adult Lead Methodology's Default Baseline Blood Lead Concentration and Geometric Standard Deviation Parameters, OSWER 9200.2-82 (USEPA, June 2009)
    - Frequent Questions from Risk Assessors on the Adult Lead Methodology (ALM) (USEPA, November 2013)
- State
  - ARARs
    - Part 201, Environmental Remediation, Michigan Compiled Laws (MCL) Chapter 324: Natural Resource and Environmental Protection Act (NREPA) 1994 PA 451, as amended
    - Part 31, Water Resources Protection, NREPA 1994 PA 451, as amended
    - Part 4, Water Quality Standards, Water Resources Protection, NREPA 1994 PA 451, as amended
  - TBCs
    - MDEQ Remediation and Redevelopment Division (RRD) Operational Memorandum Number 1: Part 201 Generic Cleanup Criteria/Part 213 Risk Based Cleanup Levels (December 30, 2013)
    - MDEQ RRD Operational Memorandum Number 5: Groundwater Surface Water Pathway Criteria (September 2004)

### 3.2.2 Location-Specific

Location-specific requirements, criteria and guidance set restrictions on the types of remedial activities that can be performed based on specific site characteristics or location. Location-specific ARARs and TBCs provide a basis for assessing restrictions during the formulation and evaluation of site-specific remedies. The location-specific ARARs and TBCs identified at the Site were the following:

- Federal
  - ARARs
    - Endangered Species Act of 1973 (Title 50 CFR Part 17 and Part 402), as amended
    - National Historic Preservation Act (NHPA) of 1966 (Title 16, United States Code [U.S.C.] Section 470): Protection of Historic Properties (Title 36, CFR Part 800), as amended
  - TBCs - None
- State
  - ARARs
    - Part 31, Water Resources Protection, NREPA 1994 PA 451, as amended
    - Part 17, Environmental Protection Act, MCL Chapter 324: Natural Resource and Environmental Protection Act (NREPA) 1994 PA 451, as amended
    - Part 91, Soil Erosion and Sedimentation Control, NREPA 1994 PA451, as amended
    - Part 301, Inland Lakes and Streams, NREPA 1994 PA 451, as amended
    - Part 329, Great Lakes Protection, NREPA 1994 PA 451, as amended
    - Part 365, Endangered Species Protection, MCL Chapter 324: Natural Resource and Environmental Protection Act (NREPA) 1994 PA 451, as amended
    - Part 305, Natural Resources, MCL Chapter 324: Natural Resource and Environmental Protection Act (NREPA) 1994 PA 451, as amended
    - Part 411, Protection and Preservation of Fish, Game, and Birds, NREPA 1994 PA 451
    - Part 401, Wildlife Conservation, NREPA 1994 PA 451
  - TBCs
    - Soil Erosion and Sedimentation Control Guidebook (Michigan Department of Technology, Management and Budget, February 2000)
    - State of Michigan Coastal Management Program and Final Environmental Impact Statement (U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Michigan Office of Coastal Zone Management, July 1978)

### 3.2.3 Action Specific

Action-specific requirements, criteria and guidance set controls or restrictions on the design, implementation, and performance of removal actions. These ARARs and TBCs specify performance levels, actions, or technologies and specific levels for discharge of residual chemicals. Action-specific ARARs and TBCs identified for the removal action being evaluated at the Site were the following:

- Federal
  - ARARs
    - Resource Conservation and Recovery Act of 1976 (Title 42, U.S.C. Sections 6901-6939)

- Identification and Listing of Hazardous Waste Regulations (Title 40, CFR Part 261)
- Standards Applicable to Generators of Hazardous Waste Regulations (Title 40, CFR Part 262)
- Standards Applicable to Transporters of Hazardous Waste (Title 40, CFR Part 263)
- Standards For Owners And Operators Of Hazardous Waste Treatment, Storage, And Disposal Facilities (Title 40, CFR Part 264)
- Hazardous Materials Transportation Act (HMTA) as amended by the Hazardous Materials Transportation Uniform Safety Act of 1990, (Title 49, U.S.C. Sections 5101-5127): Regulation of Hazardous Materials Transportation in Commerce (Title 49, CFR Parts 171-173)
- National Historic Preservation Act (NHPA) of 1966 (Title 16, United States Code [U.S.C.] Section 470): Protection of Historic Properties (Title 36, CFR Part 800), as amended
- Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Title 42, U.S.C. Sections 9601-9628), as amended by Superfund Amendments and Reauthorization Act (SARA), October 1986
- National Oil and Hazardous Substances Pollution Contingency Plan (Title 40, CFR Part 300)
- Reporting Hazardous Substance Activity When Selling or Transferring Federal Real Property (Title 40, CFR Part 373)
- Clean Air Act (CAA) of 1970 (Title 42, U.S.C. Section 7401 et seq.): National Preliminary and Secondary Ambient Air Quality Standards (Title 40, CFR Part 50.12)
- Occupational Safety and Health Act of 1970 (Title 29, U.S.C. Section 651 et seq.)
- Occupational Safety and Health Standards (Title 29, CFR Part 1910)
- Safety and Health Regulations for Construction (Title 29, CFR Part 1926)

  – TBCs

- Guidance on Conducting Non-Time-Critical Removal Action Under CERCLA, OWSER Directive 9360.0-32 (USEPA, August 1993)
- Conducting Non-Time-Critical Removal Actions Under CERCLA Fact Sheet, OSWER 9360.0-32FS (USEPA, December 1993)
- Superfund Community Involvement Handbook (USEPA, January 2016)
- Presumptive Remedy for Metals-in-Soil Sites Fact Sheet, OSWER 9355.0-72FS (USEPA, September 1999)

- State
  - ARARs
    - Part 17, Environmental Protection Act, MCL Chapter 324: Natural Resource and Environmental Protection Act (NREPA) 1994 PA 451, as amended
    - Part 111, Hazardous Waste Management, MCL Chapter 324: Natural Resource and Environmental Protection Act (NREPA) 1994 PA 451, as amended
    - Part 91, Soil Erosion and Sedimentation Control, MCL Chapter 324: Natural Resource and Environmental Protection Act (NREPA) 1994 PA 451, as amended
    - Part 55, Air Pollution Control, MCL Chapter 324: Natural Resource and Environmental Protection Act (NREPA) 1994 PA 451, as amended

  - Part 121, Liquid Industrial Waste, MCL Chapter 324: Natural Resource and Environmental Protection Act (NREPA) 1994 PA 451, as amended
  - Part 201, Environmental Remediation, MCL Chapter 324: Natural Resource and Environmental Protection Act (NREPA) 1994 PA 451, as amended
  - Part 305, Natural Rivers, MCL Chapter 324: Natural Resource and Environmental Protection Act (NREPA) 1994 PA 451, as amended
  - Part 329, Great Lakes Protection, NREPA 1994 PA 451, as amended
  - Part 365, Endangered Species Protection, MCL Chapter 324: Natural Resource and Environmental Protection Act (NREPA) 1994 PA 451, as amended
  - Part 401, Wildlife Conservation, NREPA 1994 PA 451
- TBCs
  - MDEQ RRD Operational Memorandum Number 2: *Sampling and Analysis Guidance* (October 2004)
  - MDEQ RRD Operational Memorandum Number 4: *Site Characterization and Remediation Verification* (May 2006, rev. through December 2008)
  - MDEQ Water Bureau Soil Erosion and Sedimentation Control Program, *Soil Erosion and Sedimentation Control Training Manual* (November 2007)
  - Michigan Motor Carrier Safety Code, MCL257.722
  - MDEQ Nonpoint Source Best Management Practices Manual (December 2015)

### 3.2.4 Compliance with ARARs and TBCs

Compliance with the chemical-specific ARARs and TBCs identified for the removal action were discussed in Sections 2.2, 2.3, and 3.0 of this report. Compliance with the action-specific ARARs and TBCs identified for the removal action are discussed in Section 4.0 of this report. A discussion of the location-specific ARARs is presented below.

#### 3.2.4.1 Endangered Species

The proposed project location was checked against documented occurrences of rare species and unique features recorded by the Michigan Natural Features Inventory (MNFI) natural heritage database. In accordance with Part 365 of the Michigan NREPA, a removal action that could adversely affect the potential habitat for state-threatened or state-endangered species would require an Endangered Species Permit from the Michigan Department of Natural Resources (MDNR) Wildlife Division. A copy of the correspondence documenting the rare species review is provided in **Appendix G**.

On June 8, 2015, AECOM requested a MNFI Rare Species Review summarizing the potential to impact State-listed threatened or endangered species during the proposed activities associated with the remediation of lead impacted soils at the Gull Rock Lighthouse (T58N, R26W, Sections 18 and 19), Keweenaw County, Michigan. The MNFI review identified eighteen (18) legally protected species and an additional eight (8) special concern species within 1.5 miles of the project areas. There were no documented occurrences of threatened or special concern species on Gull Rock. Documented species are listed in Tables 1 and 2 in the MNFI correspondence letter provided in **Appendix G**. In addition, a Section 7 Determination for Federally-listed threatened and endangered species was completed by AECOM (**Appendix G**), which identified four species that may be present in close proximity to the project Site.

A field survey was completed on June 9, 2015 in an effort to identify any of the listed species that may occur within the project Site. The area surveyed included the entirety of Gull Rock. The field survey did not result in the identification of any of the state-listed species. No critical habitats for Federal threatened and endangered species were present at or near the Site. Based on the nature and extent of the planned remediation at the Gull Rock Light Station, AECOM, on behalf of the US Coast Guard, has concluded that the proposed activities will have “no effect” on the listed species of their habitats.

#### 3.2.4.2 Natural Historic Preservation Act

AECOM conducted a Phase I Archaeological Survey at the project Site on behalf of the USCG (**Appendix H**). The National Historic Preservation Act (NHPA) and its implementing regulations (Section 106 - 36 CFR 800) require federal agencies to take into account the effects of their undertakings on *historic properties*, as defined, and to afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment. The NHPA and the regulations also require federal agencies to consult with the appropriate State Historic Preservation Offices (SHPOs) or a Tribal Historic Preservation Office (THPO) for projects on tribal lands, federal land managing agencies, federally recognized Native American tribes, and other parties (as defined by 36 CFR 800.2(c) (5)) for undertakings with the potential to cause effects to historic properties. By definition, *historic properties* are any properties listed in, or eligible for listing in, the National Register of Historic Places (NRHP).

An undertaking as defined by 36 CFR 800.16 (y) of Section 106 is any activity using federal funds, requiring Federal permits, or involving Federal properties. In Michigan, the Michigan State Housing Development Authority (MSHDA) serves as the SHPO. Therefore, consultations regarding cultural resources, whether they are NRHP listed or eligible or State-significant, would be with MSHDA. Historical lighthouses are also protected under the National Historic Lighthouse Preservation Act (NHLPA) of 2000.

A review of available data indicated that the Project does not cross any Native American tribal lands; however, consultations with Native American Tribes are not part of the scope of work, but would be needed to confirm this conclusion.

The Gull Rock Light Station was constructed in 1867 on Gull Rock. Gull Rock is approximately 150 feet wide and 250 feet long, and consists of a keeper’s dwelling (built as a 1.5 story, square wood frame brick building with an adjoining light tower), oil house (built in 1906), boat house, and a brick privy. The oil house and boat house structures have since been demolished. In 1901, a 40-foot long retaining wall was constructed around the northeast corner of the keeper’s dwelling/light tower to prevent wave damage. The light was automated in 1913 and maintained by the keepers of the Manitou Island Light. The Gull Rock Light Station is listed on the NRHP, with listing number 84001751.

To commence the Phase I archaeological study, AECOM completed background research and records review at the MSHDA in Lansing, Michigan on June 8, 2015. The research was completed by Ms. Amanda Jenkins under the supervision of the Project’s Principal Investigator, Ms. Lynn M. Gierek, RPA of AECOM. Field work was completed on June 9, 2015 by Ms. Gierek.

As previously stated, the Gull Rock Light Station is listed on the NRHP (listing number 8400175). However, based upon a review of the file, AECOM determined that no previous archaeological surveys had been conducted at the Site and no additional previously-recorded archaeological sites are in the project area.

AECOM’s archaeological field work covered the entirety of Gull Rock, including areas immediately surrounding the lighthouse structure **(Figure 2** of **Appendix H)**. The field methodology utilized included pedestrian survey methodology on two- to five-meter transect intervals. No cultural materials were found as a result of the survey. Therefore, no further work is warranted and AECOM recommends that a finding of “No Historic Properties Affected” for archaeological resources for the Site as presently designed. AECOM assumes that there will be no disturbance to the structures themselves from the Site as planned and that remediation work will be temporary in nature. Therefore, AECOM recommends that a finding of “No Adverse Effect” for the NRHP-listed Gull Rock Light Station (listing number 84001751).

In the event that artifact concentrations, archaeological features, or human remains or burials are discovered as a result of site activities, a stop-work must be issued in the immediate area and the USCG and MSHDA must be contacted for consultations prior to resuming any activities.

#### 3.2.4.3 Environmental and Natural Resources Protection

Two rare natural features, volcanic bedrock lakeshore and volcanic lakeshore cliff, were also in the assessment completed by the MNFI. In addition, these features create the rocky shorelines, which are not conducive to vegetation establishment. Based upon the risk assessment, lead concentrations in soil are not above the RAO at the site, and therefore, there are no threats to public health or the environment during future recreational use of the Site or potential construction activities on site. In addition, no risks associated with migration of lead from soils to groundwater or surface water at concentrations above MDEQ drinking water or groundwater/surface water criteria are present. Further discussion of compliance with this ARAR is discussed in Section 4.0 of this report.

# 4. Remedial Alternative Analysis and Selection

In accordance with the USEPA's guidance on conducting non-time critical removal actions under CERCLA (USEPA 1993), applicable remedial and closure technologies/alternatives were identified and evaluated based on the site-specific conditions. In order to achieve the site RAO (9,303 mg/kg) or the PAL (400 mg/kg) and comply with the identified ARARs, a limited number of alternatives were evaluated on the basis of effectiveness, implementability, and cost.

## 4.1 Identification and Analysis of Alternatives

The potential alternatives evaluated included no further action, restrictive covenants, capping and soil removal.

### 4.1.1 No Action

This alternative could be chosen based on the selected cleanup goal. If the RAO is the preferred cleanup goal, no remediation would be required, since the lead concentrations in soil are below the established RAO value of 9,303 mg/kg.

Effectiveness: Under this alternative, the impacted soil would remain in place. There would be no risk from exposure to human health and the environment based upon the results of the risk assessment, threatened and endangered species survey and archeological survey, and would comply with the identified ARARs.

Implementability: Does not require any construction, operational or other intrusive methods to complete.

Costs: There would be no costs associated with this alternative.

The current soil conditions are protective of human health and the environment. This alternative achieves the RAO and does not require long-term operation and maintenance activities or costs, and thus, facilitates complete property divestment. This alternative can be implemented in a way that protects the cultural and historical resources at the Site and complies with the ARARs. Therefore, no action represents the most effective, implementable, and cost-effective action for the Site.

### 4.1.2 Restrictive Covenant

This alternative would require the application of deed restrictions limiting or prohibiting the use or disturbance of soil at the Site and restricting access (exposure) to areas of the Site with soil impacts above the RAO of 9,303 mg/kg. However, lead concentrations found in the soil do not exceed the RAO. If the initial PAL of 400 mg/kg is to be the established cleanup goal for lead in soil at the Site, then a deed restriction would be necessary.

Effectiveness: This alternative would reduce the risk from exposure to human health to the soils impacted above the PAL.

Implementability: The restrictive covenant would accompany the property deed into perpetuity. Site inspections and reviews would be required to verify the land use and compliance with land-use restrictions.

Costs: Estimated $20,000 to implement the restrictive covenant and develop an operation and maintenance plan for the Site. Subsequent site inspections and reviews are estimated at $7,000 per event, with escalating costs of approximately 4% per year.

There are long-term operation and maintenance activities and costs associated with this alternative, which does not comply with the property divestiture requirements. Therefore, this alternative was not considered for further evaluation for this Site.

### 4.1.3 Exposure Cap or Barrier

This alternative involves constructing an exposure barrier or “cap” to eliminate the soil direct contact exposure pathway if the initial PAL (400 mg/kg) is to be the established cleanup goal for lead in soil at the Site. This option would not have to be implemented if the RAO (9,303 mg/kg) is the chosen cleanup goal. If the PAL is chosen as cleanup goal then the following would apply:

Effectiveness: This alternative would reduce the risk from exposure to human health to the soils impacted above the PAL.

Implementability: Requires the construction/placement of a soil and/or man-made material (e.g. concrete, asphalt, plastic/rubber sheet) barrier to eliminate the direct contact exposure pathway to soils impacted above the PAL. The barrier or “cap” would need to be constructed with caution to avoid damage to the historical structures at the Site. Due to its remote location, the only possible alternative would be to manually place a concrete walkway around the perimeter of the structure using bags of concrete mix and wheel barrels or buckets. In addition, a restrictive covenant would need to be implemented and accompany the property deed into perpetuity. Site inspections and reviews would be required to verify the integrity of the cap, land use, and compliance with land use restrictions.

Costs: The estimated costs to construct/place an exposure barrier or “cap”, implement the restrictive covenant, and develop and operation and maintenance plan for the Site is $250,000. Subsequent site inspections and reviews are estimated at $7,000 per event, with escalating costs of approximately 4% per year.

Although this alternative would eliminate the direct contact exposure pathway to soils (adjacent to the keeper’s dwelling) impacted above the PAL, without maintenance it would not be effective at addressing other potential migration pathways (e.g. surface water). In addition, there are long-term operation and maintenance activities and costs associated with this alternative (the concrete walkway would not last very long due to the extreme weather conditions the Site is exposed to), which does not comply with the property divestiture requirements. Therefore, this alternative was not considered for further evaluation for this Site.

### 4.1.4 Soil Removal

This alternative could be implemented if the chosen cleanup goal is the PAL (400 mg/kg) and not the established RAO (9,303 mg/kg). This alternative involves excavation and off-site disposal of soils impacted with lead above the PAL criterion and restoration of the land surface and vegetation similar to existing conditions.

Effectiveness: The removal of impacted soil effectively eliminates the potential exposure pathways to human health and the environment at the Site above the PAL.

Implementability: The characteristically hazardous and impacted soil above the PAL would be excavated and transported to an appropriate off-site treatment and/or disposal facility. Soil removal activities would need to be performed with caution to avoid damage to the historical structures at the Site. In addition, the small area and rocky terrain is not feasible for small construction equipment such as a bobcat, therefore, hand digging of soils adjacent to the structures would need to be implemented.

Costs: The estimated costs to remove an estimated 2 cubic yards of characteristically hazardous lead-impacted soil and an estimated 20 cubic yards of non-hazardous lead-impacted soil (with all documentation and reporting requirements) is $200,000.

This alternative removes soil impacted above the PAL and does not require long-term operation and maintenance activities or costs, and thus, facilitates complete property divestment. This alternative can be implemented in a way that protects the cultural and historical resources at the Site and complies with the ARARs.

## 4.2 Selected Alternative

The most economically and technically feasible remedial alternative for the Site is “no action”. Lead impacted soils are below the site RAO of 9,303 mg/kg, which is based on the risk assessment completed for the Site. Concentrations less than 9,303 mg/kg will not pose a risk to human receptors under current and reasonably anticipated future land use scenarios and does not require long-term operation and maintenance activities or costs, and thus, facilitates complete property divestment from the federal inventory. This alternative can be implemented in a way that protects the cultural and historical resources at the Site and complies with the ARARs.

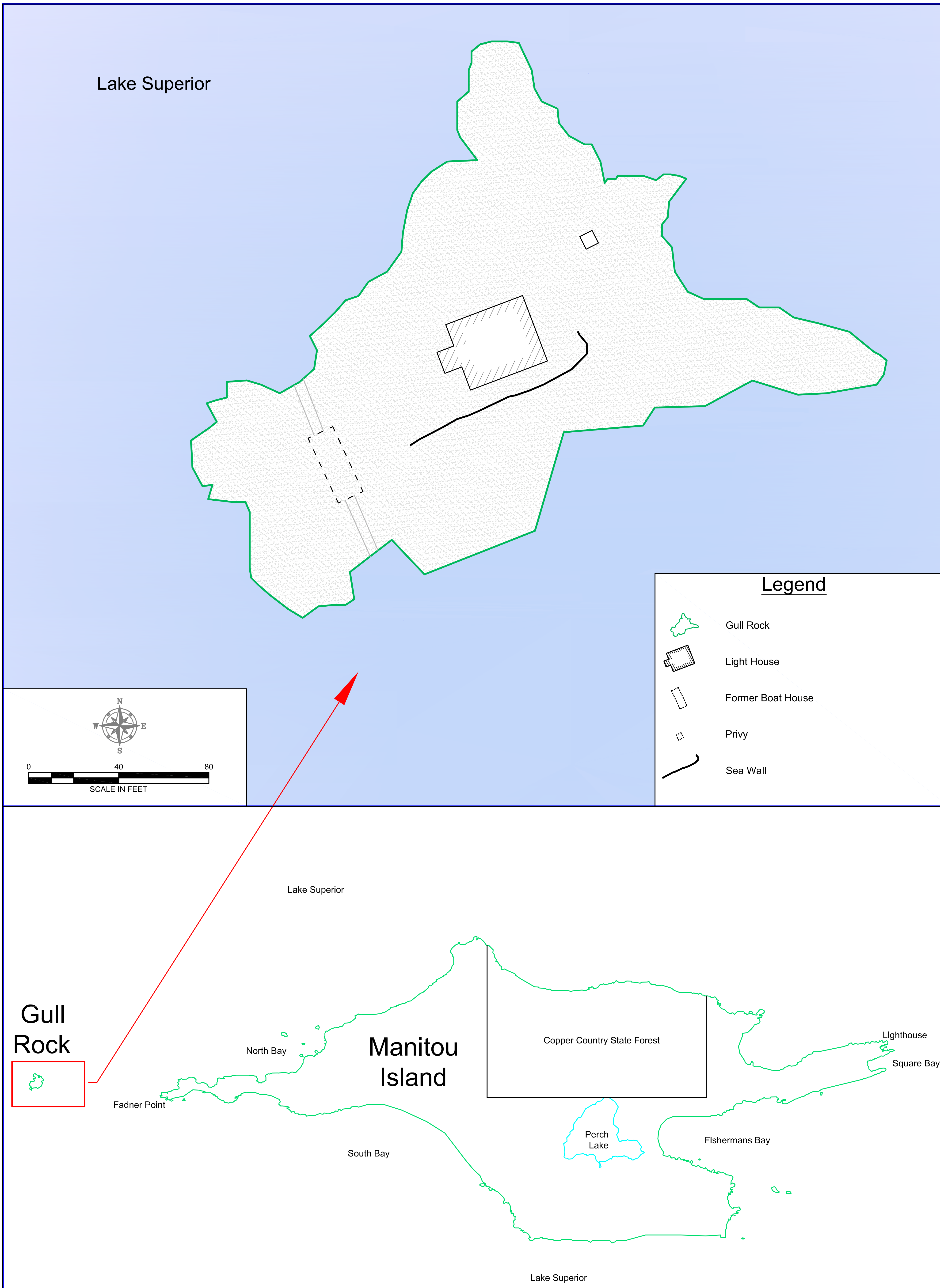
### 4.2.1 Stakeholder Participation

To date, communication with local stakeholders has included discussions and sharing of information with local government agencies, Gull Rock Lightkeepers, Michigan Lighthouse Conservancy, and representatives of the MDEQ, MDNR, and SHPO. Communication with the listed individuals and organizations will continue, as necessary, until completion of the project. The documents prepared related to this Site’s investigation and remedial action evaluation will be available for review through the USCG.

### 4.2.2 Schedule

Submittal of the final EE/CA to the USEPA will occur after the USCG review and comment on the draft documents. Upon review and concurrence from the USEPA (approximately 30 days), Site activities related to the delineation and characterization of impacts to soil and surface water from the Light Station operations will be considered complete and the property can be completely divested from the federal inventory.

# Figures




Oshkosh, Wisconsin
920-235-0270

A/E PROJECT NO: 60289135-1.1
CAD FILE NAME: Gull Rock Site
DESIGNED BY: MLF
DRAWN BY: HEP/rpm
EDITED BY: AJP
CHECKED BY: MLF

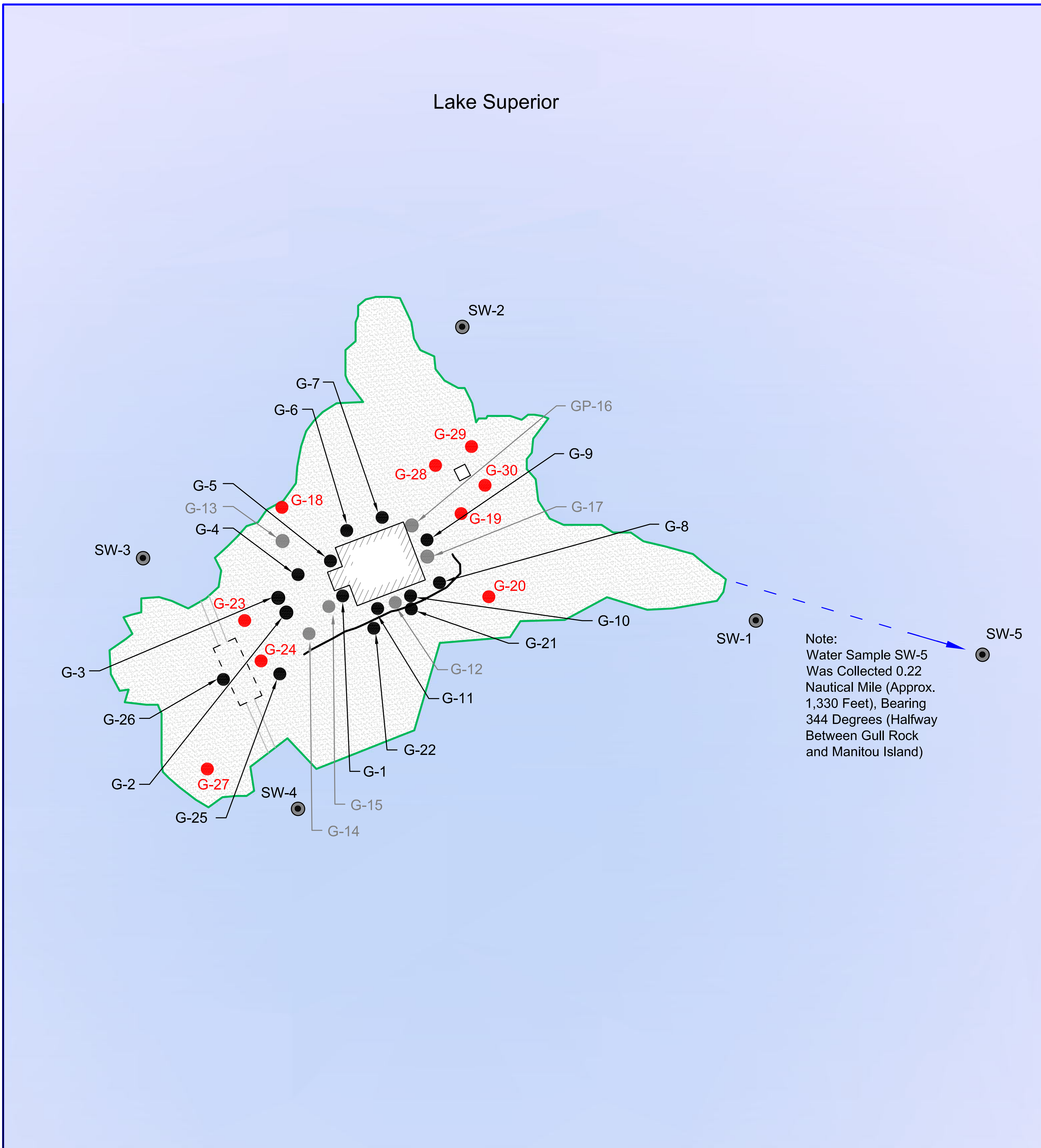
Site Layout Map

Gull Rock Light Station

Copper Harbor Michigan

United States Coast Guard
Civil Engineering Unit
Cleveland, Ohio

SHEET 1 OF 3




## Legend

| | | | |
|---|---|---|---|
| Gull Rock | | G-1 | Screen and Lab Sample Location |
| Light House | | G-12 | Screen Sample Location |
| Former Boat House | | G-18 | Proposed Soil Sample Location (not sampled due to bedrock/no soils) |
| Privy | | SW-1 | Water Sample Locations |
| Sea Wall | | | |

N W E S

0 50 100

SCALE IN FEET

NOTE:

1) All samples are approximately six (6) inches deep (G-21, G-22, G-25, & G-26 are surface samples due to lack of soil)

Oshkosh, Wisconsin
920-235-0270

A/E PROJECT NO: 60289135-1.1
CAD FILE NAME: Gull Rock Sampling
DESIGNED BY: MLF
DRAWN BY: HEP/RPM
EDITED BY: AJP
CHECKED BY: MLF

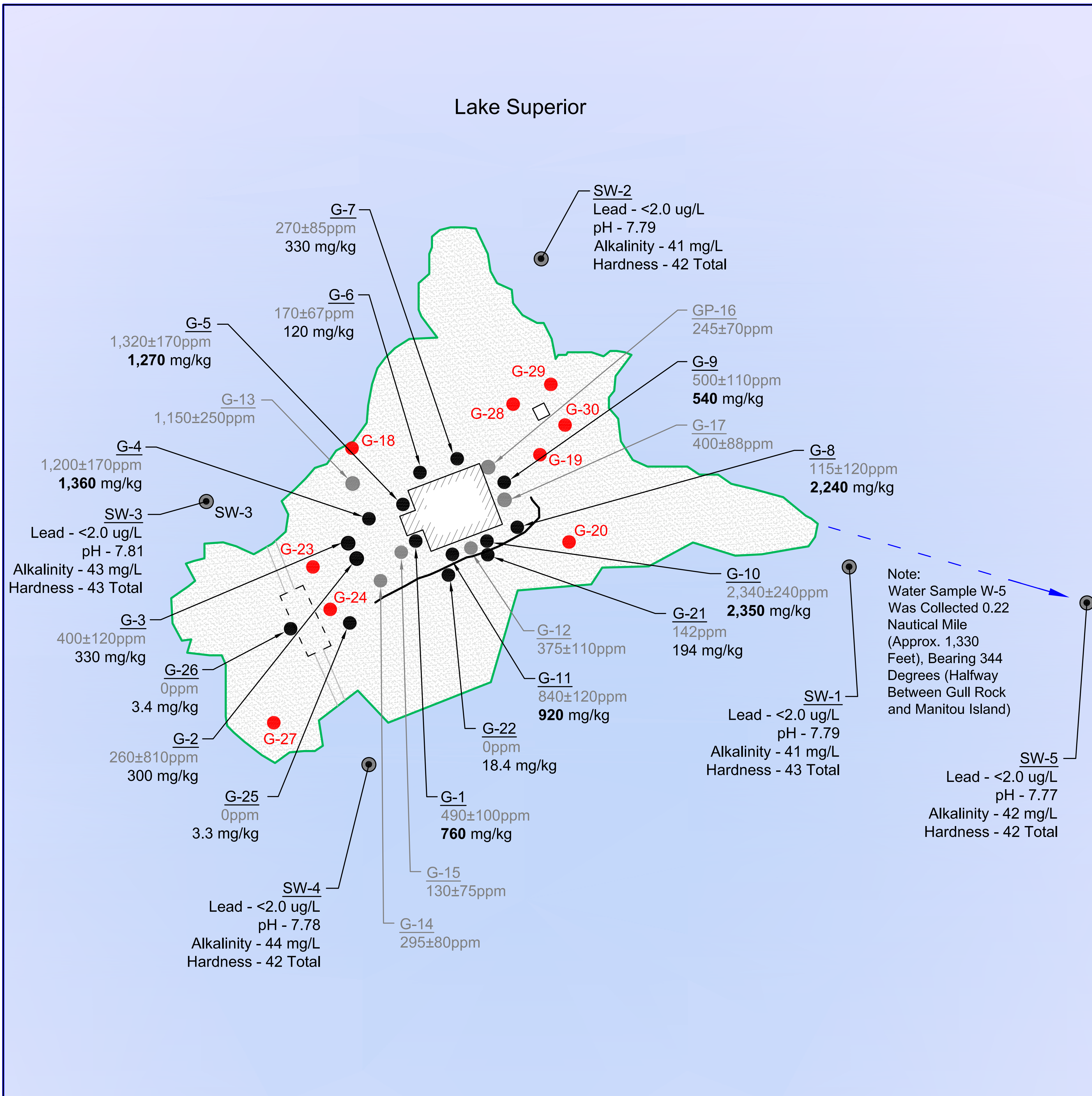
UNITED STATES COAST GUARD 1790

# Sample Locations Map

Gull Rock Light Station
Copper Harbor Michigan

United States Coast Guard
Civil Engineering Unit
Cleveland, Ohio

SHEET 2 OF 3




## Legend

| | |
|---|---|
| Gull Rock | |
| Light House | |
| Former Boat House | |
| Privy | |
| Sea Wall | |

| | |
|---|---|
| G-1 ● | Screen and Lab Sample Location |
| 400 mg/kg | Lead Lab Result (milligrams per kilogram) |
| G-12 ● | Screen Sample Location |
| 400±120ppm | Screen Sample Measurement (parts per million, which is equivalent to mg/kg) |
| G-18 ● | Proposed Soil Sample Location (not sampled due to bedrock/no soils) |
| SW-1 ◉ Lead - <2.0 ug/L pH - 7.77 Alkalinity - 40 mg/L Hardness - 41 Total | Water Sample Locations (units are as shown) |

N W E S

0 50 100
SCALE IN FEET

NOTE:
1) All samples are approximately six (6) inches deep (G-21, G-22, G-25, & G-26 are surface samples due to lack of soil)
2) All soil sample results are for Lead
3) **BOLD** values are above the Residential Direct Contact Limits for Michigan

Oshkosh, Wisconsin
920-235-0270

A/E PROJECT NO: 60289135-1.1
CAD FILE NAME: Gull Rock Sampling
DESIGNED BY: MLF
DRAWN BY: HEP/RPM
EDITED BY: AJP
CHECKED BY: MLF

# Results of Soil & Surface Water Investigation Map

Gull Rock Light Station — Copper Harbor Michigan

United States Coast Guard
Civil Engineering Unit
Cleveland, Ohio

SHEET 3 OF 3

## Tables

**Table 1**
**Investigation and Waste Characterization Soil Sampling Results**
**USCG Gull Rock Light Station**
**Keweenaw County, Michigan**
**Project No. 60289135**

| | Sample Identification and Depth | | | | Project Action Limit | Toxicity Characteristic of Hazardous Waste Criteria [3] |
|---|---|---|---|---|---|---|
| | G-21 | G-25 | G-22 | G-26 | | |
| **Parameter** | 0-6" | 0-6" | 0-6" | 0-6" | | |
| **XRF Reading (ppm)** | 142 | 0 | 0 | 0 | 400 [1] | NA |
| **Lead (mg/kg)** | 194 J- | 3.3 J- | 18.4 J- | 3.4 J- | 400 [1] | NA |
| **TCLP Lead (mg/L)** | 0.013 J | 0.003 J | 0.0023 J | <0.0020 UJ | 5.0 [2] | 5.0 |

Notes:

[1]Project Action Limit is as establised in the USEPA approved QAPP (AECOM, April 2015): Residential land use category values were evaluated from the USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites table (May 2013; DAF = 20) and the MDEQ RRD Operational Memoranda 1 – Part 201 Generic Cleanup Criteria/Part 213 Risk Based Cleanup Levels table (September 2012). The more restrictive value of the two tables (that was above the PQL and/or MDL) was used for the specific compound's project action limit.

[2]TCLP lead will be requested for hazardous waste determination.

[3]As listed in 40 CFR 261.24 The EPA TCLP: Toxcity Characteristic Leaching Procedure and Characteristic Wastes (D-codes), Table 1. Maximum Concentration of Contaminents for the Toxicity Characteristic, October 2009.

mg/L = milligrams per liter.

mg/kg = milligram per kilogram.

TCLP = Toxicity Characteristic Leaching Procedure.

NA = Not applicable

NL = No criteria or level listed.

Outlined and **bold** concentrations indicate values above theToxicity Characteristic of Hazardous Waste Criteria.

**Bold** cells indicate concentrations exceed the Project Action Limit.

J = The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.

J- = (Inorganics) The result is an estimated quantity, likely to be biased low. The associated numerical value is the approximate concentration of the analyte in the sample.

UJ = The analyte was analyzed for, but was not detected. The reported quantitation limit is approximated and may be inaccurate or imprecise.

**Table 2**
**Investigative Surface Water Sampling Results**
**USCG Gull Rock Light Station**
**Keweenaw County, Michigan**
**Project No. 60289135**

| Parameter | Sample Identification | | | | | | Project Action Limit |
|---|---|---|---|---|---|---|---|
| | SW-1 | SW-2 | DUP-SW | SW-3 | SW-4 | SW-5 | |
| Lead (ug/L) | <2.0 UJ | <2.0 UJ | <2.0 UJ | <2.0 UJ | <2.0 UJ | <2.0 UJ | 4.0 [1] |
| pH | 7.79 J | 7.79 J | 7.77 J | 7.81 J | 7.78 J | 7.77 J | -- |
| Alkalinity (mg/L) | 41 J+ | 41 J+ | 40 J+ | 43 J+ | 44 J+ | 42 J+ | -- |
| Hardness (Total) | 43 J | 42 J | 42 J | 43 J+ | 42 J | 42 J+ | -- |

Notes:

[1]Project Action Limit is as establised in the USEPA approved QAPP (AECOM, April 2015): Residential land use category values were evaluated from the USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites table (May 2013; DAF = 20) and the MDEQ RRD Operational Memoranda 1 – Part 201 Generic Cleanup Criteria/Part 213 Risk Based Cleanup Levels table (September 2012). The more restrictive value of the two tables (that was above the PQL and/or MDL) was used for the specific compound's project action limit.
ug/L = micrograms per liter.
mg/L = milligrams per liter.
-- = Criterion value not available or not applicable.
**Bold** cells indicate concentrations exceed the Project Action Limit.
J = The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.
J+ = (Inorganics) The result is an estimated quantity, likely to be biased high. The associated numerical value is the approximate concentration of the analyte in the sample.
UJ = The analyte was analyzed for, but was not detected. The reported quantitation limit is approximated and may be inaccurate or imprecise.

# Appendix A – Site Photographs

AECOM

## PHOTOGRAPH LOG

| Client Name: USCG | Project: Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | Project No. 60289135.1.3 |
|---|---|---|

| Photo No. 1 | Date: 6/9/15 |
|---|---|

**Direction Photo Taken:**

North

**Description:**

View of the Gull Rock Light Station from Lake Superior.

| Photo No. 2 | Date: 6/9/15 |
|---|---|

**Direction Photo Taken:**

Northwest

**Description:**

Close-up view of the Gull Rock light.

| AECOM | **PHOTOGRAPH LOG** |
|---|---|

| **Client Name:** USCG | **Project:** Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | **Project No.** 60289135.1.3 |
|---|---|---|

| **Photo No.** **3** | **Date:** 6/9/15 |
|---|---|
| **Direction Photo Taken:** North | |
| **Description:** Close-up view of the south side of the Gull Rock light and the keeper's dwelling. | |

| **Photo No.** **4** | **Date:** 6/9/15 |
|---|---|
| **Direction Photo Taken:** East-Northeast | |
| **Description:** Close-up view of the west side of the Gull Rock light and the keeper's dwelling | |

AECOM

**PHOTOGRAPH LOG**

| | | |
|---|---|---|
| **Client Name:** USCG | **Project:** Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | **Project No.** 60289135.1.3 |

| | |
|---|---|
| **Photo No.** 5 | **Date:** 6/9/15 |

**Direction Photo Taken:**

Northeast

**Description:**

View of the west side of the Gull Rock light and the keeper's dwelling

| | |
|---|---|
| **Photo No.** 6 | **Date:** 6/9/15 |

**Direction Photo Taken:**

East

**Description:**

Close-up view of the concrete walkways on the west side of the light and keeper's dwelling.

# PHOTOGRAPH LOG

| Client Name: USCG | Project: Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | Project No. 60289135.1.3 |
|---|---|---|

| Photo No. 7 | Date: 6/9/15 |
|---|---|

**Direction Photo Taken:**

East

**Description:**

Close-up view of the seawall located to the northwest of the light and keeper's dwelling.

| Photo No. 8 | Date: 6/9/15 |
|---|---|

**Direction Photo Taken:**

Northeast

**Description:**

View of the seawall and shore located to the northwest of the light and keeper's dwelling.

AECOM

# PHOTOGRAPH LOG

| | | |
|---|---|---|
| **Client Name:** USCG | **Project:** Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | **Project No.** 60289135.1.3 |

**Photo No.** 9

**Date:** 6/9/15

**Direction Photo Taken:**

Northeast

**Description:**

View of the north side of the keeper's dwelling showing privy in the background.

**Photo No.** 10

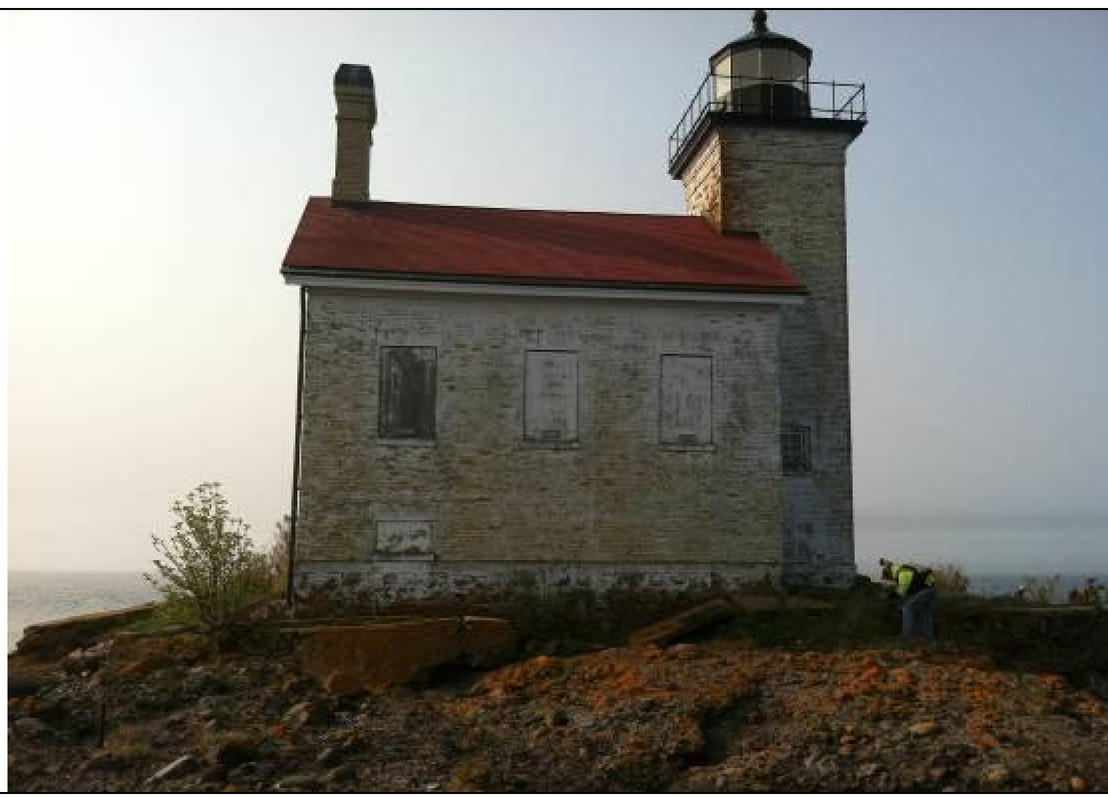
**Date:** 6/9/15

**Direction Photo Taken:**

Southeast

**Description:**

View of the north side of the light and keeper's dwelling.



**PHOTOGRAPH LOG**

| **Client Name:** USCG | **Project:** Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | **Project No.** 60289135.1.3 |
|---|---|---|

**Photo No. 11** **Date:** 6/9/15

**Direction Photo Taken:**

Southeast

**Description:**

View of the east side of the keeper's dwelling (far right) and the eastern shore of Gull Rock.

**Photo No. 12** **Date:** 6/9/15

**Direction Photo Taken:**

East

**Description:**

Close-up view of the privy.

AECOM

# PHOTOGRAPH LOG

| Client Name: USCG | Project: Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | Project No. 60289135.1.3 |
|---|---|---|

| Photo No. | Date: |
|---|---|
| 13 | 6/9/15 |

**Direction Photo Taken:**

North-Northwest

**Description:**

View of the privy and the eastern shore of Gull Rock with the seawall and keeper's dwelling shown at far left.

| Photo No. | Date: |
|---|---|
| 14 | 6/9/15 |

**Direction Photo Taken:**

North

**Description:**

View of the west side of Gull Rock showing location of former boathouse and boat landing.

**PHOTOGRAPH LOG**

| **Client Name:** USCG | **Project:** Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | **Project No.** 60289135.1.3 |
|---|---|---|

| **Photo No.** 15 | **Date:** 6/9/15 |
|---|---|
| **Direction Photo Taken:** West | |
| **Description:** View of the west side of Gull Rock west of the former boat landing. | |

| **Photo No.** 16 | **Date:** 6/9/15 |
|---|---|
| **Direction Photo Taken:** South | |
| **Description:** View of the iron features remaining from the boat landing located on the southwestern portion of Gull Rock. | |

AECOM

# PHOTOGRAPH LOG

| **Client Name:** USCG | **Project:** Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | **Project No.** 60289135.1.3 |
| --- | --- | --- |

| **Photo No.** 17 | **Date:** 6/9/15 |
| --- | --- |

**Direction Photo Taken:**

West

**Description:**

Close-up view the iron features remaining from the boat landing located on the southwestern portion of Gull Rock.

| **Photo No.** 18 | **Date:** 6/9/15 |
| --- | --- |

**Direction Photo Taken:**

South

**Description:**

Close-up view the iron features remaining from the boat landing located on the southwestern portion of Gull Rock.

# Appendix B – Field Sampling Plan

AECOM Environment

Submitted to :
U.S. Coast Guard CEU Cleveland
Cleveland, Ohio

Submitted by :
AECOM
Oshkosh, WI
March 18, 2015

U.S. Department of
Homeland Security

United States
Coast Guard

# Field Sampling Plan - Gull Rock Light Station CERCLA Investigation

AECOM **Environment**

Submitted to :
U.S. Coast Guard CEU Cleveland
Cleveland, Ohio

Submitted by :
AECOM
Oshkosh, WI
March 18, 2015

U.S. Department of
Homeland Security

United States
Coast Guard

# Field Sampling Plan - Gull Rock Light Station CERCLA Investigation

*Richard Mazurkiewicz, Senior Hydrogeologist* — Date: April 17, 2015

*Michelle L. Freimund, Project Manager* — Date: April 17, 2015

*Steven K. Laube, Technical Reviewer* — Date: April 17, 2015

*Albert W. Cole, QA Reviewer* — Date: April 17, 2015

# Table of Contents



**FIGURES**



**APPENDICES**

# 1 Introduction

As provided in Executive Order 12580 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the U.S. Coast Guard (USCG) is acting as the lead agency in implementing a Site Investigation (SI) under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) at the USCG Gull Rock Light Station. The SI is being conducted in accordance with the United States Environmental Protection Agency's (USEPA's) *Guidance for Preliminary Assessments Under CERCLA* (USEPA, September 1991, 540/G-91/013) and *Federal Facilities Remedial Preliminary Assessment Summary Guide* (USEPA, July 21, 2005) to determine the extent of impacts of a hazardous substance (lead based paint) at the USCG Gull Rock Light Station from historic operations and to develop a remedial strategy. This Field Sampling Plan (FSP) documents practices and procedures to be followed during the SI at the USCG Gull Rock Light Station (Site). The FSP outlines the sampling rationale for selecting and analyzing soil and surface water samples to characterize and determine the extent of the lead impacts at the Site.

## 1.1 Sampling Areas

This FSP encompasses the USCG Gull Rock Light Station (approximately 0.719 acre), located approximately 2.5 miles east of the Keweenaw Point on the Keweenaw Peninsula, Michigan in Lake Superior. The Site occupies a portion of the southwest quarter of the southwest quarter of Section 18, Township 58 North, Range 25 West (SW ¼, SW ¼, of Sec. 18, T58N, R25W). The Site layout is presented on **Figure 1**. The sample locations are shown on **Figure 2**.

## 1.2 Site Background

Gull Rock Light Station was built in 1867 on Gull Rock. Gull Rock is approximately 150 feet wide and 250 feet long, and consists of a keeper's dwelling (built as one and one half-story square wood frame brick building with an adjoining light tower), oil house (built 1906), boat house, and a brick privy. The oil house and boat house structures have since been demolished. In 1901, a 40-foot long retaining wall was constructed around the northeast corner of the keeper's dwelling/light tower to prevent wave damage. The light was automated in 1913 and maintained by the keepers of the Manitou Island Light. The Gull Rock Light Station is listed on the National Register of Historic Places, with listing number 84001751.

A phase I environmental site assessment (PIESA) was conducted for the Site in 1997 (*Phase I Environmental Site Assessment: Gull Rock Light, Keweenaw County, Michigan*, Woodward-Clyde Federal Services, November 21, 1997). The results of the PIESA indicated that the Site was undeveloped prior to its purchase by the USCG. The PIESA identified the following:

- The facility consists of approximately 0.719 acre of land in a rural area of Lake Superior, Michigan. Current improvements include two structures (lighthouse/keeper's dwelling and privy);
- Historical land use information indicates that the Site was developed as an aid to navigation in 1867. The light tower was originally illuminated with oil and automated in the mid 1900s;
- Historical use of the areas adjacent to the facility is Lake Superior. The facility is located greater than 1 mile from any identified National Priorities List , Comprehensive Environmental Response, Compensation, and Liability Act, spill sites or other areas of environmental concern;
- Based on the age of the facility, lead-based paint (LBP) is suspected to be present in the light tower, other structures at the facility, and possibly in soil surrounding the existing, and former structures. LBP, if present, could pose a hazard if not managed properly; and
- Asbestos containing materials may be present in the keeper's dwelling.

ENSR International (now part of AECOM), performed a phase II environmental site assessment (PIIESA) at the Site in 2004 (*Phase II Environmental Site Assessment for the USCG Gull Rock Light in Copper Harbor, Michigan, February 4, 2005)*. The PIIESA included the advancement of seventeen (17) shallow hand borings (G-1 through G-17) that were advanced around the Gull Rock Light structure. Seventeen soil samples were collected for field screening of lead utilizing an x-ray fluorescence (XRF) analyzer. Eleven of the seventeen soil samples were submitted for laboratory analysis of lead. The boring locations are illustrated on **Figure 2**. The results of the PIIESA documented the following:

- The soil type encountered generally consisted of silt to the termination depth (refusal) of the borings, approximately 6 inches below ground surface (bgs), where weathered bedrock (sandstone conglomerate) was encountered. Paint chips were also observed in the soil samples collected adjacent to the light house structure, at an approximate depth of 2 inches bgs;
- Lead concentrations measured with the XRF ranged from 115±120 parts per million (ppm; G-8) to 2,340±240 ppm (G-10);
- Lead concentrations from laboratory samples ranged from 120 milligrams per kilogram (mg/kg; G-6) to 2,350 mg/kg (G-10);
- Lead concentrations in six (6) (G-1, G-4, G-8, G-9, G-10, and G-11) of the eleven (11) soil samples are above the Michigan Department of Environmental Quality (MDEQ) direct contact criteria for residential properties of 400 mg/kg. In general, the highest lead concentrations were documented in soil samples collected from the southeast (downwind) corner of the lighthouse keeper's dwelling; and
- The lead impact in soil is not delineated, thus further site investigation was recommended.

## 1.3 Sampling Objectives

Based on the results of the PIIESA, the contaminant of concern at the Site is lead, stemming from the historical use of lead based paint at the Site. The primary objective of this FSP is to provide instructions for the collection of data necessary to delineate and characterize the documented lead impacts as discovered during the September 2004 PIIESA activities. The SI is being conducted to identify potential risks to public health, welfare and the environment. Specifically:

- Collect additional soil samples for laboratory analysis of total lead to delineate the extent of lead impacts;
- Analyze the soil samples for TCLP lead for the purpose identifying if hazardous concentrations of lead are present at the Site and if so, the extent, as well as for waste disposal characterization;
- Collect surface water samples from around the Gull Rock Light property to evaluate potential impacts to the aquatic environment in Lake Superior from the historical use of lead based paints at the USCG Gull Rock Light; and
- Complete an archeological survey to identify and define historic properties in the project area.

The soil and surface water sampling data will also be utilized to assess and develop site-specific risk levels for the aquatic environment at the Site. In addition, potential detections of lead in surface water samples collected during this investigation will be compared to published levels of lead background concentrations in Lake Superior.

## 1.4 Sample Collection and Designation

This section of the FSP presents the planned field activities for evaluation of the subsurface soil and surrounding water at the Site. Standard Operating Procedures (SOPs) for field activities are included in **Appendix A**. Within AECOM, routine SOPs are prepared or adopted for each project to provide a guide and control for the performance of work. SOPs implement quality requirements by ensuring the appropriate and consistent performance of a repetitive task. AECOM developed these SOPs to reflect the steps and methods to be performed in the field at the Site. The procedures contained in *Guidance for Preliminary Assessments Under CERCLA* (USEPA, September 1991, 540/G-91/013), *Federal Facilities Remedial Preliminary Assessment Summary Guide* (USEPA, July 21, 2005), and MDEQ's *Sampling Strategies and Statistics Training Manual* (MDEQ, 2002) and *Remediation Redevelopment Division Operational Memoranda No. 2: Sampling and Analysis Guidance* (MDEQ, October 22, 2004) were used as guidance in the development of this FSP.

A Quality Assurance Project Plan (QAPP; AECOM, July 2014) was prepared for this project under separate cover. Also, a Site-specific Health and Safety Plan (HASP; AECOM, January 2014) was developed by AECOM that establishes health and safety procedures to minimize potential risk to AECOM and contractor personnel implementing the field investigation at the Site. This HASP is included in **Appendix B**. The table below presents a summary of the sampling frequency and parameters matrix for the field investigation.

| Sample Identification | Sampling Frequency | Analytical Parameter |
|---|---|---|
| Soil Samples - Shallow Hand Borings | One analytical sample collected at approximately 6 inches bgs per each sample location | Total Lead and lead **TCLP** |
| Surface Water Samples | One per sample location | Alkalinity, Total lead, pH, and Total Hardness |
| Duplicates (field and analytical) | One for every 10 soil samples collected for laboratory analysis<br><br>One for every 10 surface water samples collected for laboratory analysis | Total Lead and **TCLP**<br><br>Total Lead |
| Field Equipment Blanks | One at the end of each day of soil sampling (from equipment rinsate)<br><br>One at the end of each day of surface water sampling (from equipment rinsate) | Total Lead<br><br>Total Lead |

TCLP – Toxicity Characteristic Leaching Procedure

An estimated twenty-six (26) soil samples will be collected from thirteen (13) shallow borings, resulting in three (3) duplicate soil samples that will be collected during the field investigation. An estimated five (5) sets of surface water samples will be collected from five (5) sample locations, resulting in one (1) duplicate surface water sample that will be collected during the field investigation. Boring and surface water sample locations are illustrated on **Figure 2**.

## 1.5 Pre-Field Sampling Program Activities

Preparation for field work will include: resolution of site access issues; selection and procurement of qualified subcontractors for analytical work; procurement of necessary field and sampling equipment; and designation of an equipment decontamination area.

## 1.6 Sample Collection

### 1.6.1 Soil

AECOM will collect soil samples according to the procedures outlined in the project-specific SOP 200 included in **Appendix A**. The soil samples will be collected directly from the bottom of the boring locations for field screening and/or laboratory analyses. Field screening of the soil samples will be conducted utilizing an Innov-X Systems **a** 4000™ Handheld XRF analyzer according to the methods and procedures described in project-specific SOP 100 included in **Appendix A**. Field personnel will utilize the XRF as a guide to determine the limits of the lead impact that is greater than 400 mg/kg.

All soil samples will be field screened for lead using an X-Ray fluorescence (XRF) analyzer, which will be calibrated prior to use each day. The field screening approach will be used to minimize the number of samples for laboratory analysis. The soil samples will be contained in sealed plastic bags and allowed to equilibrate. The

XRF will remain in contact with the sample in the sample bag until the readings become steady or consistently decline. Peak readings will be recorded for each sample. Soil samples with field screening readings equal to or greater than 300 milligrams per kilogram (mg/kg) will be considered as lead impacted soils that will require remediation. This is to ensure the delineation of soils impacted with lead concentrations greater than the 400 mg/kg MDEQ Part 201 Residential Direct Contact Generic Cleanup Criteria.

If field screening results, conducted during the advancement of the delineation probes, indicate readings above 300 mg/kg, ENSR will abandon the sampling location and relocate to a position ten feet farther (outward) from the Site structures to delineate the extent of lead impacted soil that will require removal. Laboratory analytical soil samples will be collected from the “new” locations in order to confirm the field screening results.

The laboratory analytical samples will be placed into appropriate laboratory provided containers and labeled with at the minimum: project name, sample designation, sample collection date, sample collection time, and sampler's name. The soil sampling method requirements are presented in the table below:

| Analytical Parameter | Sample Container | Sample Amount and Preservation |
|---|---|---|
| Total Lead | 4 ounce wide-mouth plastic bottle | Fill container (no preservative), cool to 4° Celsius |
| TCLP Lead | 4 ounce wide-mouth plastic bottle | Fill container (no preservative), cool to 4° Celsius |

### 1.6.2 Surface Water

AECOM will collect surface water samples according to the procedures outlined in the project-specific SOP 400 included in Appendix A. The surface water samples will be collected from five locations around the Site for laboratory analyses. Four surface water samples will be collected from 25 feet away from the shore of Gull Rock (sample locations will be evenly spaced around the perimeter.) In addition, another surface water sample will be collected from mid-way between Gull Rock and Manitou Island. Manitou Island is approximately 0.44 nautical mile to the east of Gull Rock (the mid-way surface water sample will be collected approximately 1,330 feet from Gull Rock.) The laboratory analytical samples will be placed into appropriate laboratory provided containers and labeled with at the minimum: project name, sample designation, sample collection date, sample collection time, and sampler's name. The surface water sampling method requirements are presented in the table below:

| Analytical Parameter | Sample Container | Sample Amount and Preservation |
|---|---|---|
| Total Lead | 250 milliliter plastic container | Unfiltered, fill container, $HNO_3$ to pH<2, cool to 4° Celsius |
| Alkalinity | 250 milliliter plastic container | Fill container, cool to 4° Celsius (no preservative)[1] |
| pH | 250 milliliter plastic container | Fill container, cool to 4° Celsius (no preservative) |
| Hardness | 250 milliliter plastic container | Fill container, $HNO_3$ to pH<2, cool to 4° Celsius |

[1] = Alkalinity and pH analyses (per sample) can be obtained from the same 250 milliliter unpreserved plastic bottle.
$HNO_3$ = Nitric acid

## 1.7 Sample Designation

The sample identification code described below will be recorded on the sample label, in the field log book, on the custody form, and will be carried through the analytical process to reporting.

### 1.7.1 Soil

Immediately upon collection, each sample container and field screening zip lock bag will be labeled. Samples will be assigned unique sample identifications (IDs) based on an alphanumeric code that identifies the Site (Gull Rock Light), continues numerically in sequence from the previous sampling event, and identifies the sample depth bgs. For example, the soil sample collected from the first shallow hand boring will be designated as "G-18, 6".

Field duplicates will be identified as "Dup-1", and continue sequentially for each duplicate sample collected thereafter. Samples designated as matrix spike and matrix spike duplicates (MS/MSDs) will be noted as such in the comments field of the custody form.

### 1.7.2 Surface Water

Immediately upon collection, each sample container will be labeled. Samples will be assigned unique sample IDs based on an alphanumeric code that identifies the type of sample (surface water) with sequential numbering for location. For example, the samples collected from the first surface water location will be designated as "SW-1".

Field duplicates will be identified as "Dup-1", and continue sequentially for each duplicate sample collected thereafter. The sample designated as MS/MSD will be noted as such in the comments field of the custody form.

## 1.8 Sample Equipment Decontamination

Upon completion of sample collection, the sampling equipment will be decontaminated according to the procedures described in project-specific SOP 500, included in **Appendix A**. All equipment used in the field at the Site will be cleaned between sample collection points. Cleaning of equipment is performed to prevent cross-contamination between samples and to maintain a clean working environment for all personnel (a new pair of nitrile gloves will be used during collection of each sample.)

A summary of the decontamination method for all sampling equipment used for the collection of samples is presented below:

- Clean equipment with distilled water and a laboratory grade non-phosphate detergent;
- Double rinse with distilled water; and
- Place in a plastic bag, which is sealed to prevent contamination if equipment is going to be stored or transported.
- Detergents and rinse waters used to clean field equipment will be disposed following laboratory sample analysis for waste characterization.

# 2 Analytical Sample Handling and Analysis

This section of the FSP outlines the quality control and handling procedures for equipment and samples collected at the Site. A more detailed discussion of these procedures is presented in the QAPP and in **Appendix A** (AECOM SOP 300) of this FSP.

## 2.1 Quality Control Samples

Quality control (QC) samples assess the validity of field and analytical results by measuring the accuracy and precision of each method and matrix, serving as a means to detect errors or out-of-control events, and requiring corrective action techniques to prevent or minimize the recurrence of these events. The QC samples associated with field sampling will include field equipment blanks and field duplicates. The table in Section 3.0 of this FSP summarizes the frequency of field blanks and field and analytical duplicates. Each QC sample will be analyzed for the required analysis. Field equipment blanks and field duplicate samples will be prepared or collected according to the protocols and frequencies specified in the QAPP.

Laboratory generated QC samples will include method blanks, calibration standards, matrix spikes, laboratory replicates, and laboratory check samples. The protocols defining preparation and analysis methods, and frequency of analysis, are contained in the relevant analytical methodologies referenced in the QAPP.

## 2.2 Sample Handling and Data Record

Environmental sample packaging and shipping will be performed according to the project-specific SOP 300 (Sample Handling and Analysis), included in **Appendix A**. This SOP describes the procedures associated with the packaging and shipment of environmental samples consisting of soil and water submitted for routine environmental testing. The samples collected by AECOM will remain in the custody of the AECOM field sampling personnel until relinquished for shipment to the analytical laboratory. The sample bottles will be appropriately labeled (label affixed directly to the bottle), tagged and shipped in a cooler. The samples will be collected in appropriate containers as specified in the QAPP. All samples will be collected in “certified-clean” sample containers that are supplied by the laboratory.

Chain-of-custody forms, identifying each sample contained in a shipping container, will be completed and signed by the AECOM field sampling personnel, sealed in a plastic bag, and taped to the inside of the cooler lid. One copy of the chain-of-custody form will be retained for the field records; the remaining copies will be placed inside the plastic bag.

Before sealing the shipping container, two chain-of-custody seals will be placed on the container. The seals will be placed on opposite corners of the container in such a manner that the container cannot be opened without disturbing the seals. The container will then be sealed shut with packing tape. The tape will cover the chain-of-custody seals to protect them from damage.

Samples will be shipped daily from the field to the laboratory using an overnight service or reputable courier. All samples will be handled and shipped in accordance with current Department of Transportation and International Air Transport Authority.

## 2.3 Analytical Requirements

Samples collected during the field activities will be analyzed according to the table below:

| Sample Location | Sample Matrix | Analytical Methods |
|---|---|---|
| Gull Rock Light | Soil | Total Lead (USEPA Method SW 846-6010)<br>TCLP Lead (USEPA Method SW 846 1311/6010) |
| Lake Superior Surface Water (Surrounding Gull Rock Light) | Water | Total Lead (USEPA Method SW 846-6010)<br>Alkalinity (USEPA Method 310.2)<br>pH (USEPA Method SW 846-9040)<br>Hardness (USEPA Method 6010) |

Laboratory analyses will be conducted in accordance with the QAPP. All samples collected will be delivered by courier/overnight services to CT Laboratories, LLC in Baraboo, Wisconsin.

# 3 Natural and Cultural Resources Survey and Assessment

AECOM will assess natural resources in and around the Site in support of the development of an appropriate remedial action. Subsequent to a review of agency and publicly available information, AECOM will conduct a site visit to verify the information. AECOM will employ the appropriate federal and state approved survey methodologies for wetland identification/delineation; rare, threatened, and endangered species and habitat evaluation; and land use classification, and will photo document the Site. Based on the information known about the project site to date, this assessment/survey does not include performing species-specific surveys employing transects or other species-specific methodologies beyond the described verification of information/data gathered during the research. Should the need for such surveys be identified during the course of completing this project, AECOM will recommend implementation of in-depth surveys or survey methodologies.

AECOM will complete an archeological survey to identify any historic properties[1] in the project area. The archaeological Area of Potential Effects (APE) on Gull Rock is approximately 250 feet by 150 feet (approximately 0.719 acre).

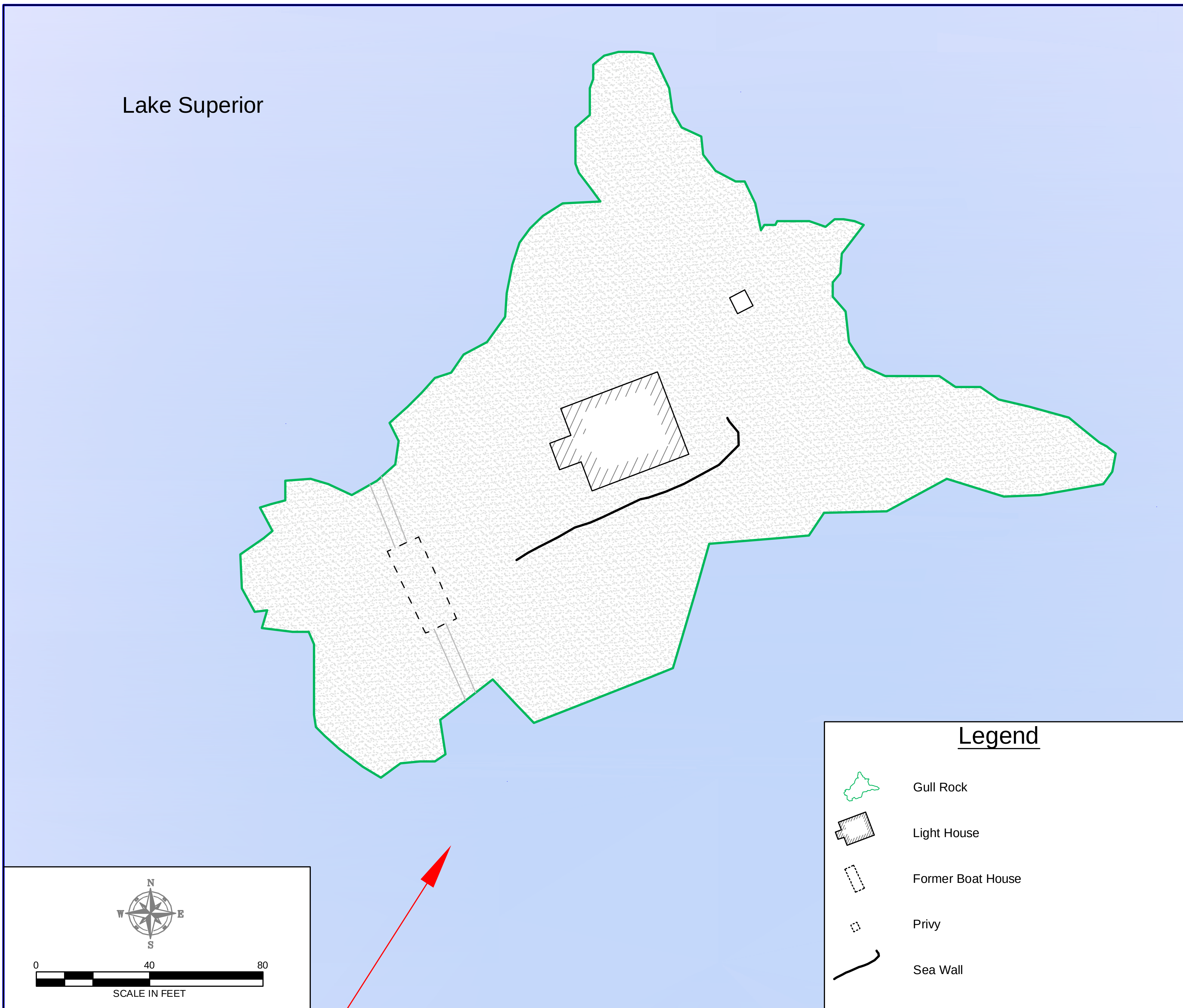
AECOM's federally qualified archaeologist will travel to the project area on Gull Rock to complete a Phase I archaeological survey. Prior to mobilization, AECOM will complete background research at the Office of the State Archaeologist (OSA) in Lansing to compile information about previous archaeological investigations and presently recorded archaeological sites, if any, on the Site. Because soils are anticipated to be very shallow, very stony, and contaminated in the project areas, the field investigation will consist of a combination of pedestrian surface reconnaissance, shovel-testing or bucket-augering, and soil probing. Excavated soils, if any, will be screened through 1/4-inch hardware mesh and any archaeological artifacts will be documented on-Site but not collected. Subsurface tests will be described in the field on standardized shovel-test forms. All subsurface tests will be backfilled before demobilization. A Phase I archeological report will be prepared for the site, presenting the results of the survey.

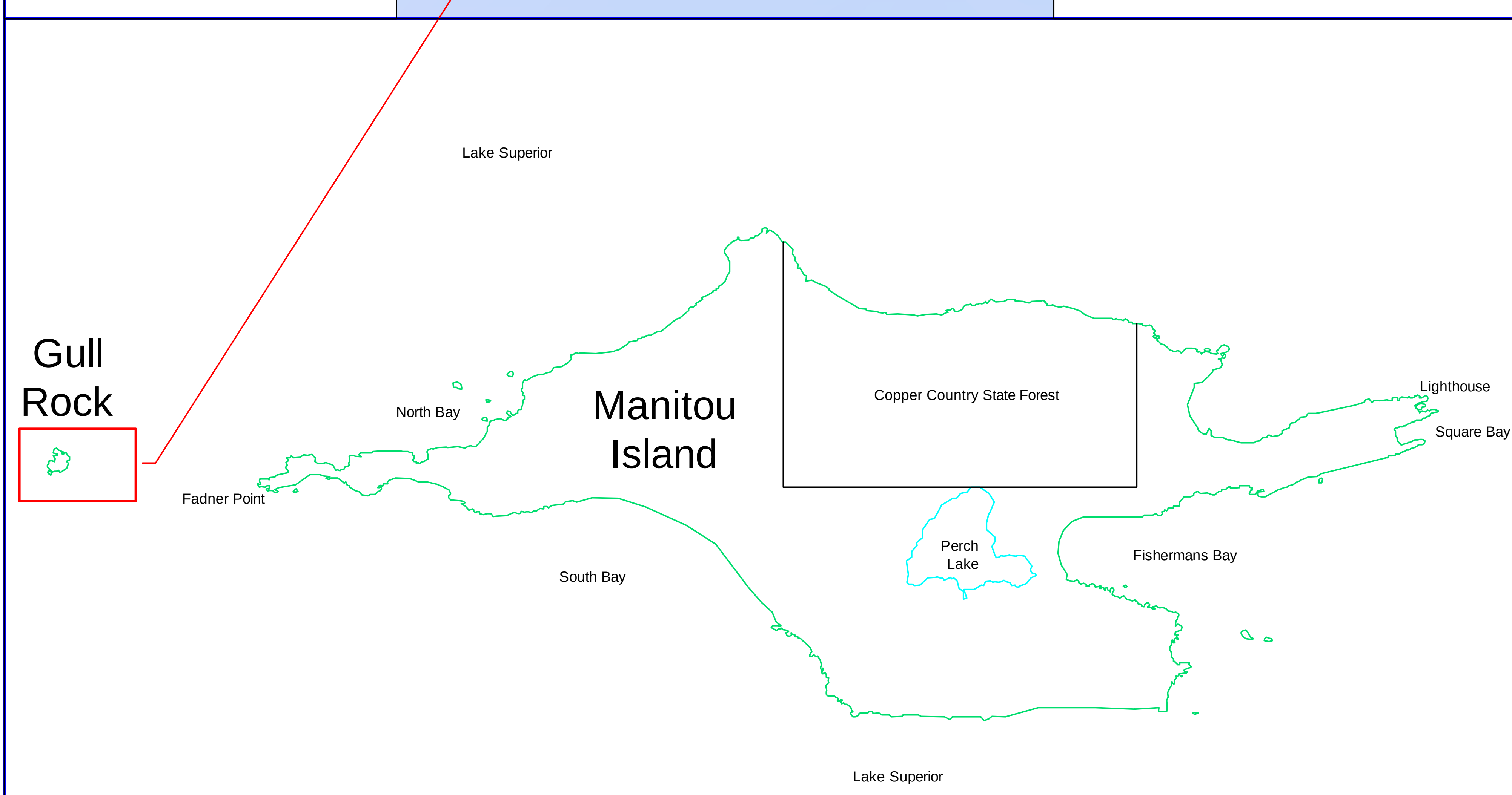
[1] The term "historic property" is defined in the National Historic Preservation Act (NHPA) as: "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on, the National Register"; such term includes artifacts, records, and remains which are related to such district, site, building, structure, or object. 16 U.S.C. Section 470(w)(5).

# Figures

## Figure 1 Site Layout

## Figure 2 Sampling Locations




Oshkosh, Wisconsin
920-235-0270

A/E PROJECT NO: 60289135-1.1
CAD FILE NAME: Site Layout Map

| | |
|---|---|
| DESIGNED BY: | MLF |
| DRAWN BY: | HEP/rpm |
| EDITED BY: | rpm |
| CHECKED BY: | MLF |

UNITED STATES COAST GUARD 1790

SHEET TITLE: FIELD SAMPLING PLAN

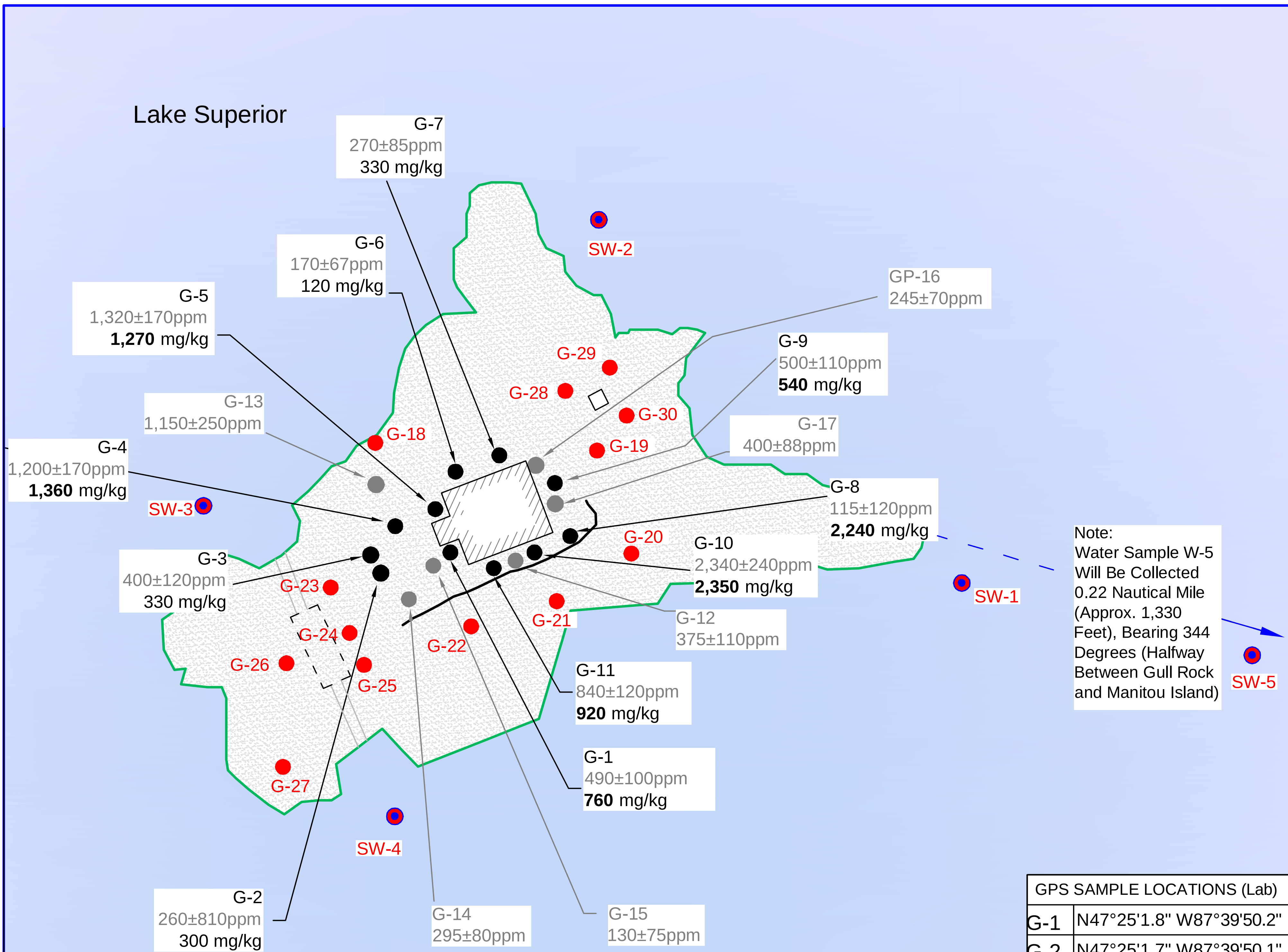
Site Layout

Gull Rock Light Station

Copper Harbor Michigan

United States Coast Guard
Civil Engineering Unit
Cleveland, Ohio

SHEET 1 OF 2




| GPS SAMPLE LOCATIONS (Lab) | |
|---|---|
| G-1 | N47°25'1.8" W87°39'50.2" |
| G-2 | N47°25'1.7" W87°39'50.1" |
| G-3 | N47°25'1.7" W87°39'50.4" |
| G-4 | N47°25'1.8" W87°39'50.3" |
| G-5 | N47°25'1.9" W87°39'49.4" |
| G-6 | N47°25'2.0" W87°39'50.0" |
| G-7 | N47°25'2.1" W87°39'49.8" |
| G-8 | N47°25'1.8" W87°39'49.2" |
| G-9 | N47°25'1.9" W87°39'49.2" |
| G-10 | N47°25'1.7" W87°39'49.6" |
| G-11 | N47°25'1.9" W87°39'49.6" |
| **GPS SAMPLE LOCATIONS (Screen)** | |
| G-12 | N47°25'1.9" W87°39'49.6" |
| G-13 | N47°25'1.9" W87°39'50.3" |
| G-14 | N47°25'1.5" W87°39'50.4" |
| G-15 | N47°25'1.4" W87°39'50.3" |
| G-16 | N47°25'2.0" W87°39'49.7" |
| G-17 | N47°25'1.7" W87°39'49.3" |

## Legend

Gull Rock

Light House

Former Boat House

Privy

Sea Wall

G-1 — Screen and Lab Sample Location

400 mg/kg — Lead Lab Result (milligrams per kilogram)

G-12 — Screen Sample Location

400±120ppm — Screen Sample Measurement (parts per million, which is equivalent to mg/kg)

G-18 — Proposed Soil Sample Locations

W-1 — Proposed Water Sample Locations

N W E S

0 50 100

SCALE IN FEET

NOTE:
1) All Samples are Approxiamately Six (6) Inches Deep
2) All Sample results are for Lead
3) **BOLD** values are above the Residential Direct Contact Limits for Michigan

Oshkosh, Wisconsin
920-235-0270

A/E PROJECT NO: 60289135-1.1
CAD FILE NAME: Site Layout Map
DESIGNED BY: MLF
DRAWN BY: HEP/rpm
EDITED BY: rpm
CHECKED BY: MLF

UNITED STATES COAST GUARD 1790

SHEET TITLE: FIELD SAMPLING PLAN

# Sampling Locations

Gull Rock Light Station — Copper Harbor Michigan

United States Coast Guard
Civil Engineering Unit
Cleveland, Ohio

SHEET 2 OF 2

# Appendix A.

# Standard Operating Procedures

Standard Operating Procedure
XRF Field Screening of Soil Samples

# Gull Rock Light Station CERCLA Investigation

# XRF Field Screening of Soil Samples

Procedure Number: 100

Date: July 2014

| | | | |
|---|---|---|---|
| Prepared By: | | Date: | July 10, 2014 |
| Approved By: | Technical Reviewer | Date: | July 10, 2014 |
| Approved By: | Michelle L. [illegible] QA Reviewer | Date: | July 10, 2014 |

# Contents

## 1.0 Introduction

This Standard Operating Procedure (SOP) describes the method for field screening soil samples collected from the surface soil borings at the Gull Rock Light Station property. This SOP provides specific procedures that will be used to field screen the soil samples collected which, if followed properly, will promote consistency. Field sampling personnel will follow specific quality assurance guidelines for the field screening as outlined in the project-specific Quality Assurance Project Plan (QAPP; AECOM, July 2014). The health and safety procedures outlined in the site-specific Health and Safety Plan (HASP; AECOM, January 2014) will also be followed by all field sampling personnel. The procedures contained in USEPA's *Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment* (SW-846, Method 6200; USEPA, February 2007) were used as guidance in the development of this SOP.

## 2.0 Required Equipment

The soil samples will be collected utilizing either trowel and/or scoop collection methods. The trowel and scoop will be constructed of stainless steel or other lead-free materials that can easily be decontaminated with an Alconox and distilled water solution. Additional equipment includes:

- Disposable zip lock plastic bags large enough to hold eight ounces of soil;
- Decontamination materials;
- Folding rule or measure tape;
- Innov-X Systems **a**4000 Handheld X-Ray Florescence (XRF) Analyzer (supplied by US Environmental Rental);
- Personal protective equipment (PPE, as described in the HASP); and
- Field log book.

Equipment decontamination procedures are provided in AECOM SOP 400. The soil sample collection procedures are provided in AECOM SOP 200.

## 3.0 Field Screening Procedures

**3.1** Equipment Calibration

Soil samples will be screened in the field using an Innov-X Systems **a**4000 Handheld XRF analyzer. The XRF analyzer will be tested for battery power level and proper operation prior to the start of field work. Upon arriving to the work site, the XRF analyzer will be allowed to power up for 15 minutes at ambient field temperature.

Before performing tests, it is necessary to standardize the XRF instrument. This automated procedure involves collecting a spectrum on a known standard (Alloy 316) and comparing a variety of parameters to values stored when the instrument was calibrated at the factory. If there are any problems with the instrument, they will be indicated by an error message.

The XRF will be set to bulk sample mode for soil screening. The XRF analyzer will be tested for accuracy using National Institute of Standards and Technology (NIST) Standard Reference Materials Program calibration samples[1]. The calibration standards used and the XRF analyzer results will be recorded in the field log book. The XRF analyzer will be tested prior to sampling and every four hours throughout the sampling period to ensure accurate data collection.

**3.2** Sample Screening

The prepared field screening samples (bagged soil samples) will be placed on a lead-free metal or plastic work table prior to XRF screening. Each sample will be screened by placing the XRF analyzer onto the bag sample for 30 seconds. This procedure will be performed twice on each sample. The XRF analyzer results will be recorded in instrument units that are equivalent to parts per million.

## 4.0 Documentation

The field log book will be maintained as an overall record of all samples collected during the soil sampling activities. The XRF field screening data will be recorded on a Soil Sampling Log (see AECOM SOP 200), which includes specific information about the sample. The highest XRF analyzer results observed between the two tests performed on each sample collected will be recorded on the Soil Sampling Log. All documents generated during the excavation field screening will be maintained in the project file.

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[1] NIST 2709 (18.9 milligrams per kilogram [mg/kg]), NIST 2710 (5,532 mg/kg), and NIST 2711 (1,162 mg/kg)

AECOM

Standard Operating Procedure
Shallow Boring - Soil Sample Collection

# Gull Rock Light Station CERCLA Investigation

## Shallow Boring - Soil Sample Collection

Procedure Number: 200

Date: July 2014

| | | | |
|---|---|---|---|
| Prepared By: | | Date: | July 10, 2014 |
| Approved By: | Technical Reviewer | Date: | July 10, 2014 |
| Approved By: | Michelle L. Dreimund<br>QA Reviewer | Date: | July 10, 2014 |

# Contents

## 1.0 Introduction

This Standard Operating Procedure (SOP) describes the method for obtaining soil samples from shallow surface soil borings for field screening and/or chemical analysis at the Gull Rock Light Station property. This SOP provides specific procedures that will be used to collect the soil samples which, if followed properly, will promote consistency in sampling and provide a basis for sample representativeness. Field sampling personnel will follow specific quality assurance guidelines for the soil sampling as outlined in the project-specific Quality Assurance Project Plan (QAPP; AECOM, July 2014). The health and safety procedures outlined in the site-specific Health and Safety Plan (HASP; AECOM, January 2014) will also be followed by all field sampling personnel.

## 2.0 Required Equipment

The soil samples will be collected utilizing either trowel and/or scoop collection methods. The trowel and scoop will be constructed of stainless steel or other lead-free materials that can easily be decontaminated with an Alconox and distilled water solution. Additional sampling equipment includes:

- Disposable zip lock plastic bags large enough to hold eight ounces of soil;
- Laboratory analytical sample kit (*i.e.* bottles, labels, chain of custody, *etc*.);
- Decontamination materials;
- Folding rule or measure tape;
- Innov-X Systems **a** 4000™ Handheld X-Ray Florescence (XRF) Analyzer;
- Personal protective equipment (PPE, as described in the HASP); and
- Field log book.

XRF field screening, soil sample handling and analysis, and equipment decontamination procedures are provided in AECOM SOPs 100, 300, and 500, respectively.

## 3.0 Sampling Procedures

Field personnel wearing disposable nitrile gloves or other appropriate PPE (as described in the HASP) will clear away any surface material (flora and gravel) from the selected sample location. Using the trowel and/or scoop, field personnel will dig down to the top of bedrock (sandstone conglomerate), approximately 6 inches, to collect approximately 8 ounces of soil for field screening and/or laboratory analyses. The soil collected for field screening with the XRF will be placed into a zip lock plastic bag, sealed, and any large pieces of soil within the plastic bag will be broken into smaller pieces and the soil will be blended to form as homogeneous a mixture as practical. The soil collected for laboratory analysis will be placed into a laboratory-provided plastic four-ounce container with a plastic screw-on lid. Any soil particles remaining on the plastic container's rim will be brushed away with an unused sheet of paper towel before securely screwing on the container's lid. Following sample collection, the sample containers will be labeled in accordance with the July 2014 Field Sampling Plan and QAPP.

## 4.0 Documentation

The field log book will be maintained as an overall record of all samples collected during the soil sampling activities. Sample collection data will be recorded on a Soil Sampling Log (attached) and includes specific information about the sample. Analytical sample custody procedures will comply with the United States Environmental Protection Agency (USEPA) and USEPA's National Enforcement Investigations Center requirements for sample control. A chain of custody form will be filled out upon completion of sampling and accompany the samples to laboratory. All documents generated during the excavation soil sampling will be maintained in the project file.

# SOIL SAMPLING LOG

**Project Name:** ______________________________

**Project Location:** ______________________________

**AECOM Project:** ______________________________

**Sample Point Description/Designation:** ______________________________

______________________________

______________________________

| Sample Name | Depth (inches below grade) | Material Type | Analyses Requested | XRF Reading | Sample Date/Time |
|---|---|---|---|---|---|
| | | | | | |
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Standard Operating Procedure
Sample Handling and Analysis

# Gull Rock Light Station CERCLA Investigation

## Sample Handling and Analysis

Procedure Number: 300

Date: July 2014

| | | | |
|---|---|---|---|
| Prepared By: | | Date: | July 10, 2014 |
| Approved By: | Technical Reviewer | Date: | July 10, 2014 |
| Approved By: | QA Reviewer | Date: | July 10, 2014 |

# Contents

# 1.0 Introduction

This Standard Operating Procedure (SOP) describes the quality control and handling procedures for samples collected at the United States Coast Guard (USCG) Gull Rock Light Station property. This SOP provides specific procedures that will be used to: prepare the samples for shipment to the laboratory for analysis; the analysis that will be performed; briefly describe quality assurance/quality control (QA/QC) samples to be collected; and documentation of the procedures. Field sampling personnel will follow specific quality assurance guidelines for the soil and groundwater sampling as outlined in the project-specific Quality Assurance Project Plan (QAPP; AECOM, July 2014). The health and safety procedures outlined in the site-specific Health and Safety Plan (HASP; AECOM, January 2014) will also be followed by all field sampling personnel.

# 2.0 Analytical sample handling

Upon receipt of the analytical sample jars and shipping container (cooler) from the laboratory, the shipping container will be inspected for cleanliness and integrity. The cooler will be discarded if any interior or exterior cracks on the walls and/or cracked or broken hinges are observed, and a new container will be purchased. The cooler(s) will also be discarded if replacement handles can not be fashioned to replace those that are missing upon receipt. Previous shipping labels and tape will be removed from the container upon receipt from the laboratory. The cooler will be decontaminated in accordance with AECOM SOP 500 for this project if, upon inspection, the interior has visual evidence of contamination or odors.

During the sampling activities, the analytical samples will be required to be kept cool (between 6° and 0° Celsius), therefore, the cooler will require ice and cold packs, as needed, while on site. If cubed ice will be used, the ice will be placed on the bottom of the cooler. If cold packs are used, they will be placed along the walls inside the bottom of the cooler. The cooler will then be lined with a clean, new, large plastic (trash) bag (on top of the ice or cold packs) in which to place the analytical samples.

## 2.1 Soil

Following sample collection, the sample containers will be labeled with the sample identification, date of sample collection, and intended analysis. The 4-ounce plastic sample containers will be placed in zip lock plastic bags and placed in the cooler. In order to maintain the interior temperature, the cooler will only be opened during placement of the sample containers.

**2.2** Surface water

Following sample collection, the sample containers will be labeled with the sample identification, date of sample collection, and intended analysis. The water sample bottles from each sample location will be placed together (as a set) into a zip lock plastic bag and wrapped in protective packaging material or a sealing, bubble matted bag. The surface water sample containers will be packed in the cooler. In order to maintain the interior temperature, the cooler will only be opened during placement of the sample containers.

**2.3** Shipping

To prepare the analytical samples for shipping to the laboratory, the bottom of the cooler will be lined with bubble matting or similar-type protective packaging material. A new, clean, plastic (trash) bag will be placed into the cooler (over the bottom lining), on top of which will be placed the sample containers in an upright position and in single layers, separated by packaging material. Any residual space between sample containers in each layer will be filled with additional packaging material. Once the cooler(s) is/are filled to approximately 75% capacity, double-bagged (in zip locking bags) cubed ice will be placed on top of the sample containers, filling the remaining space.

The completed chain of custody (according to the procedures outlined in Section 4.2 of this SOP) will be placed in a zip lock plastic bag and taped to the inside lid of the cooler (chain of custody will correlate to the samples placed inside that particular cooler). The two pieces of custody seal tape will then be placed on the container, on opposite corners of the lid. The shipping container will be sealed with packing tape, which will be wrapped twice around the entire container and on opposite ends, over custody seals. The appropriate shipping form will be completed for overnight delivery via commercial courier to the laboratory and affixed to the lid/top of shipping container. The shipping receipt will be maintained for documentation. Analytical samples will be submitted to CT Laboratories LLC located in Baraboo, Wisconsin, for analysis according to the table presented in Section 3.0 of the Gull Rock CERCLA Investigation Field Sampling Plan (FSP; AECOM July 2014) as presented below.

| Sample Identification | Sampling Frequency | Analytical Parameter |
|---|---|---|
| Soil Samples - Shallow Hand Borings | One analytical sample collected at approximately 6 inches bgs | Total Lead and lead TCLP |
| Surface Water Samples | One sample location | Alkalinity, Dissolved Lead, pH, and Total Hardness |
| Duplicates (field and analytical) | One for every 10 soil samples collected for laboratory analysis<br><br>One for every 10 surface water samples collected for laboratory analysis | Total Lead and TCLP<br><br>Total Lead |

| Sample Identification | Sampling Frequency | Analytical Parameter |
|---|---|---|
| Field Equipment Blanks | One at the end of each day of soil sampling | Total Lead |
| | One at the end of each day of surface water sampling | Total Lead |

TCLP – Toxicity Characteristic Leaching Procedure

Upon receipt of the analytical samples by the laboratory, the cooler will be inspected and any damage and/or broken custody seals will be noted on the chain of custody. The container will then be opened and the laboratory will sign the chain of custody as receipt of samples. The laboratory will document the condition of the samples and note any damage and discrepancies between the contents of the container and what is documented on the chain of custody. Any damaged samples or discrepancies will be immediately reported to the AECOM project manager.

# 3.0 Quality assurance/quality control

Field personnel should follow specific quality assurance guidelines as outlined in the QAPP (AECOM, July 2014). Quality assurance (QA) requirements typically suggest the collection of a sufficient quantity of quality control (QC) samples such as field duplicate, equipment and/or field blanks, and matrix spike/matrix spike duplicate (MS/MSD) samples. These requirements are outlined in the FSP and QAPP. The following laboratory QA/QC samples will be submitted with the analytical samples.

## 3.1 Equipment blank sample collection

Equipment blank samples serve as a quality assurance check of equipment decontamination procedures at the time of sampling. Equipment blank samples are usually prepared by transferring analyte-free water over the sampling equipment before it is used to collect a set of analytical samples, which is then collected in a laboratory provided sampling jar for analysis. The FSP and QAPP contain specific information regarding the type and number of equipment blanks required for collection.

## 3.2 Field duplicate sample collection

Field duplicate samples are collected for the purpose of providing two sets of results for comparison. These samples are used to assess precision of sample collection and the laboratory instruments. Duplicate samples are usually prepared by splitting the sample into two sets of sample containers, then analyzing each set as a separate sample. The FSP and QAPP contain specific information regarding the type and number of duplicate samples for collection.

### 3.3 Matrix spike/matrix spike duplicate (MS/MSD) sample collection

MS/MSDs provide information about the effect of the sample matrix on digestion and measurement methodology. For samples submitted for MS/MSD analysis, triple sample volume is generally required. The QAPP contains specific information regarding the frequency of MS/MSD samples.

## 4.0 Documentation

### 4.1 Field log book

The notes transcribed in a field log book will be maintained as an overall record of the sample handling procedures. The shipping firm, method, and receipt will be documented in and maintained with the field log book during the field sampling activities. Upon completion of the field activities, the referenced pages in the field log book will be scanned and converted to a .pdf file. All documents generated during the Site Investigation soil and surface water sampling will be maintained in the project file.

### 4.2 Chain of custody

Sample custody procedures will comply with USEPA and USEPA's National Enforcement Investigations Center requirements for sample control. A chain of custody form, provided by the laboratory, will be filled out completely and legibly in ink upon completion of sampling, and the form will accompany the samples to CT Laboratories. Field personnel are required to complete the following information on the chain of custody form(s):

- Project Number
- Client or Project Name
- Project Location
- Field Sample Identification Number
- Date and Time of Sample Collection
- Sample Matrix
- Analysis Requested
- Sampler's Signature
- Signature of Person Relinquishing Sample Custody
- Date and Time Relinquished
- Sampler Remarks
- Chain of Custody ID Number

Custody seals will include the date, time, sampler name, and project name. Chain of custody form(s) will accompany each sample shipment. At least two custody seals will be placed on all sample coolers. The sampler will relinquish the sample containers with the form(s) to the commercial courier and retain one copy for the project file.

Standard Operating Procedure
Surface Water Sample Collection and Handling

# Gull Rock Light Station CERCLA Investigation

# Surface Water Sample Collection and Handling

Procedure Number: 400

Date: July 2014

| | | | |
|---|---|---|---|
| Prepared By: | | Date: | July 10, 2014 |
| Approved By: | Technical Reviewer | Date: | July 10, 2014 |
| Approved By: | Michelle L. [illegible] QA Reviewer | Date: | July 10, 2014 |

Standard Operating Procedure
Surface Water Sample Collection and Handling



# Contents

# 1.0 Introduction

This Standard Operating Procedure (SOP) describes the method for obtaining surface water samples from Lake Superior around the United States Coast Guard (USCG) Gull Rock Light Station. This SOP provides specific procedures that will be used to collect the water samples which, if followed properly, will promote consistency in sampling and provide a basis for sample representativeness. Field sampling personnel will follow specific quality assurance guidelines for the surface water sampling as outlined in the project-specific Quality Assurance Project Plan (QAPP; AECOM, July 2014). The health and safety procedures outlined in the site-specific Health and Safety Plan (HASP; AECOM, January 2014) will also be followed by all field sampling personnel.

# 2.0 Required equipment

The surface water samples will be collected utilizing dedicated (disposable) bailers. Additional sampling equipment includes:

- Bailer rope/cord;
- Bottom discharge sampling devices (bailer);
- Laboratory analytical sample kit (i.e. bottles, labels, chain of custody, etc.);
- Decontamination materials;
- Personal protective equipment (PPE, as described in the HASP); and
- Field log book.

Sample handling and analysis. and equipment decontamination procedures are provided in AECOM SOPs 300 and 500, respectively.

# 3.0 Sampling procedures

The surface water samples will be collected directly from Lake Superior to evaluate potential biological impacts from the historical use of lead based paints at the USCG Gull Rock Light Station. The surface water samples will be collected using disposable polyethylene bailers. Four surface water samples will be collected from 25 feet away from the shore of Gull Rock. The sample locations will be evenly spaced around the shore. In addition, another surface water sample will be collected from mid-way between Gull Rock and Manitou Island. Manitou Island is approximately 0.44 nautical mile to the east of Gull Rock (the fifth surface water sample will be collected approximately 1,330 feet from Gull Rock).

## 3.1 Sampling

Field personnel will wear disposable nitrile gloves or other appropriate PPE (as described in the HASP) while performing the surface water sampling. Field personnel will utilize a boat to access the surface water sample locations. The water samples will be collected utilizing a disposable polyethylene bailer. The top of the bailer will be exposed, keeping the rest of the bailer in its protective packaging, in order to tie the bailer rope to the bailer loop. The bailer will be removed completely from its protective packaging and lowered into the water. When the bailer has completely submerged (3 feet deep) into the water, the rope will be cut to an appropriate length to allow for creation of a hand loop.

Field personnel will raise the bailer by grasping/ungrasping sections of the rope/cord with alternating hands. Once the upper portion of the bailer is within reach, field personnel will grab the bailer in preparation to fill the sample bottles. The sample bottles will be filled by placing a discharge tube into the bottom of the bailer.

The surface water samples collected for laboratory analysis of total lead will be placed in laboratory-provided 250-milliliter plastic bottles with the appropriate measure of laboratory provided preservative (nitric acid). The surface water samples collected for laboratory analyses of alkalinity and pH will be placed in laboratory-provided 250-milliliter unpreserved plastic bottles. The surface water samples collected for laboratory analysis of hardness will be placed in laboratory-provided 250-milliliter plastic bottles with the appropriate measure of laboratory provided preservative (nitric acid). Each of the surface water sample bottles will be filled to the shoulder and securely capped. After all the surface water samples are collected, the bailer, rope, and PPE used for the sampling location will be discarded.

# 4.0 Documentation

The field log book will be maintained as an overall record of all samples collected during the sampling activities. Laboratory analytical sample collection data will be recorded in the field log book, which will include specific information about the sample, such as sample name, date and time collected, and requested analysis, corresponding with the labels on the sample bottles. Analytical sample custody procedures will comply with the United States Environmental Protection Agency (USEPA) and USEPA's National Enforcement Investigations Center requirements for sample control. A chain of custody form will be filled out upon completion of sampling and accompany the samples to laboratory. Documentation of the number and location of drums storing spent sampling paraphernalia will also be recorded in the field log book. All documents generated during the surface water sampling will be maintained in the project file.

AECOM

Standard Operating Procedure
Sampling Equipment Decontamination

# Gull Rock Light Station CERCLA Investigation

# Sampling Equipment Decontamination

Procedure Number: 500

Date: July 2014

| | | | |
|---|---|---|---|
| Prepared By: | | Date: | July 10, 2014 |
| Approved By: | Technical Reviewer | Date: | July 10, 2014 |
| Approved By: | QA Reviewer | Date: | July 10, 2014 |

# Contents

# 1.0 Introduction

This Standard Operating Procedure (SOP) describes the method for decontamination of field equipment used to collect soil and surface water samples during the Site Investigation field activities at the United States Coast Guard (USCG) Gull Rock Light Station. This SOP provides specific procedures that will assist in the protection of field personnel from potential exposure to hazardous materials, protect the community by preventing the transportation of contaminants from the site, and prevent cross-contamination of the soil and groundwater samples collected during the field activities. Field personnel will follow specific quality assurance guidelines for the sampling equipment decontamination as outlined in the project-specific Quality Assurance Project Plan (QAPP; AECOM, July 2014). The health and safety procedures outlined in the site-specific Health and Safety Plan (HASP; AECOM, January 2014) will also be followed by all field sampling personnel.

# 2.0 Required materials

A decontamination station will be established on the property that is easily accessible from the sampling locations. The field sampling equipment will be inspected prior to use and decontaminated, if needed. Decontamination materials include:

- Decontamination agents, which include Alconox (or other phosphate-free biodegradable detergent) and distilled water;
- Chemical-free paper towels;
- Cleaning containers (plastic buckets or tubs);
- Cleaning brushes;
- Personal protective equipment (PPE, as described in the HASP);
- Squeeze bottles (for rinsing);
- Plastic sheeting; and
- Field log book.

# 3.0 Decontamination procedures

All spent decontamination liquids will be drummed and stored on site pending analysis for proper treatment and disposal. A new pair of nitrile gloves will be used between decontamination events (following the sample collection).

## 3.1 Soil sampling equipment

After a soil sample has been collected, all residual soil, to the extent practicable, will be removed from the hand tools by brushing and then rinsed with distilled water. This step can be accomplished using a bucket filled with distilled water and a brush. The sampling equipment will be washed, using a brush, in a phosphate-free detergent and distilled water solution until there is no physical evidence of soil/sediment on the equipment. The soil sampling equipment will then be rinsed, twice, with distilled water: the first in a designated rinse water bucket; and second, using a squeeze bottle and holding the equipment over the rinse bucket to collect the rinsate. The equipment will then be blotted dry using the chemical-free paper towels prior to use at the next sampling location.

## 3.2 Surface water sampling equipment

All surface water sampling equipment (disposable polyethylene bailers, bailer rope, nitrile gloves, and paper towels) is disposable (dedicated) and decontamination is not required.

# 4.0 Documentation

The field log book will be maintained as an overall record of all decontamination procedures implemented during the field sampling activities. The documentation will include: a list of the equipment that was decontaminated; date, time and method of collection of any rinsate and equipment blank samples; and location and number of drums storing decontamination wastes. All documents generated during the decontamination procedures will be maintained in the project file.

# Appendix B.

# Health and Safety Plan

# HEALTH AND SAFETY PLAN
# Site Investigation Activities
# Manitou Island Lighthouse
# and Gull Rock Lighthouse
# Manitou Island and Gull Rock - Keweenaw County, Michigan

***Prepared for:***

United States Coast Guard

***Prepared by:***

AECOM Technical Services
1555 N. RiverCenter Drive
Milwaukee, Wisconsin 53212

***Health and Safety Plan Expiration Date:*** April 30, 2016

Project No: 60289135

# Project Health and Safety Plan
# Approval Page

This project Health and Safety Plan (HASP) was prepared for employees performing a specific, limited scope of work. It was prepared based on the best available information regarding the physical and chemical hazards known or suspected to be present on the project site. While it is not possible to discover, evaluate, and protect in advance against all possible hazards, which may be encountered during the completion of this project, adherence to the requirements of the HASP will significantly reduce the potential for occupational injury.

By signing below, I acknowledge that I have reviewed and hereby approve the HASP for the Site Investigation Activities at Manitou Island Lighthouse and Gull Rock Lighthouse sites. The sites are located in Lake Superior on the eastern tip of Manitou Island, roughly 6 miles from the eastern end of the Keweenaw Peninsula and the Gull Rock Lighthouse located on Gull Rock, 0.5 mile off the western end of Manitou Island and 2.5 miles from the eastern end of the Keweenaw Peninsula. This HASP has been written for the exclusive use of AECOM, its employees, and subcontractors. The plan is written for specified site conditions, dates, and personnel, and must be amended if these conditions change.

**Prepared by:**

R

**Richard Mazurkiewicz**
Senior Hydrogeologist
414-944-6174

January 28, 2014
Date

**Approved by:**

Michelle L. Freimund

**Michelle Freimund**
Project Manager
920- 236-6712

January 28, 2014
Date

**Approved by:**

William C. Looney

**William C. Looney**
Senior Program Manager
AECOM Safety Professional
414-944-6182

January 28, 2014
Date

## Executive Summary

The purpose of this HASP is to address health and safety concerns related to the AECOM Technical Services (AECOM) managed Environmental Investigation Activities at the Manitou Island Lighthouse and Gull Rock Lighthouse sites. The sites are located in Lake Superior on the eastern tip of Manitou Island, roughly 6 miles from the eastern end of the Keweenaw Peninsula and the Gull Rock Lighthouse located on Gull Rock, 0.5 mile off the western end of Manitou Island and 2.5 miles from the eastern end of the Keweenaw Peninsula. The specific roles, responsibilities, authority, and requirements as they pertain to the safety of employees and the scope of services are discussed herein. The document is intended to identify known potential hazards and facilitate communication and control measures to prevent injury or harm. Additionally, provisions to control the potential for environmental impact from these activities are included where applicable.

AECOM, under contract with the United States Coast Guard, will complete environmental investigation activities at the Sites. This investigation will involve the completion of soil borings, the collection of soil samples for laboratory analysis, the completion of temporary monitoring wells in select boreholes, the collection and analysis of groundwater samples from the temporary monitoring wells. The drilling activities will be completed by AECOM utilizing a hand operated hammer drill.

The primary physical hazards which may be encountered include:

| | | |
|---|---|---|
| Vehicle Operation | Lifting | Traffic |
| Overhead Utilities | Noise | Falling objects |
| Underground Utilities | Dust | Flying debris |
| Heavy Equipment Operation (hand tools; vehicles; boats) | Sharp Objects | Biologic Hazards (plants; insects, animals) |
| Drilling and Boring | Splashing Liquids | Weather (Heat and Cold Stress; sunburn) |
| Slips, Trips and Falls | Corrosive Liquids | Inclement Weather |
| Hot Surfaces | Flammable Liquids | Poor Lighting |
| Pinch Points | High Pressure Liquids | Personal Safety |
| Electrical | | |

Note: This list should not be considered to be all-inclusive. **ADDITIONAL PHYSICAL HAZARDS MAY BE PRESENT**

The chemical hazards which may be encountered include:

| | |
|---|---|
| Lead | Semi Volatile Organic Compounds |
| Volatile Organic Compounds | PCBs |
| Petroleum Hydrocarbons (Gasoline Range Organics) | Carbon Monoxide |
| Petroleum Hydrocarbons (Diesel Range Organics) | Dust |

Note: This list should not be considered to be all-inclusive. **ADDITIONAL CONTAMINANTS MAY BE PRESENT.**

All staff are bound by the provisions of this HASP and are required to participate in a preliminary project safety meeting to familiarize them with the anticipated hazards and respective onsite controls. The discussion will cover the entire HASP subject matter, putting emphasis on critical elements of the plan; such as the emergency response procedures, personal protective equipment, site control strategies, and monitoring requirements. In addition, daily tailgate safety meetings will be held to discuss: the anticipated scope of work, required controls, identify new hazards and controls, incident reporting, review the results of inspections, any lessons learned or concerns from the previous day.

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## FIGURES

# 1.0 Introduction

This HASP (including Attachments) provides a general description of the levels of personal protection and safe operating guidelines expected of each employee or subcontractor associated with the Environmental Investigation Activities at the Manitou Island Lighthouse and Gull Rock Lighthouse properties (Site). The Sites are located in Lake Superior on the eastern tip of Manitou Island, roughly 6 miles from the eastern end of the Keweenaw Peninsula and the Gull Rock Lighthouse located on Gull Rock, 0.5 mile off the western end of Manitou Island and 2.5 miles from the eastern end of the Keweenaw Peninsula. This HASP also identifies chemical and physical hazards known to be associated with the AECOM-managed activities addressed in this document.

HASP Supplements will be generated as necessary to address any additional activities or changes in site conditions, which may occur during field operations.

## 1.1 General

The provisions of this HASP are mandatory for all AECOM personnel engaged in fieldwork associated with the environmental services being conducted at the subject Site. A copy of this HASP, any applicable HASP Supplements and the AECOM's North America Safety, Health, and Environmental (SH&E) Procedures and Manual shall be accessible on Site and available for review at all times. Record keeping will be maintained in accordance with this HASP and the applicable Standard Operating Procedures (SOPs). In the event of a conflict between this HASP, the SOPs and federal, state, and local regulations, workers shall follow the most stringent/protective requirements. Concurrence with the provisions of this HASP is mandatory for all personnel at the site covered by this HASP and must sign the HASP acknowledgement page.

## 1.2 Project Policy Statement

AECOM is committed to protecting the safety and health of our employees and meeting our obligations with respect to the protection of others affected by our activities. We are also committed to protecting and preserving the natural environment in which we operate. The safety of persons and property is of vital importance to the success of this project and accident prevention measures shall be implemented to avoid injury, waste and loss. It shall be the policy that all operations be conducted safely. Onsite supervisors are responsible for maintaining a safe and healthy working environment in their areas of responsibility and for fairly and uniformly enforcing safety and health rules and requirements for all project personnel.

Client, AECOM subcontractor and third party employees performing work that potentially exposes them to the hazards at the site are responsible for the safety and health for their personnel, must work under their own HASP and are also expected to review and acknowledge this HASP as a recognition of the SH&E standards that AECOM expects outside personnel to uphold.

Subcontractors shall comply with the requirements of the health and safety provisions contained within the contract document and all applicable rules, requirements and health, safety and environmental regulations. All practical measures shall be implemented to promote safety and maintain a safe place to work. Contractors are wholly responsible for the prevention of accidents on work under their direction and shall be responsible for thorough safety and loss control programs and the execution of their own safety plans for the protection of workers.

## 1.3 References

This HASP conforms to the regulatory requirements and guidelines established in the following documents:

- Title 29, Part 1910 of the Code of Federal Regulations (29 CFR 1910), Occupational Safety and Health Standards (with special attention to Section 120, *Hazardous Waste Operations and Emergency Response*).
- Title 29, Part 1926 of the Code of Federal Regulations (29 CFR 1926), *Safety and Health Regulations for Construction*.
- National Institute for Occupational Safety and Health (NIOSH)/OSHA/U.S. Coast Guard (USCG)/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, Publication No. 85-115, 1985..

# 2.0 Site Information and Scope of Work

AECOM will complete the environmental investigation activities at the Manitou Island Lighthouse and Gull Rock Lighthouse properties. The Sites are located in Lake Superior on the eastern tip of Manitou Island, roughly 6 miles from the eastern end of the Keweenaw Peninsula and the Gull Rock Lighthouse located on Gull Rock, 0.5 mile off the western end of Manitou Island and 2.5 miles from the eastern end of the Keweenaw Peninsula. Work will be performed in accordance with the applicable Statement of Work (SOW) and associated Project Work Plan developed for project site. Deviations from the listed SOW will require that a Safety Professional review and changes made to this HASP, to ensure adequate protection of personnel and other property.

The following is a summary of relevant data concerning the project site and the work procedures to be completed. The Project Work Plan prepared by AECOM as a companion document to this HASP provides more detail concerning both site history and planned work operations.

## 2.1 Site Information

This section provides a general description and historical information associated with the Site.

### 2.1.1 General Description

**Manitou Island Lighthouse**

The Manitou Island Lighthouse is located in Lake Superior on the eastern tip of Manitou Island, roughly 6 miles from the eastern end of the Keweenaw Peninsula. Manitou Island is approximately 3 miles in length and 1¼ miles at its widest point, the westernmost portion of the Island sits approximately 2¾ miles to the east of Keweenaw Point at the northern end of the Keweenaw Peninsula. The only access to Manitou Island is via boat. Structures include the light tower and several outbuildings generally in a state of disrepair and neglect.

**Gull Rock Lighthouse**

The Gull Rock Lighthouse is located off Gull Rock, ½ mile off the western end of Manitou Island and 2½ miles from the eastern end of the Keweenaw Peninsula. Gull Rock is approximately 250 feet in length and 100 feet in width with its highest point less than twelve feet above the water under the calmest conditions. Structures include the light tower with an attached dwelling, a boat dock and a privy. The only access to Gull Rock is via boat.

The United States Coast Guard Site contact for the Sites is Greg Carpenter (216.902.6219).

### 2.1.2 Site Background/History

**Manitou Island Lighthouse**

The Manitou Island Lighthouse has been in operation from 1849 until the present. The light is currently solar powered and the Lighthouse is not manned. The USCG has been identified as a responsible party for the Site. Previous investigations at the Site identified several dump areas. More than 30-tons of scrap metal, trash and trash-laced soil were removed from the main dump on the island in 1996 along with nine overpack drums of transformers, capacitors, diesel fuel and batteries that were classed as hazardous waste. The potential use of lead-based paint on structures at the property with the attendant potential for lead impacts to soil has also been noted.

**Gull Rock Lighthouse**

From 1867 until the present, the property was used as an aid to navigation. The light is currently solar powered and the Lighthouse is not manned. The USCG has been identified as a responsible party for the Site. The potential use of lead-based paint on structures at the property with the attendant potential for lead impacts to soil has been noted. Vinyl chloride was present in a soil gas sample collected on site at a concentration exceeding the US EPA Region 3 and WDNR residential and non-residential screening levels.

## 2.2 Scope of Work

This project will include work detailed in the project-specific work plans. In general, major field activities will consist of:

- Mobilization to the Site;
- Advancing soil borings, using hand auger and hammer drill techniques;
- Collecting soil samples from boring locations for field screening with a photoionization detector (PID) and an X-Ray fluorescence (XRF) analyzer, and subsequent laboratory analysis;

- Installing temporary monitoring wells at select soil boring locations;
- Collecting groundwater samples from new temporary monitor wells for screening and subsequent laboratory analyses;
- Performing other services required to support investigation activities; and
- Demobilization.

#### 2.2.1 Additional Work Operations

Operations at the site may require additional tasks not identified in this section or addressed in **Attachment A**, THAs (Task Hazard Analysis). Before performing any task not covered in this HASP, a THA must be prepared, and approved by the Safety Professional.

## 3.0 Project Health and Safety Organization

### 3.1 AECOM Project Manager

The AECOM Project Manager (PM; Michelle Freimund) has overall management authority and responsibility for all AECOM site operations, including safety. The PM will provide the site supervisor with work plans, staff, and budgetary resources, which are appropriate to meet the safety needs of the project operations.

### 3.2 AECOM Site Supervisor

The AECOM Site Supervisor has the overall responsibility and authority to direct work operations at the job site according to the provided work plans. The PM may act as the site supervisor while on site.

#### 3.2.1 Responsibilities

The site supervisor is responsible for:

- Discussing deviations from the work plan with the AECOM Site Safety Officer (SSO) and PM.
- Discussing safety issues with the PM, AECOM SSO, and field personnel.
- Assisting the AECOM SSO with the development and implementation of corrective actions for site safety deficiencies.
- Assisting the AECOM SSO with the implementation of this HASP and ensuring compliance.
- Assisting the AECOM SSO with inspections of the site for compliance with this HASP and applicable SOPs.

#### 3.2.2 Authority

The site supervisor has authority to:

- Verifying that all operations are in compliance with the requirements of this HASP, and halt any activity that poses a potential hazard to personnel, property, or the environment.
- Temporarily suspending individuals from field activities for infractions against the HASP pending consideration by the AECOM SSO, the Safety Professional, and the PM.

#### 3.2.3 Qualifications

In addition to being Hazardous Waste Operations and Emergency Response (HAZWOPER)-qualified (see Section 4.1), the Site Supervisor is required to have completed the 8-hour HAZWOPER Supervisor Training Course in accordance with 29 CFR 1910.120 (e)(4).

### 3.3 AECOM Site Safety Officer

The AECOM Site Safety Officer will have the following responsibilities and authority:

#### 3.3.1 Responsibilities

The AECOM SSO is responsible for:

- Updating the site-specific HASP to reflect changes in site conditions or the scope of work. HASP updates must be reviewed and approved by the Safety Professional.
- Being aware of changes in AECOM Safety Policy.
- Monitoring the lost time incidence rate for this project and work toward improving it.
- Inspecting the site for compliance with this HASP and applicable SOPs using the appropriate audit inspection checklist provided by an AECOM Safety Professional.
- Working with the site supervisor and PM to develop and implement corrective action plans to correct deficiencies discovered during site inspections. Deficiencies will be discussed with project management to determine appropriate corrective action(s).
- Contacting the Safety Professional for technical advice regarding safety issues.
- Providing a means for employees to communicate safety issues to management in a discreet manner (i.e., suggestion box, etc.).
- Determining emergency evacuation routes, establishing and posting local emergency telephone numbers, and arranging emergency transportation.

- Checking that all site personnel and visitors have received the proper training and medical clearance prior to entering the site.
- Establishing any necessary controlled work areas (as designated in this HASP or other safety documentation).
- Presenting tailgate safety meetings and maintain attendance logs and records.
- Discussing potential health and safety hazards with the AECOM Site Supervisor, the AECOM Safety Professional, and the PM.
- Selecting an alternate AECOM SSO by name and inform him/her of their duties, in the event that the AECOM SSO must leave or is absent from the site.

#### 3.3.2 Authority

The AECOM SSO has authority to:

- Verify that all AECOM operations are in compliance with the requirements of this HASP.
- Issue a “Stop Work Order” under the conditions set forth in this HASP.
- Temporarily suspend AECOM employees from field activities for infractions against this HASP pending consideration by the AECOM Safety Professional and the AECOM PM.

#### 3.3.3 Qualifications

In addition to being HAZWOPER-qualified, the AECOM SSO is required to have completed the 8-hour HAZWOPER Supervisor Training Course in accordance with 29 CFR 1910.120 (e)(4).

### 3.4 Employees

#### 3.4.1 AECOM Employee Responsibilities

Responsibilities of employees associated with this project include, but are not limited to:

- Understanding and abiding by the policies and procedures specified in the HASP and other applicable safety policies, and clarifying those areas where understanding is incomplete.
- Providing feedback to health and safety management relating to omissions and modifications in the HASP or other safety policies.
- Notifying the AECOM SSO, in writing, of unsafe conditions and acts.

#### 3.4.2 AECOM Employee Authority

The health and safety authority of each employee assigned to the site includes the following:

- The right to refuse to work and/or stop work authority when the employee feels that the work is unsafe (including subcontractors or team contractors), or where specified safety precautions are not adequate or fully understood.
- The right to refuse to work on any site or operation where the safety procedures specified in this HASP or other safety policies is not being followed.
- The right to contact the AECOM SSO or the AECOM Safety Professional at any time to discuss potential concerns.
- The right and duty to stop work when conditions are unsafe, and to assist in correcting these conditions.

### 3.5 AECOM Safety Professional

The AECOM Safety Professional (Bill Looney) is the member of the AECOM Safety, Health and Environmental Department assigned to provide guidance and technical support for the project. Duties include the following:

- Approving this HASP and any required changes.
- Approving the designated AECOM SSO.
- Reviewing all personal exposure monitoring results.
- Investigating any reported unsafe acts or conditions.

## 3.6 AECOM Regional Safety, Health and Environmental Manager (RSHEM)

AECOM's RSHEM (Nash Doyle) or his designated representative (Bill Looney) is the individual responsible for the preparation, interpretation and where appropriate, modification of this HASP. Modifications to this HASP which might result in less stringent precautions cannot be undertaken by the PM or the SSO without the approval of the RSHEM. Specific duties of the RSHEM include:

- Writing, approving and amending the HASP for this project;
- Advising the AECOM PM and AECOM SSO on matters relating to health and safety on this site;
- Recommending appropriate personal protective equipment (PPE) and respiratory equipment to protect personnel from potential site hazards;
- Facilitating accident investigations;
- Maintaining regular contact with the AECOM PM and AECOM SSO to evaluate site conditions and new information that might require modifications to the HASP, and;
- Conducting random project audits.

## 3.7 Subcontractors

The requirements for AECOM subcontractor selection and subcontractor safety responsibilities are outlined in *S3NA-213-PR Subcontractors*. Subcontractor and third party employees performing work that potentially exposes them to the hazards at the site are responsible for the safety and health for their personnel, must work under their own HASP and are also expected to review and acknowledge this HASP as a recognition of the SH&E standards that AECOM expects outside personnel to uphold. Each AECOM subcontractor is responsible for assigning specific work tasks to their employees. Each subcontractor will provide qualified employees and allocate sufficient time, materials, and equipment to safely complete assigned tasks. In particular, each subcontractor is responsible for equipping their personnel with any required personnel protective equipment (PPE) and will provide all required training.

AECOM considers each subcontractor to be an expert in all aspects of the work operations for which they are tasked to provide, and each subcontractor is responsible for compliance with the regulatory requirements that pertain to those services. Each subcontractor is expected to perform its operations in accordance with its own unique safety policies and procedures. To ensure that hazards associated with the performance of the work activities are properly controlled, copies of any required safety documentation for the subcontractor's work activities will be provided to AECOM for review prior to the start of onsite activities, if required.

Hazards not listed in this HASP but known to any subcontractor, or known to be associated with a subcontractor's services, must be identified and addressed to the AECOM PM or the AECOM Site Supervisor prior to beginning work operations. The AECOM Site Supervisor or authorized representative has the authority to halt any subcontractor operations, and to remove any subcontractor or subcontractor employee from the site for failure to comply with established health and safety procedures or for operating in an unsafe manner.

## 3.8 Visitors

Authorized visitors (e.g., client representatives, regulators, AECOM management staff, etc.) requiring entry to any AECOM-controlled work location on the site will be briefed by the AECOM PM or his designated representative on the hazards present at that location. Visitors will be escorted at all times at the work location and will be responsible for compliance with their employer's health and safety policies. In addition, this HASP specifies the minimum acceptable qualifications, training and personal protective equipment which are required for entry to any controlled work area; visitors must comply with these requirements at all times.

### 3.8.1 Visitor Access

Visitors to any AECOM-controlled HAZWOPER-work area must comply with the health and safety requirements of this HASP and demonstrate an acceptable need for entry into the work area. All visitors desiring to enter any controlled work area must observe the following procedures:

- A written confirmation must be received by AECOM documenting that each of the visitors has received the proper training and medical monitoring required by this HASP. Verbal confirmation can be considered acceptable provided such confirmation is made by an officer or other authorized representative of the visitor's organization.
- Each visitor will be briefed on the hazards associated with the site activities being performed and acknowledge receipt of this briefing by signing the appropriate tailgate safety briefing form.
- All visitors must be escorted by an AECOM employee.

If the site visitor requires entry to any AECOM-controlled exclusion zone (EZ), but does not comply with the above requirements, all work activities within the EZ must be suspended. Until these requirements have been met, entry will not be permitted.

Unauthorized visitors, and visitors not meeting the specified qualifications, will not be permitted within established controlled work areas.

## 4.0 Hazard Assessment

### 4.1 Physical Hazards

The following physical hazards are anticipated to be present at the site. Mitigation procedures for these hazards are detailed in applicable AECOM Americas Safety Health and Environment Standard Operating Procedures (SOPs). These SOPs can be found on the AECOM intranet at:

http://my.aecomnet.com/Intranet/Geographies/Americas/Functions/Safety,+Health+&+Environment/Policies+and+Procedures/North+America+Procedures

Additional hazards may be noted on the THA's developed for the individual tasks.

| | | |
|---|---|---|
| Vehicle Operation | Lifting | Traffic |
| Overhead Utilities | Noise | Falling objects |
| Underground Utilities | Dust | Flying debris |
| Heavy Equipment Operation (Drill rigs; Trucks) | Sharp Objects | Biologic Hazards (plants; insects, animals) |
| Drilling and Boring | Splashing Liquids | Weather (Heat and Cold Stress; sunburn) |
| Slips, Trips and Falls | Corrosive Liquids | Inclement Weather |
| Hot Surfaces | Flammable Liquids | Poor Lighting |
| Pinch Points | High Pressure Liquids | Personal Safety |
| Electrical | | |

Note: This list should not be considered to be all-inclusive. **ADDITIONAL PHYSICAL HAZARDS MAY BE PRESENT**

Brief descriptions and risk controls for a selection of some of the physical hazards that may be encountered are provided below. Additional information and controls are found in applicable SOPs.

#### 4.1.1 Vehicle Safety

Refer to SH&E SOP *S3NA-005-PR Vehicle and Driver Safety Program*. Make sure that the following basic safe driving practices are followed at all times while working on this project:

- Always wear a seat belt while operating a motor vehicle or while traveling as a passenger.
- Obey speed limits and local traffic laws at all times.
- Obtain proper directions to the site in advance and take the route that is most likely to be free of known traffic hazards (e.g., congestion, construction, etc.) and that avoids travel through potentially dangerous neighborhoods.
- Leave early to allow for contingencies.
- Prior to entering the vehicle, inspect the vehicle.
- Do not move your vehicle unless all equipment and supplies are secured. Items and material which may roll, slide, or move about in your vehicle while traveling are a major hazard. Secure the load
- Abstain from distractions while driving (e.g., the use of cell phones, eating/drinking, reading maps, etc.) If necessary, stop the vehicle and pull over to perform such activities safely. AECOM policy is engine on, cell phone off.
- Do not operate a motor vehicle if you are tired and/or have not had sufficient rest.

DOT Requirements

If you are to operate a vehicle exceeding 10,000 pounds (or vehicle and trailer with a combined weight over 10,000 pounds), or you are to transport greater than 1,000 pounds of hazardous materials, you MUST comply with DOT regulations. These are NOT addressed in this HASP; contact the H&S Department if this applies.

Emergency Procedures:

Always move out of traffic if possible; even if those in front of you have stopped. Stopping on an active highway can precipitate being hit from the rear. If you must stop on an active roadway, leave at least one car length in front of you, and watch the rear mirror, so you can ease up if someone behind can't stop. Keep your flashers on in this situation. If you are the only driver coming to a stop on an active roadway, leave the flashers on and when safe to do so, exit the car and get to a safe location.

If you must stop due to vehicle failure, etc. try to coast out of traffic. Put on your flashers, and tie a white handkerchief, etc. on the driver's side door or mirror. If you remain in the vehicle, lock the doors. Use your cell phone to summon help.

#### 4.1.2 Boating Safety

It will be necessary for employees to use a small boat (e.g., rowboat) to gain access to the lighthouse sites. The following precautions will be observed when such an activity is required to implement the proposed site investigation:

- While on the boat, Coast Guard approved Type III personal floatation devices must be worn or Type-V suits, or jackets. Vests will also be worn from boat to boat or boat to shore.
- No less than two people shall be in the boat while underway.
- The sampling team must be equipped with communications equipment to contact emergency responders directly.
- While underway, passengers and crew shall maintain a seated or otherwise stable position. **Do not stand in the boat.**
- Do not load the boat beyond its rated capacity.
- Distribute the load evenly.
- When handling gasoline for small outboard motors, always fuel the boat in good light and fill all portable tanks on the dock, not while in the boat.

#### 4.1.3 Working From the Banks of a Water Body

If samples are being collected from the banks of a body of water, employees should tie off (with a sturdy rope) to a tree or other fixed object located above the proposed sampling locations. If the employee slips, his/her fall will be stopped and will prevent employees from rolling down the slope into the water body. While on the banks, Coast Guard approved Type III personal floatation devices must be worn.

#### 4.1.4 Slips, Trips, Falls and Protruding Objects

A variety of conditions may exist that may result in injury from slips, trips, falls, and protruding objects. Slips and trips may occur as a result of wet, slippery, or uneven walking surfaces. To prevent injuries from slips and trips, always keep work areas clean; keep walkways free of objects and debris; and report/clean up liquid spills. Serious injuries may occur as a result of falls from elevated heights. Always wear fall protection while working at heights of 6 feet or greater above the next lower level. Protruding objects are any object that extends into the path of travel or working area that may cause injury when contacted by personnel. Always be aware of protruding objects and when feasible remove, protect or label the protruding object with an appropriate warning.

#### 4.1.5 Cuts and Lacerations

Geoprobe soil samples are contained within an acetate liner that must be cut open in order to retrieve the sample. As such, employees are at an increased risk of cutting themselves since a knife or blade is typically used to open the liner and the liner is often placed on an irregular or unstable work surface (i.e., the back of the Geoprobe van or the ground). When using knives or blades, follow the safety precautions listed below:

- Keep your free hand out of the way
- Secure the acetate liner so it won't roll or move while your cutting
- Use only sharp blades; dull blades require more force which results in less knife control
- Pull the knife toward you; pulling motions are easier to manage

- Don't put your knife in your pocket
- Use a hooked knife (i.e. linoleum knife) or a utility knife with a self-retracting blade
- Wear leather or Kevlar gloves when using knives or blades.

### 4.1.6 Clearing and Grubbing Hazards/Use of Hand tools

The following safety precautions will be followed if use of hand tools and/or site clearing and tree felling is required:

Hand Tools

- All hand tools must be in safe condition. Tools must be inspected by the user daily.
- Handles must be sound, straight and tight-fitting.
- Driven tools must be dressed to remove any mushrooming.
- Cutting tools must be kept sharp and properly shaped.
- All clearing activities shall terminate during electrical storms and periods of high winds.
- Dead, broken or rotted limbs or trees (widow makers) shall be felled first.

Machete Use

- A machete will only be used for its designated purpose; do not carelessly swing the machete when it is not needed.
- To prevent lacerations, employees will wear Kevlar gloves and Kevlar chain saw chaps.
- Machetes shall not be used when other employees are in the immediate work area.

Chain Saws

- Chain saws must be inspected daily to assure that all handles and guards are in place and tight, that all controls function properly and that the muffler is operative.
- Start the saw only on the ground or when otherwise firmly supported.
- Clear brush, which might interfere with clear footing before starting to cut.
- Shut off the saw when carrying it for a distance greater than from tree to tree or when surface is slippery or heavy with underbrush. The saw must be at idle speed when carried short distances.
- Do not use the saw to cut directly overhead or a distance at which the operator no longer has a safe grip on the saw. Always use two hands to operate the saw.
- Safety glasses with permanently attached sideshields will be worn underneath a steel mesh faceshield, which will attach to standard hard hats. The brush shield is designed to protect the head and face from debris created by using a chain saw. Employees will wear Kevlar gloves and Kevlar chain saw chaps. Earmuffs or earplugs with a minimum NRR of 24 dB must also be worn.

Felling Trees Manually

- Before cutting begins, survey the work area for dead limbs, the lean of the tree to be cut, wind conditions and the location of other trees
- Remove lodged trees (tree has not fallen to the ground after being separated from its stump) as soon as possible. Never work under a lodged tree.
- The distance between workers should be maintained at twice the height of the trees being felled.

Chipping Operations

- Access covers and doors must not be opened until the drum or disk is at a complete stop.
- Infeed and discharge ports shall be designed to prevent employee contact with disc, knives and blower blades.

### 4.1.7 Housekeeping

During site activities, work areas will be continuously policed for identification of excess trash and unnecessary debris. Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal. At no time will debris or trash be intermingled with waste PPE or contaminated materials. Procedures outlined in NA SH&E SOP *S3NA-307-PR Housekeeping, Worksite* will be followed.

#### 4.1.8 **Manual Lifting**

Most materials associated with investigation and remedial activities are moved by hand. The human body is subject to severe damage in the forms of back injury, muscle strains, and hernia if caution is not observed in the handling process. Whenever possible, use mechanical assistance to lift or move materials and at a minimum, use at least two people to lift, or roll/lift with your arms as close to the body as possible. Procedures outlined in NA SH&E SOP *S3NA-308-PR Manual Lifting, Field* will be followed.

#### 4.1.9 **Utilities**

Various forms of underground/overhead utility lines or pipes may be encountered during site activities. Prior to the start of intrusive operations, utility clearance is mandated, as well as obtaining authorization from all concerned public utility department offices. If insufficient data is available to accurately determine the location of the utility lines, AECOM will hand clear to a depth of at least five feet below ground surface in the proposed areas of subsurface investigation. Should intrusive operations cause equipment to come into contact with utility lines, the SSO and an AECOM SH&E Professional will be notified immediately. Work will be suspended until the applicable utility agency is contacted and the appropriate actions for the particular situations can be taken. The phone number for the applicable state agency is provided in the Emergency Contacts list found in Section 11.

For additional requirements, refer to NA SH&E SOP S3NA-417-PR, *Utilities, Underground* and S3NA-406-PR *Electrical Lines, Overhead*. Overhead power and utility lines may be present on, or adjacent to, the site and represent a potential hazard during the mob/demob of equipment and supplies. Ensure equipment operators, truck drivers, etc. and signal person are aware of overhead power lines and maintain a safe distance.

#### 4.1.10 **Concrete and Asphalt Coring, Cutting, Breaking**

Cutting and coring and breaking concrete and asphalt can involve numerous hazards. The noise generated as a result of the tools used, and adequate hearing protection is necessary when conditions outlined in the Noise section below are encountered. Tools used which can include drills and saws, must be appropriately guarded to prevent hands, PPE, and other objects from being caught-up in the moving parts and drawing employees in. Dust may also be generated while cutting concrete and either respiratory protection or dust suppression will need to be utilized to prevent exposure. Additional consideration must be given chemical hazard concerns that may exist in the materials underlying the concrete.

#### 4.1.11 **Drilling Operations**

Drilling operations, including hollow-stem, rotary and/or direct push drilling, present their own set of hazards. Several basic precautions that should be taken include, but are not limited to, confirming locations of underground and overhead utilities, wearing of appropriate PPE and the avoidance of loose clothing or jewelry, staying clear of moving parts, and knowing the locations of emergency shut-off switches. Detailed information regarding safety concerns and mitigation procedures are contained in SHE SOP *S3NA-405-PR, Drilling, Boring, and Direct Push Probing*. Additionally, prior to initiating operations, always contact the local utility locator service. Utilities shall be marked and cleared as detailed in S3NA-417-PR, Utilities, Underground. Overhead utilities must also be identified in accordance with *S3NA-406-PR, Electrical Lines, Overhead*.

#### 4.1.12 **Heavy Equipment (Drill Rigs etc.)**

Refer to SH&E SOP *S3NA-309-PR Mobile or Heavy Equipment*. Working around heavy equipment (drill rigs, dump trucks, backhoes, dozers etc.) poses potential hazards to employees. Such equipment can cause trauma injuries to the operator or nearby workers. It may also roll over, or fall on sloped ground or unstable soil. AECOM personnel are to remain clear of operating heavy equipment to the extent feasible.

When working around heavy equipment, employees should:

- Ensure that the operator is aware of your presence/activities;
- Stay in the operator's line of sight; don't work in his/her blind spot;
- Approach areas where equipment is operating from a direction visible to the operator;
- Develop a series of hand signals to facilitate communication with the operator

#### 4.1.13 **General Electrical Hazards**

Electrical and powered equipment may be used during a variety of site activities. Injuries associated with electrical and powered equipment include electric shock, cuts/lacerations, eye damage (from flying debris), and burns. Refer to AECOM SH&E SOP *S3NA-302-PR Electrical, General* and *S3NA-410-PR Hazardous Energy Control* for discussion and procedures to reduce risk of injury. To reduce the potential of injury from the hazards associated with electrical and powered equipment, always comply with the following:

- Use ground fault circuit interrupters (GFCIs) when using electrical powered tools/equipment. GFCIs prevent electrical shock by detecting the loss of electricity from a power cord and/or electrical device.
- Ensure generators are properly grounded, including the use of a grounding rod, driven to a depth of 3-feet.
- Wear ANSI-approved (Z87.1) safety glasses. Face shields may be required to provide additional face protection from flying debris.
- Wear appropriate work gloves. Work gloves may reduce the severity of burns and cuts/lacerations.

All temporary electric installations (site trailer, subpanels) will comply with OSHA (29 CFR 1926, Subpart K, and 29 CFR 1910, Subpart S) guidelines. Only qualified and competent individuals (licensed electrician) will provide electrical service/servicing. Refer to *S3NA-410-PR Hazardous Energy Control*, for additional requirements and information.

#### 4.1.14 **Dust and Odor Control**

Specific controls will be in place to prevent dust generation. If dust is observed reaching or approaching the site boundary, activities causing the dust will be immediately stopped. Dust control measures (water spray, soil covers, slower work pace, or change in work activities) will be deployed prior to resuming work. Corrective measures will be documented in the daily report.

Due to the nature of the contaminants at the site, odors may be of concern. In the event that an odor complaint is received, the Site Supervisor and/or SSO will immediately assess site conditions and determine the probable cause or causes. Appropriate odor mitigation measures will be deployed. These measures may include covering piles, deploying odor suppressing foam, implementation of air monitoring or discontinuing activities that are generating the odor. Corrective measures will be documented in the daily report.

#### 4.1.15 **Spill Prevention**

Work activities may involve the use of hazardous materials (i.e. fuels, solvents) or work involving drums or other containers. The following procedures will be used to prevent or contain spills:

- All hazardous material will be stored in appropriate containers
- Tops/lids will be placed back on containers after use.
- Containers of hazardous materials will be stored appropriately away from moving equipment.
- At least one spill response kit, to include an appropriate empty container, materials to allow for booming or diking the area to minimize the size of the spill, and appropriate clean-up material e.g., Oil Dri) shall be available at each work site (more as needed).
- All hazardous commodities in use (i.e. fuels) shall be properly labeled.
- Containers shall only be lifted using equipment specifically manufactured for that purpose.
- For drums/containers, follow the procedures in *S3NA-308-PR, Manual Lifting*, *Field*, to minimize potential for injury or spill.

#### 4.1.16 **Traffic Control**

##### 4.1.16.1 AECOM Employees

This site may have open access to the public and/or operational vehicular traffic (e.g., forklifts). As such, traffic will be a concern to the field teams. When working in high traffic areas or inside structures, the following precautions should be implemented.

- Notify the property owner and tenants of your work location, dates of work and the anticipated work times. Suggest the possibility of a detour around the work area.
- Wear an ANSI-approved Class II or III reflective safety vest when working in or near an active roadway.
- Set up traffic cones, safety barriers or barrels 50 feet in front of the work area. "Men at Work" signs should also be placed in a conspicuous area to warn others of your presence.
- Consider working off-hours when traffic is at a minimum.

4.1.16.2 Work On/Adjacent to Public Roadways

If field activities may occur along or in a public roadway or right-of-way, the AECOM field team leader or PM must contact the local police department to determine if a police detail or traffic plan is required. Consult SH&E SOP S3NA-306-PR, Highway and Road Work.

Specific requirements exist when traffic must be redirected around a work area that is on or adjacent to a public roadway. In certain locations only police officers may redirect traffic. As a minimum, OSHA requires that flaggers be formally trained in accordance with the requirements specified in ANSI D6.1-1971. As a result, AECOM personnel should not redirect traffic on public roadways. When traffic must be redirected, and the local police do not perform that role, a traffic control firm should be hired (these are frequently listed in the yellow pages under "safety").

4.1.16.3 Patrons, Residents, General Public

The facilities may be open to the public while operations are taking place. A restricted zone will be established around those areas where work activities are occurring. The purpose of this restricted zone is to warn of the potential physical hazards associated with the activities being performed or supervised by AECOM. If space permits, a 20-foot radius restricted zone will be established around the work area. The restricted zone should be outlined with traffic cones, barricades, fencing or "Caution Tape" to prohibit entry by the general public.

### 4.1.17 **Wildlife, Plant and Insect Hazards**

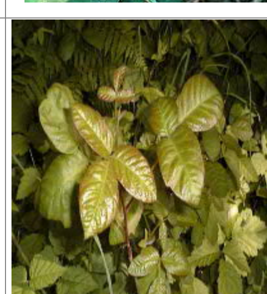
Refer to *S3NA-313-PR Wildlife, Plants and Insects*, for additional information on hazard recognition and mitigation.

Sensitivity to toxins generated by plants, insects and animals varies according to dosage and the ability of the victim to process the toxin; therefore it is difficult to predict whether a reaction will occur, or how severe the reaction will be. Staff should be aware that there are a large number of organisms capable of causing serious irritations and allergic reactions. Some reactions will only erupt if a secondary exposure to sunlight occurs. Depending on the severity of the reaction, the result can result in severe scarring, blindness or even death.

Plants that field staff should recognize and take precautions to avoid include: Poison Sumac, Poison Ivy (terrestrial and climbing), Poison Oak, Giant Hogweed (or Giant Cow Parsnip), Wild Parsnip, Devil's Club and Stinging Nettle. Many others are extremely poisonous to eat (e.g., Poison Hemlock; Water Parsnip) – do not eat anything that has not been identified.

A large number of plants are not harmful to touch but may contain poisonous berries or foliage that could cause serious complications or death if they are ingested. It goes without saying not to eat any berries or plants that you are not absolutely sure of their identity. Examples of common poisonous or irritating plant species, common to the United States, are shown in Table 4-2.

**Table 4.2: Hazardous Plant Identification Guide**

| | |
|---|---|
| **Poison Ivy**<br>• Grows in West, Midwest, Texas, East<br>• Several forms – vine, trailing shrub, or shrub<br>• Three leaflets (can vary 3-9)<br>• Leaves green in summer, red in fall<br>• Yellow or green flowers<br>• White berries |   |
| **Poison Oak**<br>• Grows in the East (NJ to Texas), Pacific Coast<br>• 6-foot tall shrubs or long vines<br>• Oak-like leaves, clusters of three<br>• Yellow berries |   |

### 4.1.18 Insects

Insects for which precautionary measures should be taken include: mosquitoes (potential carriers of disease aside from dermatitis), black flies, wasps, bees, ticks, and European Fire Ant.

Wasps and bees will cause a painful sting to anyone if they are harassed. They are of most concern for individuals with allergic reactions who can go into anaphylactic shock. Also instances where an individual is exposed to multiple stings can cause a serious health concern for anyone. These insects are most likely to sting when their hive or nest is threatened.

Ticks can be encountered when walking in tall grass or shrubs. They crawl up clothing searching for exposed skin where they will insert mouthparts to drink blood. Most serious concern is possibility of contracting Lyme disease which is spread by the Black-legged or Deer Tick. Occasionally a tick can cause Tick Paralysis if it is able to remain feeding for several days. Full recovery usually occurs shortly after the tick is removed.

### 4.1.19 Ultraviolet Hazards (Sun Exposure)

Workers performing field work outdoors may be susceptible to sunburn if not properly protected with sunscreen or protective clothing and hats. Skin can burn in minutes when the UV Index is VERY HIGH. Protective measures are advisable.

### 4.1.20 Weather Hazards

The Site Safety Officer will be attentive to daily weather forecasts for the project area each morning. Predicted weather conditions of potential field impact are to be included in safety briefings and the Task Hazard Analysis (THA) for that day. Weather changes should initiate a review and updates (THA) as necessary.

Severe weather can occur with little warning. Employees will be vigilant for the potentials for storms, lightning, high winds, and flash flood events.

## 4.2 Contaminant Hazards

The following is a discussion of the hazards presented to workers during this project from chemical hazards known, suspected or anticipated to be present on site.

| | |
|---|---|
| Lead | Semi Volatile Organic Compounds |
| Volatile Organic Compounds | PCBs |
| Petroleum Hydrocarbons (Gasoline Range Organics) | Carbon Monoxide |
| Petroleum Hydrocarbons (Diesel Range Organics) | Dust |

### 4.2.1 Lead

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. The use of lead as an additive to gasoline was banned in 1996 in the United States.

The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in your body. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults can result in decreased performance in some tests that measure functions of the nervous system. It may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. Exposure to high lead levels can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high levels of exposure to lead may cause miscarriage. High level exposure in men can damage the organs responsible for sperm production.

### 4.2.4 Volatile Organic Compounds

Volatile Organic Compounds (VOCs) refer to a group of volatile compounds or mixtures that are relatively stable chemically and that exists in the liquid state at temperatures of approximately 320 to 820F.

VOCs are typically organic solvents used for extracting, dissolving, or suspending materials such as fats, waxes, and resins that are not soluble in water. The removal of the solvent from a solution permits the recovery of the solute intact with its original properties. Solvents are used in paints, adhesives, glues, coatings, and degreasing/ cleaning agents.

VOC inhalation by workers can cause effects ranging from an alcohol-like intoxication to narcosis and death from respiratory failure. Symptoms may include drowsiness, headache, dizziness, dyspepsia, and nausea.

A type of VOC - Chlorinated VOCs (CVOCs) - were widely used as dry cleaning solvents and for the degreasing of metal parts and are commonly detected at industrial or commercial sites. Typical solvents include tetrachloroethylene (perchloroethylene), trichloroethylene and 1,1,1- trichloroethane.

The natural breakdown products of chlorinated solvents (e.g., 1,1-dicloroethylene, 1,2-dichloroethylene and vinyl chloride) may also be present. These compounds are generally more toxic than their hydrocarbon analogs but are less flammable (most chlorinated hydrocarbons are not flammable.).

Dermal contact with liquid chlorinated solvents may produce skin irritation or a rash. Prolonged or repeated skin contact may cause dermatitis or "chloracne." Workers taking the precautions associated with the parent compounds should be protected from the hazards associated with the break down products.

Overexposure to the chlorinated organic solvent vapors from impacted groundwater and soils may result in depression of the central nervous system, symptoms of which include dizziness, headache, giddiness and drunken-like behavior. Chronic overexposures can result in liver and kidney damage.

### 4.2.2 Petroleum Hydrocarbons (Gasoline Range Organics)

Gasoline is a highly complex mixture of more than 150 aliphatic and aromatic hydrocarbons including small amounts of benzene, toluene, ethylbenzene, xylene, and sometimes either tetraethyl lead or methyl tertiary butyl ether. The actual composition varies with the source of the crude petroleum, the manufacturer, and the time of year.

Gasoline is a colorless, pale brown or pink liquid. Gasoline is very flammable; it catches on fire quite easily, evaporates quickly, and forms explosive mixtures with air. Most people can begin to smell gasoline at 0.25 parts of gasoline per million parts of air (ppm). Gasoline may be present in the air, groundwater, and soil. Gasoline does not dissolve readily in water. However, some of the chemicals that make up gasoline can dissolve easily in water.

Exposure to the vapors of gasoline above its exposure limit may produce irritation of the mucous membranes of the upper respiratory tract, nose and mouth. Overexposure may also result in the depression of the central nervous system. Symptoms of such exposure include drowsiness, headache, fatigue and drunken-like behaviors. Another common effect is irritation of the skin and mucous membranes of the upper respiratory tract. Repeated or prolonged skin contact may result in dermatitis due to defatting of the skin.

The American Conference of Governmental Industrial Hygienists (ACGIH) has recommended a threshold limit value (TLV) of 300 ppm for gasoline as an 8-hour time weighted average (TWA).

### 4.2.3 Petroleum Hydrocarbons (Diesel Range Organics)

Fuel oils generally consist of a complex mixture of polynuclear aromatic hydrocarbons (PAHs) are generally considered to be of moderate to low toxicity; however, some of which have been reported to cause skin cancer in humans under conditions of poor personal hygiene, prolonged repeated contact, and exposure to sunlight. Toxic effects are unlikely to occur if good personal hygiene is practiced. Federal or recommended airborne exposure limits have not been established for the vapors of fuel oils. However, inhalation of low concentrations of the vapor of either may cause mucous membrane irritation. Inhalation of high concentrations of the vapors may cause extensive pulmonary edema. Chronic direct skin contact with the liquids may produce skin irritation as a result of defatting. Repeated skin contact may also cause irritation of the hair follicles and block the sebaceous glands. This produces a rash of acne pimples and spots, usually on the arms and legs.

There are no OSHA permissible exposure limits for most of the specific compounds; however, the "Coal Tar Pitch Volatiles" PEL should be used (0.2 mg/m3).

### 4.2.4 Semi Volatile Organic Compounds

SVOCs are various combinations of multiple closed (benzene) rings that may include other attached molecular structures. They occur naturally in coal, petroleum, tars, pitches, and woods, and may be formed in fires involving heavy hydrocarbon materials.

Examples of SVOCs include compounds such as anthracene, benzo(a)pyrene, chrysenes, fluoranthcene, naphthalene, and pyrenes, among many others. Many of the SVOCs are carcinogenic. As a class they should be treated as carcinogens and exposures kept to a minimum. There are no OSHA permissible exposure limits for most of the specific compounds; however the "Coal Tar Pitch Volatiles" PEL should be used (0.2 mg/m3). SVOCs are generally solids and not very volatile, making ingestion or inhalation of dust or smoke the likely routes of exposure.

### 4.2.5 Polychlorinated biphenyls

Polychlorinated biphenyls (PCBs) are a series of technical mixtures, consisting of many isomers and compounds that vary from mobile oily liquids to white crystalline solids and hard non-crystalline resins. The variability is based upon the degree of chlorination (and location of chlorine atoms) on the diphenyl rings that act as the skeleton for PCBs. The name Aroclor® 1221, 1233, 1242, 1248, 1254, 1260 etc. correspond as to the percentage that the diphenyl rings have been instituted, i.e., 21%, 33%, 42%, etc. The most commonly encountered PCBs are chlorodiphenyl (42% chlorine) [Aroclor® 1242] and chloridiphenyl (54% chlorine) [Aroclor® 1254]. These compounds are light, straw-colored liquids with typical chlorinated aromatic odors; 42% chlorodiphenyl is a mobile liquid and 54% chlorodiphenyl is a viscous liquid. Chlorodiphenyl (42% chlorine) boils between 617o and 691o and freezes at -2oF. Chlorodiphenyl (54% chlorine) boils between 689o and 734oF and freezes at 50oF. The synonyms for PCBs are chlorodiphenyls, Aroclors, and Kanechlors. Names further defining PCBs, based upon chlorine substitution are Aroclor® 1221, 1232, 1242, 1248, 1254, 1260, 1262, 1268, 2565, 4465, 5442, 5460 and Kanechlor 300, 400, 500. PCBs are incompatible with strong oxidizers.

PCBs are used alone and in combination with chlorinated naphthalenes. They are stable, thermoplastic, and nonflammable, and find chief use in insulation for electric cables and wires, in the production of electric condensers, as additives for extreme pressure lubricants, and as a coating in foundry use. PCBs are one member of a class of chlorinated aromatic organic compounds which are of increasing concern because of their apparent ubiquitous dispersal, persistence in the environment, and tendency to accumulate in food chains, with possible adverse effects on animals at the top of food webs, including man. The OSHA PEL and ACGIH TLV are 1 mg/m3 for chlorodiphenyl 42% Cl and 0.5 mg/m3 for 54% Cl. The NIOSH REL for both 42% and 54% are 0.001 mg/m3. The IDLH level is 5 mg/m3.

Routes of entry are via inhalation of fume or vapor and percutaneous absorption of liquid, ingestion, eye and skin contact. Harmful effects from short term exposure are as follows:

- Inhalation - May produce irritation to nose, throat, and lungs. Levels above 10 mg/m3 are reported to be unbearable. Inhalation may contribute significantly to all symptoms of long term exposure.
- Skin - Absorption is moderate. Contributes significantly to all symptoms of long term exposure. Sensitized individuals may develop a rash after 2 days exposure by contact or inhalation.
- Eyes - May produce irritation. Levels of 10 mg/m3 are severely irritating.
- Ingestion - Absorption in the digestive system contributes significantly to all symptoms of long term exposure. There are no reported deaths of humans due to a single ingestion. However, experiments in animals suggest that ingestion of 6 to 10 fluid ounces would cause death to a healthy 150 pound adult.

Long term exposure to PCBs at high levels of 1 to 10 mg/m3 may produce a burning feeling in the eyes, nose and face; dry throat; lung and throat irritation; nausea, dizziness, chloracne, and the aggravation of existing acne. Liver damage and digestive disturbance have been reported in some individuals. OSHA has identified PCBs as a dermal carcinogen. PCBs may impair the function of the immune system. PCBs at high levels have been shown to produce cancer and birth defects in laboratory animals. Whether PCBs produce these effects in humans is not known.

North and MSA do not approve the use of APRs for protection against 42% and 54% chlorodiphenyl as a Determination in air is via collection on a particulate filter or with a florisil tube, adhering to NIOSH Method 5503 for PCBs' vapor. However, if it is a particulate concern via adhering to soil, level C with HEPA filters can be used.

### 4.2.6 Carbon Monoxide

Carbon Monoxide is a colorless odorless gas commonly produced as a by-product of incomplete combustion. Carbon Monoxide combines with blood hemoglobin to form carboxyhemoglobin which interferes with the oxygen-carrying capacity of the blood. Typical progressive symptoms of acute exposure may include headache, dizziness, drowsiness, nausea, vomiting, collapse, coma and death. Initially the victim is pale; later the skin and mucus membranes may become cherry-red in color.

### 4.2.7 Dust

Dust generated during site activities can be hazardous to the respiratory system and irritating to the eyes. Dust can also carry the contaminants of concern potentially exposing workers by skin contact and inhalation. The ACGIH has established an eight-hour exposure limit for dust at 3 mg/m3. The concentrations of the chemicals of concern in the soil are low enough that inhalation of dust would not by itself be an exposure hazard. However contamination of skin and clothing can provide additional exposures. Therefore the generation and contact with dust should be minimized.

Water or other methods should be used to control dust during dusty operations; however care must be used to prevent electrical shock if electric tools are used in the same area. If dusts become irritating and engineering controls such as the application of water cannot be used, respirators should be donned.

#### 4.2.8 Potential Exposure Routes and Controls

Inhalation: Due to the work being performed at the site – drilling/sampling of impacted soil, groundwater sampling, vapor sampling - there is potential for inhalation of contaminants of concern. The potential for exposure will be reduced by implementing an air monitoring program. If high concentrations of contaminants are encountered or, if during routine air monitoring, concentrations of contaminants are detected above the action levels, respiratory protection will be required.

Skin Contact: Skin contact with impacted soils and groundwater will be minimized by wearing appropriate personnel protective equipment during activities when contaminated media may be contacted (e.g., nitrile gloved during sampling activities).

Ingestion: The possibility of ingestion of contaminants of concern is limited. Protection against exposure via ingestion can be accomplished by avoiding hand to mouth contact and performance of proper decontamination procedures when exiting contaminated work areas.

Monitoring procedures will be employed during activities to assess employee exposure to chemical and physical hazards. Monitoring will consist primarily of onsite determination of various parameters (e.g., airborne contaminant concentrations and heat stress effects), but may be supplemented by more sophisticated monitoring techniques, if necessary.

### 4.3 Hazard Analysis

Task Hazard Analyses (THAs) have been completed for all tasks identified in the Scope of Work (Attachment A):

#### 4.3.1 Unanticipated Work Activities/Conditions

As a result of unanticipated work activities or changing conditions, additional THAs may be required. All additional THAs will be reviewed and approved by the SH&E Professional.

### 4.4 Task Specific SH&E Procedures

As discussed in Section5.0, personnel may be exposed to a variety of chemical and physical hazards resulting from task or equipment-specific activities. The controls for many of these hazards are discussed in SOPs found in the **Series 300 to 500** North America SH&E SOPs (Attachment C).

| | SOP# | TITLE | | SOP# | TITLE |
|---|---|---|---|---|---|
| **S3NA 300 Series Field(Common)** | | | **S3NA 500 Series Industrial Hygiene** | | |
| ☐ | S3NA-301-PR | Confined Spaces | ☐ | S3NA-501-PR | Asbestos |
| ☒ | S3NA-302-PR | Electrical, General | ☐ | S3NA-502-PR | Benzene |
| ☐ | S3NA-303-PR | Excavation and Trenching | ☒ | S3NA-503-PR | Blood borne Pathogen Program |
| ☐ | S3NA-304-PR | Fall Protection | ☐ | S3NA-504-PR | Cadmium |
| ☒ | S3NA-305-PR | Hand and Power Tools | ☒ | S3NA-505-PR | Cold Stress Prevention |
| ☒ | S3NA-306-PR | Highway and Road Work | ☐ | S3NA-506-PR | Compressed Gases |
| ☒ | S3NA-307-PR | Housekeeping, Worksite | ☒ | S3NA-507-PR | Hazardous Materials Communication / WHMIS |
| ☒ | S3NA-308-PR | Manual Lifting, Field | ☒ | S3NA-508-PR | Hazardous Materials Handling and Shipping |
| ☒ | S3NA-309-PR | Mobile or Heavy Equipment | ☒ | S3NA-509-PR | Hazardous Waste Operations and Emergency Response Activities |
| ☐ | S3NA-310-PR | Rigging, Hoisting, Cranes and Lifting Devises | ☒ | S3NA-510-PR | Hearing Conservation Program |
| ☐ | S3NA-311-PR | Scaffolding | ☒ | S3NA-511-PR | Heat Stress Prevention |
| ☐ | S3NA-312-PR | Ladders and Stairways | ☐ | S3NA-512-PR | Laboratory Safety |
| ☒ | S3NA-313-PR | Wildlife, Plants and Insects | ☐ | S3NA-513-PR | Lead |
| ☒ | S3NA-314-PR | Working Alone & Remote Travel | ☐ | S3NA-514-PR | Munitions and Explosives of Concern / Unexploded Ordnance (MEC-UXO) |
| ☐ | S3NA-315-PR | Water, Working Around | ☐ | S3NA-515-PR | Nanotechnology |
| | | | ☐ | S3NA-516-PR | Radiation Safety Programs |
| **S3NA 400 Series Field (Uncommon)** | | | ☒ | S3NA-517-PR | Radiation, Non-Ionizing |
| ☐ | S3NA-401-PR | Aircraft Charters | ☐ | S3NA-518-PR | Radiation, Gauge Source program |
| ☐ | S3NA-402-PR | All Terrain Vehicles (ATVs) | ☒ | S3NA-519-PR | Respiratory Protection Program |
| ☐ | S3NA-403-PR | Avalanches | ☒ | S3NA-520-PR | Spill Response, Incidental |
| ☐ | S4NA(US)-404-PR | Commercial Motor Vehicles | ☒ | S3NA-521-PR | Decontamination |
| ☒ | S3NA-405-PR | Drilling and Boring | ☐ | S3NA-522-PR | Hydrogen Sulfide |
| ☒ | S3NA-406-PR | Electrical Lines, Overhead | | | |
| ☐ | S3NA-407-PR | Electro-fishing | | | |
| ☐ | S3NA-408-PR | Elevated Work Platforms and Aerial Lifts | | | |
| ☐ | S3NA-409-PR | Forklifts (operation of) | | | |
| ☐ | S3NA-410-PR | Hazardous Energy Control | | | |
| ☐ | S3NA-411-PR | Machine Guarding | | | |
| ☐ | S3NA-412-PR | Powder-Actuated Tools | | | |
| ☐ | S4NA(US)-413-PR1 | Process Safety Management | | | |
| ☐ | S4NA(US)-414-PR | Railway Sites | | | |
| ☐ | S4NA(US)-415-PR | RCRA Regulated Facilities | | | |
| ☐ | S3NA-416-PR | Tunnel and Underground Work | | | |
| ☒ | S3NA-417-PR | Utilities, Underground | | | |
| ☐ | S3NA-418-PR | Welding, Cutting and Other Hot Work | | | |
| ☐ | S3NA-419-PR | Water, Marine Operations, Boating | | | |
| ☐ | S3-NA420-PR | Water, Underwater Diving | | | |

# 5.0 SH&E Requirements

## 5.1 HAZWOPER Qualifications

Personnel performing work at the job site must be qualified as HAZWOPER workers (unless otherwise noted in specific THAs or by the SSO), and must meet the medical monitoring and training requirements specified in the Americas SH&E Standard Operating Procedures.

If site monitoring procedures indicate that a possible exposure has occurred above the OSHA permissible exposure limit (PEL), employees may be required to receive supplemental medical testing to document any symptoms that may be specific to the particular materials present.

## 5.2 Site-Specific Safety Training

All AECOM personnel performing activities at the site will be trained in accordance with *S3NA-003-PR SH&E Training*. All personnel are required to remain current in all of their required training and evaluate their need for additional training when there is a change in work. In addition to the general health and safety training programs, personnel will be required to complete any supplemental task specific training developed for the tasks to be performed. Administration and compliance with the requirements for additional task-specific training will be the responsibility of the project or lead manager. Any additional required training that is completed will be documented and tracked in the project files.

### 5.2.1 Competent Person Training Requirements

To complete the planned scope of work, a (OSHA conformance) competent person must be designated to perform the required daily on-site inspections of operations and/or equipment. The competent person may be an AECOM (if responsible for supervising that activity) or the subcontractor's employee. Designated competent person(s) for this project are shown in Table 5-1:

**Table 5-1: Task-Specific Competent Persons**

| Employee Name | Organization | Area of Competency |
|---|---|---|
| TBD | AECOM | XRF Screening |
| TBD | AECOM | Soil and Groundwater Sampling |
| TBD | AECOM | Respiratory Protection |

Note: The training requirements for competent persons are specified in the indicated SOPs and/or *S3NA-202-PR Competent Person Designation*. By identifying an employee as a "competent person", that person has now been authorized to take prompt corrective measures to eliminate hazards.

## 5.3 Tailgate Meetings

Prior to the commencement of daily project activities, a tailgate meeting will be conducted by the SSO to review the specific requirements of this HASP, applicable THA. Attendance at the daily tailgate meeting is mandatory for all employees at the site covered by this HASP and must be documented on the attendance form. All safety training documentation is to be maintained in the project file by the SSO.

## 5.4 Hazard Communication

Hazardous materials that may be encountered as existing on-site environmental or physical/health hazards during the work activities are addressed in this HASP and their properties, hazards and associated required controls will be communicated to all affected staff and subcontractors.

In addition, any employee or organization (contractor or subcontractor) intending to bring any hazardous material onto this AECOM-controlled work site must first provide a copy of the item's Material Safety Data Sheet (MSDS) to the SSO for review and filing (the SSO will maintain copies of all MSDS on site). MSDS may not be available for locally-obtained products, in which case some alternate form of product hazard documentation will be acceptable in accordance with the requirements of *S3NA-507-PR Hazardous Materials Communication/WHMIS*.

All personnel shall be briefed on the hazards of any chemical product they use, and shall be aware of and have access to all MSDS.

All containers on site shall be properly labeled to indicate their contents. Labeling on any containers not intended for single-day, individual use shall contain additional information indicating potential health and safety hazards (flammability, reactivity, etc.).

Attachment B provides copies of MSDS for those items planned to be brought on site at the time this HASP is prepared. This information will be updated as required during site operations.

## 5.5 Confined Space Entry

The SSO/site supervisor shall identify all potential confined spaces in accordance with S3NA-*301-PR Confined Spaces*. In addition; the SSO/site supervisor will inform all employees of the location of onsite confined spaces, and their associated security controls and procedures. **No confined space entries involving AECOM personnel or AECOM subcontractors are allowed on this project without special permission of Client H&S and Operations Management, the AECOM PM and the AECOM RSHEM.**

## 5.6 Hazardous, Solid, or Municipal Waste

If hazardous, solid, and/or municipal wastes are generated during any phase of the project, the waste shall be accumulated, labeled, and disposed of in accordance with applicable Federal, State, Provincial, Territorial and/or local regulations. Consult the Regional SH&E Manager for further guidance.

## 5.7 General Safety Rules

All site personnel shall conduct themselves in a safe manner and maintain a working environment that is free of additional hazards in adherence to *S3NA-001-PR Safe Work Standards and Rules* and *S3NA-103-PR General Housekeeping*.

### 5.7.1 Housekeeping

During site activities, work areas will be continuously policed for identification of excess trash and unnecessary debris. Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal. At no time will debris or trash be intermingled with waste PPE or contaminated materials.

### 5.7.2 Smoking, Eating, or Drinking

Smoking, eating and drinking will not be permitted inside any controlled work area at any time. Field workers will first wash hands and face immediately after leaving controlled work areas (and always prior to eating or drinking). Consumption of alcoholic beverages is prohibited at any AECOM site. Smoking, eating or drinking must be in an approved area.

### 5.7.3 Personal Hygiene

The following personal hygiene requirements will be observed:

Water Supply: A water supply meeting the following requirements will be utilized:

> *Potable Water* - An adequate supply of potable water will be available for field personnel consumption. Potable water can be provided in the form of water bottles, canteens, water coolers, or drinking fountains. Where drinking fountains are not available, individual-use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified in order to distinguish them from non-potable water sources.
>
> *Non-Potable Water* - Non-potable water may be used for hand washing and cleaning activities. Non-potable water will not be used for drinking purposes. All containers of non-potable water will be marked with a label stating:

***Non-Potable Water***
***Not Intended for Drinking Water Consumption***

Toilet Facilities: A minimum of one toilet will be provided for every 20 personnel on site, with separate toilets maintained for each sex except where there are less than 5 total personnel on site. For mobile crews where work activities and locations permit transportation to nearby toilet facilities on-site facilities are not required.

Washing Facilities: Employees will be provided washing facilities (e.g., buckets with water and Alconox) at each work location. The use of water and hand soap (or similar substance) will be required by all employees following exit from the Exclusion Zone, prior to breaks, and at the end of daily work activities.

### 5.7.4 Buddy System

All field personnel will use the buddy system when working within any controlled work area. Personnel belonging to another organization on site can serve as "buddies" for AECOM personnel. Under no circumstances will any employee be present alone in a controlled work area. For areas not in controlled work areas, the procedures outlined in *S3NA-314-PR Working Alone Remote Travel* will be followed at all times.

## 5.8 Stop Work Authority

All employees have the right and duty to stop work when conditions are unsafe and to assist in correcting these conditions as outlined in S3NA-002-PR*, Stop Work Authority.* Whenever the SSO determines that workplace conditions present an uncontrolled risk of injury or illness to employees, immediate resolution with the appropriate supervisor shall be sought. Should the supervisor be unable or unwilling to correct the unsafe conditions, the SSO is authorized and required to stop work, which shall be immediately binding on all affected AECOM employees and subcontractors.

Upon issuing the stop work order, the SSO shall implement corrective actions so that operations may be safely resumed. Resumption of safe operations is the primary objective; however, operations shall not resume until the Safety Professional has concurred that workplace conditions meet acceptable safety standards.

### 5.9 Client Specific Safety Requirements

AECOM will coordinate activities with the client PM and Site Contact prior to mobilization.

# 6.0 Exposure Monitoring Procedures

## 6.1 Health and Safety Action Levels

An action level is a point at which increased protection is required due to the concentration of contaminants or the presence of other environmental conditions (e.g., extreme heat or cold) in the work area. The concentration level (above background level) and the ability of the PPE to protect against that specific contaminant determine each action level. The action levels are based on concentrations in the breathing zone.

If ambient levels are measured which exceed the action levels in areas accessible to unprotected personnel, necessary control measures (barricades, warning signs, and other actions to limit access, etc.) must be implemented prior to commencing activities at the specific work area.

Personnel should also be able to upgrade or downgrade their level of protection with the concurrence of AECOM SSO or the Safety Professional.

Reasons to upgrade:

- Known or suspected presence of inhalation or dermal hazards.
- Occurrence or likely occurrence of gas, vapor, or dust emission.
- Change in work task that will increase the exposure or potential exposure to hazardous materials.

Reasons to downgrade:

- New information indicating that the situation is less hazardous than was originally suspected.
- Change in site conditions that decrease the potential hazard.
- Change in work task that will reduce exposure to hazardous materials.

## 6.2 Air Monitoring

AECOM will conduct the following air monitoring to determine employee exposure to the vapors of the contaminants of concern during all subsurface investigations and sampling activities.

**Note: If there is any site condition or work scope change that may expose workers to concentrations that may exceed the OSHA PEL, special precautions (additional monitoring equipment, personal protective equipment, training and planning) are required. Contact the PM and RSHEM or Safety Professional prior to initiating such operations.**

**If unusual odors are noted or if respiratory tract irritation is noticed, the work team will remove themselves from the area of odor and contact the project manager. The project manager in concert with the RSHEM/Safety Professional will evaluate the necessity of air monitoring before activities continue.**

The monitoring instruments and action levels provided below will be utilized:

<u>Instrument I: Photoionization Detector (PID) or Flame Ionization Detector (FID)</u>

A PID, such as a Photovac 2020 or RaeSystems MiniRae 2000, equipped with a 10.6 eV (or higher) lamp and calibrated to isobutylene and/or a FID such as a Photovac MicroFID calibrated to methane (or equivalent instruments) will be used to screen the breathing zone of employees during activities that may expose them to contaminated soil or groundwater. If breathing zone concentrations are sustained (5 minutes) at 5 units above background, Level C respiratory protection, as described in Section 8, will be donned.

<u>Instrument II: Combination Combustible Gas and Oxygen Monitor (CGI, or LEL Meter)</u>

If high levels of contamination are associated with the site, or if high PID and/or FID readings are encountered or if the possibility of encountering flammable vapors or materials exists, a CGI must be used to quantify the reading for explosive gases or vapors. The action level for stopping work is 10% LEL.

An oxygen meter will be used to monitor all atmospheres requiring an explosive gas meter. The oxygen level will be determined prior to the explosive gas level to ensure that there is sufficient oxygen to support both human life and to allow the explosive gas meter to operate properly.

Instrument III: Carbon Monoxide Meter

If heating or internal combustion engine-powered equipment other sources of carbon monoxide may be used inside a building, a CO meter must be used to monitor the buildup of exhaust gas in the building. The unit will be set to alarm at 25 ppm. If the alarm sounds, work will cease and all employees will leave the building. If carbon monoxide concentrations cannot be reduced, mechanical ventilation may be required. Even if the building is well ventilated and the exhaust gas is ducted to the outside, a CO meter is still required.

Additionally, consideration should be given to utilization of piping to route exhaust from engines to an area outside the structure, utilization of local exhaust to vent structures and performing interior work during hours when normal occupants are away.

**Table 6-1: Air Monitoring Instruments/Action Levels and Actions**

| Task | Instrument | Action Limit | Action |
|---|---|---|---|
| All tasks involving potential exposure to soils and groundwater contaminated with volatile organic compounds. | Photoionization Detector and/or Flame Ionization Detector | ≥ 1 units above background (sustained for 2-minutes in the breathing zone) | Don Level C protective clothing w/ NIOSH approved half or full-face piece respirator with combination organic vapor/P-100 cartridges. |
| | | ≥ 50 units above background (sustained for 2-minutes in the breathing zone) | Stop work. Evacuate. Contact PM and RSHEM to determine mitigation procedures |
| All tasks involving potential exposure to lead contaminated soils. | Thermo Scientific Data Ram (or equivalent) | 0.05 $mg/m^3$ above background on the dust monitor for sustained 5-minute period. | Don Level C protective clothing w/ NIOSH approved half or full-face piece respirator with combination organic vapor/P-100 cartridges. Evaluate and implement dust control measures as necessary. |
| | | >2.5 $mg/m^3$ above background (sustained for 5-minutes in the breathing zone) | Stop work. Evacuate. Contact PM and HSC to determine mitigation procedures |
| When possibility of exposure to Carbon Monoxide exists (e.g. utilization of internal combustion engine powered devices in interior of buildings) | Carbon Monoxide Meter | ≥ 10 ppm | Investigate source. Check, correct and control. |
| | | ≥ 25 ppm. | Stop work. Evacuate. Contact PM and RSHEM to determine mitigation procedures |
| When possibility of exposure to flammable vapors exists. | LEL (lower explosive limit) Meter | ≥ 5% LEL | Check, correct and control. |
| | | ≥ 10% LEL | Stop work. Evacuate. Contact PM and RSHEM to determine mitigation procedures |

| Task | Instrument | Action Limit | Action |
|---|---|---|---|
| All tasks involving potential flammable vapor concentrations above 10% of LEL | Oxygen Meter | Oxygen <19.5%<br><br>Oxygen >23.5% | Will not support human breathing, will not support LEL meter operation, stop work and evacuate work area.<br><br>Oxygen enriched environment which increases the likelihood of an explosive atmosphere, stop work and evacuate the work area. |

**If the PID indicates a sustained (1 minute) concentration at any location in excess of 500 ppm as isobutylene or the instrument reads an off scale high concentration, a combustible gas meter will be obtained and used to verify that no concentrations exceed ten percent (10%) of the Lower Explosive Limit (LEL). If concentrations exceed 10% of LEL, all spark and heat producing equipment will be shut down and the area evacuated until the concentration can be reduced below 10% of LEL.**

#### 6.2.1 Monitoring Equipment Calibration

All instruments used will be calibrated or "bump checked" at the beginning of each work shift in accordance with the manufacturer's recommendations to confirm the sensors in the instruments will respond and alarm when they should. If the owner's manual is not available, the personnel operating the equipment will contact the applicable office representative, rental agency or manufacturer for technical guidance for proper calibration. If equipment cannot be pre-calibrated/checked to specifications, site operations requiring monitoring for worker exposure or off-site migration of contaminants will be postponed or temporarily suspended until this requirement is completed.

#### 6.2.2 Personal Sampling

No personal sampling (individual breathing zone sampling using personal air sampling pumps) is anticipated to be required on this project. Should site activities warrant performing personal sampling to better assess chemical exposures experienced by AECOM employees, the AECOM SSO, under the direction of a Certified Industrial Hygienist (CIH), or Safety Professional will be responsible for specifying the required monitoring. Within five working days after the receipt of monitoring results, the CIH or Safety Professional will notify each employee, in writing, of the results that represent that employee's exposure. Copies of air sampling results will be maintained in the AECOM SSO project files.

If the site activities warrant, the subcontractor will ensure its employees' exposures are quantified via the use of appropriate sampling techniques. The subcontractor shall notify the employees sampled in accordance with health and safety regulations, and provide the results to the AECOM SSO for use in determining the potential for other employees' exposure.

### 6.3 Heat and Cold Stress

Heat and cold stress may vary based upon work activities, PPE/clothing selection, geographical locations, and weather conditions. To reduce the potential of developing heat/cold stress, be aware of the signs and symptoms of heat/cold stress and watch fellow employees for signs of heat/cold stress.

6.3.1 Responding to Heat-Related Illness

Heat stress can be a significant field site hazard, particularly for non-acclimated personnel operating in a hot, humid setting. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim and the prevention of heat stress casualties. Work-rest cycles will be determined and the appropriate measures taken to prevent heat stress as outlined in S3NA-511-PR Heat Stress Prevention Program.

The guidance below will be used in identifying and treating heat-related illness.

**Table 6: Identification and Treatment of Heat-Related Illness**

| Type of Heat-Related Illness | Description | First Aid |
|---|---|---|
| Mild Heat Strain | The mildest form of heat-related illness. Victims exhibit irritability, lethargy, and significant sweating. The victim may complain of headache or nausea. This is the initial stage of overheating, and prompt action at this point may prevent more severe heat-related illness from occurring. | • Provide the victim with a work break during which he/she may relax, remove any excess protective clothing, and drink cool fluids.<br>• If an air-conditioned spot is available, this is an ideal break location.<br>• Once the victim shows improvement, he/she may resume working; however, the work pace should be moderated to prevent recurrence of the symptoms. |
| Heat Exhaustion | Usually begins with muscular weakness and cramping, dizziness, staggering gait, and nausea. The victim will have pale, clammy moist skin and may perspire profusely. The pulse is weak and fast and the victim may faint unless they lie down. The bowels may move involuntarily. | • Immediately remove the victim from the work area to a shady or cool area with good air circulation (*avoid drafts or sudden chilling*).<br>• Remove all protective outerwear.<br>• Call a physician.<br>• Treat the victim for shock. (*Make the victim lie down, raise his or her feet 6–12 inches, and keep him/her cool by loosening all clothing*).<br>• If the victim is conscious, it may be helpful to give him/her sips of water.<br>• Transport victim to a medical facility ASAP. |
| Heat Stroke | The most serious of heat illness, heat stroke represents the collapse of the body's cooling mechanisms. As a result, body temperature may rise to 104 degrees Fahrenheit or higher. As the victim progresses toward heat stroke, symptoms such as headache, dizziness, nausea can be noted, and the skin is observed to be dry, red, and hot. Sudden collapse and loss of consciousness follows quickly and death is imminent if exposure continues. Heat stroke can occur suddenly. | • Immediately evacuate the victim to a cool/shady area.<br>• Remove all protective outerwear and as much personal clothing as decency permits.<br>• Lay the victim on his/her back w/the feet slightly elevated.<br>• Apply cold wet towels or ice bags to the head, armpits, and thighs.<br>• Sponge off the bare skin with cool water.<br>• The main objective is to cool without chilling the victim.<br>• Give no stimulants or hot drinks.<br>• Since heat stroke is a severe medical condition requiring professional medical attention, emergency medical help should be summoned immediately to provide onsite treatment of the victim and proper transport to a medical facility. |

### 6.3.2 **Cold Stress**

Workers who are exposed to extreme cold or work in cold environments may be at risk of cold stress. Extreme cold weather is a dangerous situation that can bring on health emergencies in susceptible people, such as those without shelter, outdoor workers, and those who work in an area that is poorly insulated or without heat. What constitutes cold stress and its effects can vary across different areas of the country. In regions relatively unaccustomed to winter weather, near freezing temperatures are considered factors for "cold stress." Whenever temperatures drop decidedly below normal and as wind speed increases, heat can more rapidly leave your body. These weather-related conditions may lead to serious health problems.

<u>Type of Cold Stress</u>

Cold injury is classified as either localized, as in frostbite, frostnip or chilblain; or generalized, as in hypothermia. Contributing factors to cold injury are exposure to humidity and high winds, wet conditions and inadequate clothing.

The likelihood of developing frostbite occurs when the face or extremities are exposed to a cold wind in addition to cold temperatures. The freezing point of the skin is about 30 o F. When fluids around the cells of the body tissue freeze, skin turns white. This freezing is due to exposure to extremely low temperatures. As wind velocity increases, heat loss is greater and frostbite will occur more rapidly.

Symptoms of Cold Stress

The first symptom of frostbite is usually an uncomfortable sensation of coldness, followed by numbness. There might be a tingling, stinging or aching feeling in the affected area. The most vulnerable parts of the body are the nose, cheeks, ears, fingers and toes.

Symptoms of hypothermia, a condition of abnormally low body temperature, include uncontrollable shivering and sensations of cold. The heartbeat slows and can become irregular, the pulse weakens and the blood pressure changes. Pain in the extremities and severe shivering can be the first warning of dangerous exposure to cold.

Maximum severe shivering develops when the body temperature has fallen to 95o F. Productive physical and mental work is limited when severe shivering occurs. Shivering is a serious sign of danger. Immediately remove any person who is shivering from the cold.

Methods to Prevent Cold Stress

When the ambient temperature, or a wind chill equivalent, falls to below 40deg F, site personnel who must remain outdoors should wear insulated coveralls, insulated boot liners, hard hat helmet liners and insulated hand protection. Wool mittens are more efficient insulators than gloves (American Conference of Governmental Industrial Hygienists recommendation). Keeping the head covered is very important, since 40% of body heat can be lost when the head is exposed. If it is not necessary to wear a hard hat, a wool knit cap provides the best head protection. A facemask may also be worn.

Persons should dress in several layers rather than one single heavy outer garment. The outer piece of clothing should ideally be wind and waterproof. Clothing made of thin cotton fabric or synthetic fabrics such as polypropylene is ideal since it helps to evaporate sweat. Polypropylene is best at wicking away moisture while still retaining its insulating properties. Loosely fitting clothing also aids in sweat evaporation. Denim is not a good protective fabric. It is loosely woven which allows moisture to penetrate. Socks with high wool content are best. If two pairs of socks are worn, the inner sock should be smaller and made of cotton, polypropylene or similar types of synthetic material that wick away moisture. If clothing becomes wet, it should be taken off immediately and a dry set of clothing put on.

If wind conditions become severe, it might become necessary to shield the work area temporarily. The SSO and the PM will determine if this type of action is necessary. Heated break trailers or a designated area that is heated should be available if work is performed continuously in the cold at temperatures, or equivalent wind chill temperatures, of 20deg F.

If wind chill temperatures fall below minus 25deg F, breaks from the cold will occur at a rate of one every hour. If wind chill temperatures fall below minus 45deg F, all work will cease and persons will be required to go indoors. However, these guidelines can be modified at any time based on actual site conditions and professional judgment rendered by either the Field Manger and/or SSO. For example, the Field Manger and/or SSO will evaluate field crew fitness; the condition of their cold-weather gear, including boots; and will observe employees alertness, including fatigue and rate of cold tolerance/acclimation.

Dehydration occurs in the cold environment and can increase the susceptibility of the worker to cold injury due to significant change in blood flow to the extremities. Drink plenty of fluids, but limit the intake of caffeine.

# 7.0 Environmental Program

## 7.1 Environmental Compliance and Management

This project and the individual tasks will comply with all federal, state, provincial, and local environmental requirements.

### 7.1.1 Waste Management

Any hazardous waste generated at the site will be stored, transported and disposed in strict compliance with all Federal, State and local regulatory requirements and client site-specific requirements. These requirements will be outlined in soil and/or groundwater management plans that will be developed prior to mobilization to any project.

Other wastes generated during site activities will be handled in accordance with all applicable federal, state and local regulations and Property owner's procedures.

Investigative Derived Waste (IDW) will be collected and categorized as non-hazardous or hazardous. Potentially hazardous IDW (purge water, and decontamination fluids, and soil cuttings [if any]) will be tested and disposed of within 90 calendar days of completing the field activities. Potentially hazardous IDW waste will be staged onsite, and then delivered to an IDW storage facility for processing. Non-hazardous IDW (normal trash) will be disposed of in a timely fashion during fieldwork.

### 7.1.2 Site Restoration

Site restoration will involve the removal of temporary roadways and staging areas, final grading of the site, surface cover installation (asphalt and concrete placement, topsoil, seeding, mulching, tree planting, and other landscaping) removal of temporary fencing and erosion control materials, and the disposal of construction debris.

### 7.1.3 Environmental Protection

This project and the individual tasks will comply with all federal, state, provincial, and local environmental requirements as well as S3NA-204-PR, *Environmental Compliance*.

### 7.1.4 Air Monitoring

Monitoring activities will be conducted throughout the program to: evaluate site conditions; ensure that the measures used to control potential fugitive emissions are effective; and document ambient air quality/conditions in the immediate vicinity of the site.

### 7.1.5 Wetlands Protection

Not applicable

### 7.1.6 Critical Habitat Protection

Not applicable

# 8.0 Personal Protective Equipment

## 8.1 Personal Protective Equipment

The purpose of personal protective equipment (PPE) is to provide a barrier, which will shield or isolate individuals from the chemical and/or physical hazards that may be encountered during work activities. *S3NA-208-PR Personal Protective Equipment Program* lists the general requirements for selection and usage of PPE. Table 8-1 lists the minimum PPE required during site operations and additional PPE that may be necessary. The specific PPE requirements for each work task are specified in the individual THAs.

By signing this HASP the employee agrees having been trained in the use, limitations, care and maintenance of the protective equipment to be used by the employee on this project. If training has not been provided, request the AECOM PM/SSO provide the proper training before signing.

**Table 8-1: Personal Protective Equipment**

| PPE Item | Mobilization/ Rig up / Rig down / Administrative Activities | Soil Boring/ Soil Sampling/ | Well Installation/ Groundwater Sampling | Vapor Probe Installation/ Vapor Sampling | Personnel/ Equipment Decontamination |
|---|---|---|---|---|---|
| Hard hat | √1 | √1 | √1 | √1 | √1 |
| Safety glasses | √ | √ | √ | √ | √ |
| Face shield | 2 | 2 | 2 | 2 | 2 |
| Steel-toed boots | √ | √ | √ | √ | √ |
| Chemical Resistant Gloves, Inner, Nitrile | - | √3 | √3 | √3 | √3 |
| Chemical Resistant Gloves, Outer Nitrile | - | √3 | √3 | √3 | √3 |
| Work Gloves, Kevlar / Leather | √3 | √3 | √3 | √3 | √3 |
| Hearing Protection | √4 | √4 | √4 | √4 | √4 |
| Reflective Traffic Vest | √ | √ | √ | √ | √ |
| Polycoated Tyvek | - | 5 | 5 | 5 | 5 |
| Tyvek | 6 | 6 | 6 | 6 | 6 |
| Ivy Block® or Ivy Screen® barrier cream | 6 | 6 | 6 | 6 | 6 |
| Snake Protection | 7 | 7 | 7 | 7 | 7 |
| Cold/Wet Weather Gear | 8 | 8 | 8 | 8 | 8 |
| Sunscreen | 9 | 9 | 9 | 9 | 9 |

✓ Required PPE

1. Hard hats not required when there are no potential head bump hazards.
2. Goggles and a face shield are required where contaminant or chemical may be splashed or is under pressure or severe hazard from flying debris is present.
3. Wear work gloves when handling pipe, drums or sharp-edged equipment; impervious gloves for chemical exposure. Thermal protective gloves and PPE may be required if working on hot equipment. Combinations of gloves may be required if multiple hazards are present.
4. Wear hearing protection in areas where noise levels exceed 85 dBA (or normal speech becomes difficult).
5. Polycoated Tyvek or chemical resistant suit required when there is potential for contact with free product or soil or groundwater that is highly impacted with contaminants. Contact PM and Safety Professional if high levels of contaminants are suspected or encountered.
6. Ivy Block® or Ivy Screen® barrier cream should be worn on exposed skin where there is a potential for exposure to poison ivy or oak. Tyvek coveralls and Nitrile gloves will be worn to protect workers from poison ivy and poison oak where contact

| | |
|---|---|
| | cannot be avoided |
| 7. | Snake protection (e.g., boots and snake chaps) should be worn when walking through vegetated areas where there is a high potential for encountering snakes. |
| 8. | As required for weather conditions. |
| 9. | As required for sun (UV) protection. Utilize SPF 30 minimum; reapply as necessary. |

## 8.2 PPE Doffing and Donning Information

The following information is to provide field personnel with helpful hints that, when applied, make donning and doffing of PPE safer and a more manageable task:

- When applying duct tape to PPE interfaces (wrist, lower leg, around respirator, etc.) and zippers, leave approximately one inch at the end of the tape to fold over itself. This will make it much easier to remove the tape by providing a small handle to grab while still wearing gloves. Without this fold, trying to pull up the tape end with multiple gloves on may be difficult and result in premature tearing of the PPE.
- Have a “buddy” check your ensemble to ensure proper donning before entering controlled work areas. Without mirrors, the most obvious discrepancies can go unnoticed and may result in a potential exposure situation.
- Never perform personal decontamination with a pressure washer.
- Never cut disposable booties from your feet with basic utility knives. This has resulted in workers cutting through the booty and the underlying sturdy leather work boot, resulting in significant cuts to the legs/ankles. Recommend using a pair of scissors or a package/letter opener (cut above and parallel with the work boot) to start a cut in the edge of the booty, then proceed by manually tearing the material down to the sole of the booty for easy removal.

# 9.0 Site Control

## 9.1 General

The purpose of site control is to minimize potential contamination of workers, protect the public from site hazards, and prevent vandalism. The degree of site control necessary depends on the site characteristics, site size, and the surrounding community.

Controlled work areas will be established at each work location, and if required, will be established directly prior to the work being conducted. Diagrams designating specific controlled work areas will be drawn on site maps, posted in the support vehicle or trailer and discussed during the daily safety meetings. If the site layout changes, the new areas and their potential hazards will be discussed immediately after the changes are made. General examples of zone layouts have been developed for drilling and earth moving activities (e.g., excavating, trenching, etc.) and are attached to this section.

## 9.2 Controlled Work Areas

Each HAZWOPER controlled work area will consist of the following three zones:

- Exclusion Zone (EZ): Contaminated work area.
- Contamination Reduction Zone (CRZ): Decontamination area.
- Support Zone (SZ): Uncontaminated or “clean area” where personnel should not be exposed to hazardous conditions.

Each zone will be periodically monitored in accordance with the air monitoring requirements established in this HASP. The Exclusion Zone and the Contamination Reduction Zone are considered work areas. The Support Zone is accessible to the public (e.g., vendors, inspectors).

### 9.2.1 Exclusion Zone

The Exclusion Zone is the area where primary activities occur, such as sampling, remediation operations, installation of wells, cleanup work, etc. This area must be clearly marked with hazard tape, barricades or cones, or enclosed by fences or ropes. Only personnel involved in work activities, and meeting the requirements specified in the applicable THA and this HASP will be allowed in an Exclusion Zone.

The extent of each area will be sufficient to ensure that personnel located at/beyond its boundaries will not be affected in any substantial way by hazards associated with sample collection activities.

All personnel should be alert to prevent unauthorized, accidental entrance into controlled-access areas (the EZ and CRZ). If such an entry should occur, the trespasser should be immediately escorted outside the area, or all HAZWOPER-related work must cease. All personnel, equipment, and supplies that enter controlled-access areas must be decontaminated or containerized as waste prior to leaving (through the CRZ only).

### 9.2.2 Contamination Reduction Zone

The Contamination Reduction Zone is the transition area between the contaminated area and the clean area. Decontamination is the main focus in this area. The decontamination of workers and equipment limits the physical transfer of hazardous substances into the clean area. This area must also be clearly marked with hazard tape and access limited to personnel involved in decontamination.

### 9.2.3 Support Zone

The Support Zone is an uncontaminated zone where administrative and other support functions, such as first aid, equipment supply, emergency information, etc., are located. The Support Zone shall have minimal potential for significant exposure to contaminants (i.e., background levels).

Employees will establish a Support Zone (if necessary) at the site before the commencement of site activities. The Support Zone would also serve as the entry point for controlling site access.

## 9.3 Site Access Documentation

If implemented by the PM, all personnel entering the site shall complete the “Site Entry/Exit Log” located at the site trailer or primary site support vehicle.

## 9.4 Site Security

### 9.4.1 General

Site security is necessary to:

- Prevent the exposure of unauthorized, unprotected people to site hazards.
- Avoid the increased hazards from vandals or persons seeking to abandon other wastes on the site.
- Prevent theft.
- Avoid interference with safe working procedures.

### 9.4.2 Working Hours

To maintain site security during working hours:

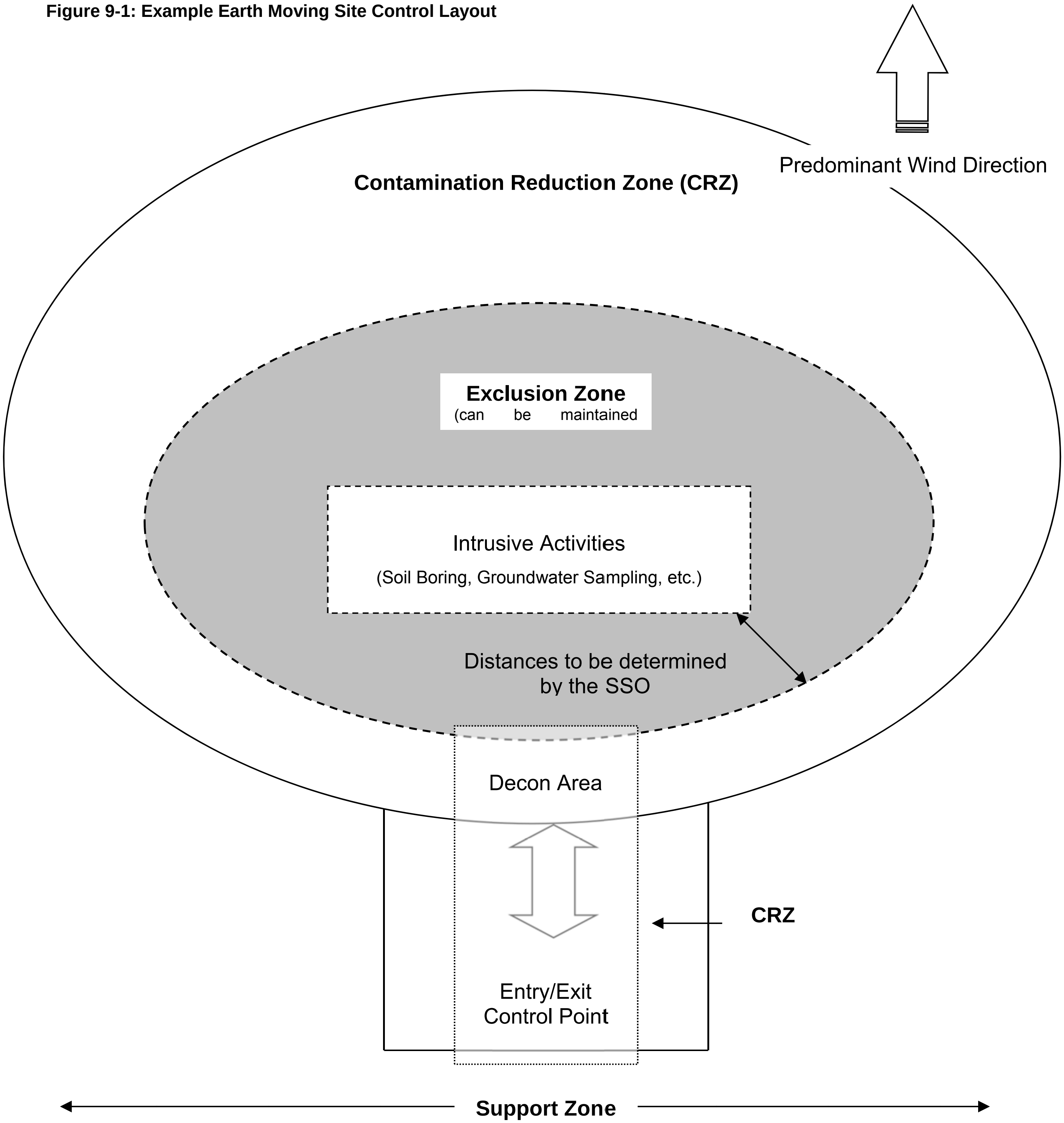
- Maintain security in the Support Zone and at access control points.
- Establish an identification system to identify authorized persons and limitations to their approved activities.
- Assign responsibility for enforcing authority for entry and exit requirements.
- When feasible, install fencing or other physical barrier around the site.
- If the site is not fenced, post signs around the perimeter and whenever possible, use guards to patrol the perimeter. Guards must be fully apprised of the hazards involved and trained in emergency procedures.
- Have the AECOM PM approve all visitors to the site. Make sure they have valid purpose for entering the site. Have trained site personnel accompany visitors at all times and provide them with the appropriate protective equipment.

### 9.4.3 Off-duty Hours

To maintain site security during off-duty hours:

- If possible, assign trained, in-house technicians for site surveillance. They will be familiar with the site, the nature of the work, the site's hazards, and respiratory protection techniques.
- If necessary, use security guards to patrol the site boundary. Such personnel may be less expensive than trained technicians, but will be more difficult to train in safety procedures and will be less confident in reacting to problems around hazardous substances.
- Enlist public enforcement agencies, such as the local police department, if the site presents a significant risk to local health and safety.
- Secure the equipment.

Figure 9-1: Example Earth Moving Site Control Layout



## 10.0 Decontamination

### 10.1 General Requirements

AECOM SH&E SOP S3NA-521-PR *Decontamination* discusses appropriate procedures to decontaminate both equipment and personnel when exposure to hazardous chemicals or physical agents has occurred. All possible and necessary steps shall be implemented to reduce or minimize contact with chemicals and contaminated/impacted materials while performing field activities (e.g., avoid sitting or leaning on, walking through, dragging equipment through or over, tracking, or splashing potential or known contaminated/impacted materials, etc.).

All personal decontamination activities shall be performed with an attendant (buddy) to provide assistance to personnel that are performing decontamination activities. Depending on specific site hazards, attendants may be required to wear a level of protection that is equal to the required level in the Exclusion Zone (EZ).

All persons and equipment entering the EZ shall be considered contaminated, and thus, must be properly decontaminated in the Contamination Reduction Zone (CRZ) prior to entering the Support Zone (SZ).

Decontamination procedures may vary based on site conditions and nature of the contaminant(s). If chemicals or decontamination solutions are used, care should be taken to minimize reactions between the solutions and contaminated materials. In addition, personnel must assess the potential exposures created by the decontamination chemical(s) or solutions. The applicable Material Safety Data Sheet (MSDS) must be reviewed, implemented, and filed by personnel contacting the chemicals/solutions.

All contaminated PPE and decontamination materials shall be contained, stored and disposed of in accordance with site-specific requirements determined by site management.

### 10.2 Decontamination Equipment

The equipment required to perform decontamination may vary based on site-specific conditions and the nature of the contaminant(s). The following equipment is commonly used for decontamination purposes:

- Soft-bristle scrub brushes or long-handled brushes to remove contaminants;
- Hoses, buckets of water or garden sprayers for rinsing;
- Plastic sheeting for an equipment laydown area;
- Large plastic/galvanized wash tubs or children's wading pools for washing and rinsing solutions;
- Large plastic garbage cans or similar containers lined with plastic bags for the storage of contaminated clothing and equipment;
- Metal or plastic cans or drums for the temporary storage of contaminated liquids; and
- Paper or cloth towels for drying protective clothing and equipment.
- High pressure washers/steam cleaners (for equipment only)

### 10.3 Personal/Equipment Decontamination

All personnel and equipment leaving the EZ shall be considered contaminated and must be properly decontaminated to minimize the potential for exposure and off-site migration of impacted materials. Equipment may include, but is not limited to: sampling tools, heavy equipment, vehicles, PPE, support devices (e.g., hoses, cylinders, etc.), and various handheld tools.

All employees performing equipment decontamination shall wear the appropriate PPE to protect against exposure to contaminated materials. The level of PPE may be equivalent to the level of PPE required in the EZ. Other PPE may include splash protection, such as face-shields and splash suits, and knee protectors. Following equipment decontamination, employees may be required to follow the proper personal decontamination procedures above.

For larger equipment, a high-pressure washer may need to be used. Some contaminants require the use of a detergent or chemical solution and scrub brushes to ensure proper decontamination.

For smaller equipment, use the following steps for decontamination:

- Remove majority of visible gross contamination in EZ.
- Wash equipment in decontamination solution with a scrub brush and/or power wash heavy equipment.

- Rinse equipment.
- Visually inspect for remaining contamination.
- Follow appropriate personal decontamination steps outlined above.

All decontaminated equipment shall be visually inspected for contamination prior to leaving the CRZ. Signs of visible contamination may include an oily sheen, residue or contaminated soils left on the equipment. All equipment with visible signs of contamination shall be discarded or re-decontaminated until clean. Depending on the nature of the contaminant, equipment may have to be sampled using a wipe method or other means.

# 11.0 Emergency Response Planning

OSHA defines emergency response as any "response effort by employees from outside the immediate release area or by other designated responders (i.e., mutual-aid groups, local fire departments, etc.) to an occurrence which results, or is likely to result in an uncontrolled release of a hazardous substance." According to AECOM policy, AECOM personnel shall not participate in any emergency response where there are potential safety or health hazards (i.e., fire, explosion, or chemical exposure). AECOM response actions will be limited to reporting, evacuation and medical/first aid as described within this section below. As such this section is written to comply with the requirements of 29 CFR 1910.38 (a).

The basic elements of an emergency evacuation plan include:

- employee training,
- alarm systems,
- escape routes,
- escape procedures,
- critical operations or equipment,
- rescue and medical duty assignments,
- designation of responsible parties,
- emergency reporting procedures and
- methods to account for all employees after evacuation.

## 11.1 Employee Training

Employees must be instructed in the site-specific aspects of emergency evacuation. On-site refresher or update training is required anytime escape routes or procedures are modified or personnel assignments are changed.

## 11.2 Emergency Response Drills

For projects with durations of greater than four days on site, the AECOM SSO will initiate an evacuation drill during the first five days and shall repeat the drills at least quarterly. Deficiencies noted during the drills will be documented as a Near Loss, a Root Cause Analysis conducted and corrective actions initiated.

A table-top run through of the evacuations procedures from the manufacturing site will be conducted the first day on the site and reviewed with all workers arriving on site after that date.

Emergency Response drills and subsequent personnel briefings on evacuation procedures will be documented in the safety briefing agenda or briefing notes.

## 11.3 Alarm System/Emergency Signals

An emergency communication system must be in effect at all sites. The simplest and most and effective emergency communication system in many situations will be direct verbal communications. Each site must be assessed at the time of initial site activity and periodically as the work progresses. Verbal communications must be supplemented anytime voices cannot be clearly perceived above ambient noise levels (i.e., noise from heavy equipment; drilling rigs, backhoes, etc.) and anytime a clear line-of-sight cannot be easily maintained amongst all AECOM personnel because of distance, terrain or other obstructions.

Verbal communications will be adequate to warn employees of hazards associated with the immediate work area. The property is occupied but AECOM may not have access to facility phones. Therefore, AECOM will bring a portable phone to the site to ensure that communications with local emergency responders is maintained, when necessary.

## 11.4 Emergency Muster Point

The emergency muster point will be designated and all employees informed of its location and provided to all workers during the project mobilization.

## 11.5 Escape Routes and Procedures

The escape route from the site and an emergency muster point will be determined and provided to all workers during the project mobilization.

## 11.6 Employee Accounting Method

The AECOM SSO is responsible for accounting for all AECOM personnel on-site at all times. AECOM and its subcontract employees will notify the AECOM SSO when they enter and leave the site. The AECOM SSO will account for all AECOM and its subcontract employees following an evacuation.

## 11.7 Rescue and Medical Duty Assignments

The phone numbers of the police and fire departments, ambulance service, local hospital, and AECOM representatives are provided in the emergency reference sheet. This sheet will be posted in the site vehicle.

In the event an injury or illness requires more than first aid treatment, local emergency agencies will be notified (dial 911 for Fire, Ambulance, and Law Enforcement dispatch). The AECOM SSO or a designated representative will accompany the injured person to the medical facility and will remain with the person until release or admittance is determined. The escort will relay all appropriate medical information to the PM and the Safety Professional.

If the injured employee can be moved from the accident area, he or she will be brought to the CRZ where their PPE will be removed. If the person is suffering from a back or neck injury the person will not be moved and the requirements for decontamination do not apply. The AECOM SSO must familiarize the responding emergency personnel about the nature of the site and the injury. If the responder feels that the PPE can be cut away from the injured person's body, this will be done on-site. If this not feasible, decontamination will be performed after the injured person has been stabilized.

## 11.8 Designation of responsible parties

The AECOM Site Supervisor is responsible for initiating emergency response. In the event the AECOM SSO cannot fulfill this duty, the alternate SSO will take charge.

## 11.9 Near Miss Reporting

A *Near Miss Incident* is defined as any undesired event that, under slightly different circumstances (e.g., timing, distance, chance, etc.) could have resulted in personal harm, property damage, an environmental release or any undesired loss of resources. In other words, a Near Miss Incident is a situation in which an accident almost occurred.

AECOM requires that all *Near Miss Incidents* be reported as soon as possible after their occurrence to the Safety Professional and RSHEM using the Near Miss form attached in Attachment C.

Situations in which a hazard is identified and corrected before an incident occurs do not necessarily meet the definition of a *Near Miss Incident* and are referred to as *HSE Observations*. Reporting and following up on *HSE Observations* can also provide opportunities for learning and improvement in the same manner as reporting and following up on *Near Miss Incidents*. AECOM also strongly encourages the reporting of HSE Observations. *HSE Observations* may also be reported using the Near Miss form attached in Attachment C using the process described above.

## 11.10 Accident Reporting and Investigation

Any incident (other than minor first aid treatment) resulting in injury, illness or property damage requires an accident investigation and report. The investigation should be conducted as soon as emergency conditions are under control. The purpose of the investigation is not to attribute blame but to determine the pertinent facts so that repeat or similar occurrences can be avoided. An AECOM accident investigation form is presented in Attachment C of this HASP. The injured AECOM employee's supervisor and the RSHEM/Safety Professional should be notified immediately of the injury.

If a subcontractor employee is injured, they are required to notify the AECOM SSO. Once the incident is under control, the subcontractor will submit a copy of their company's accident investigation report to the AECOM SSO.

### 11.11 **Spill/Release Reporting**

All environmental spills or releases of hazardous materials (e.g., fuels, solvents, etc.), whether in excess of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Reportable Quantities or not, will be reported immediately to the Site Supervisor, SSO and PM. In determining whether a spill or release must be reported to a regulatory agency, the Site Supervisor will assess the quantity of the spill or release and, in consultation with the PM, evaluate the reporting criteria against the state- and federal-specific reporting requirements, applicable regulatory permit(s), and/or client-specific reporting procedures.

**Table 11.1: Emergency Contacts**

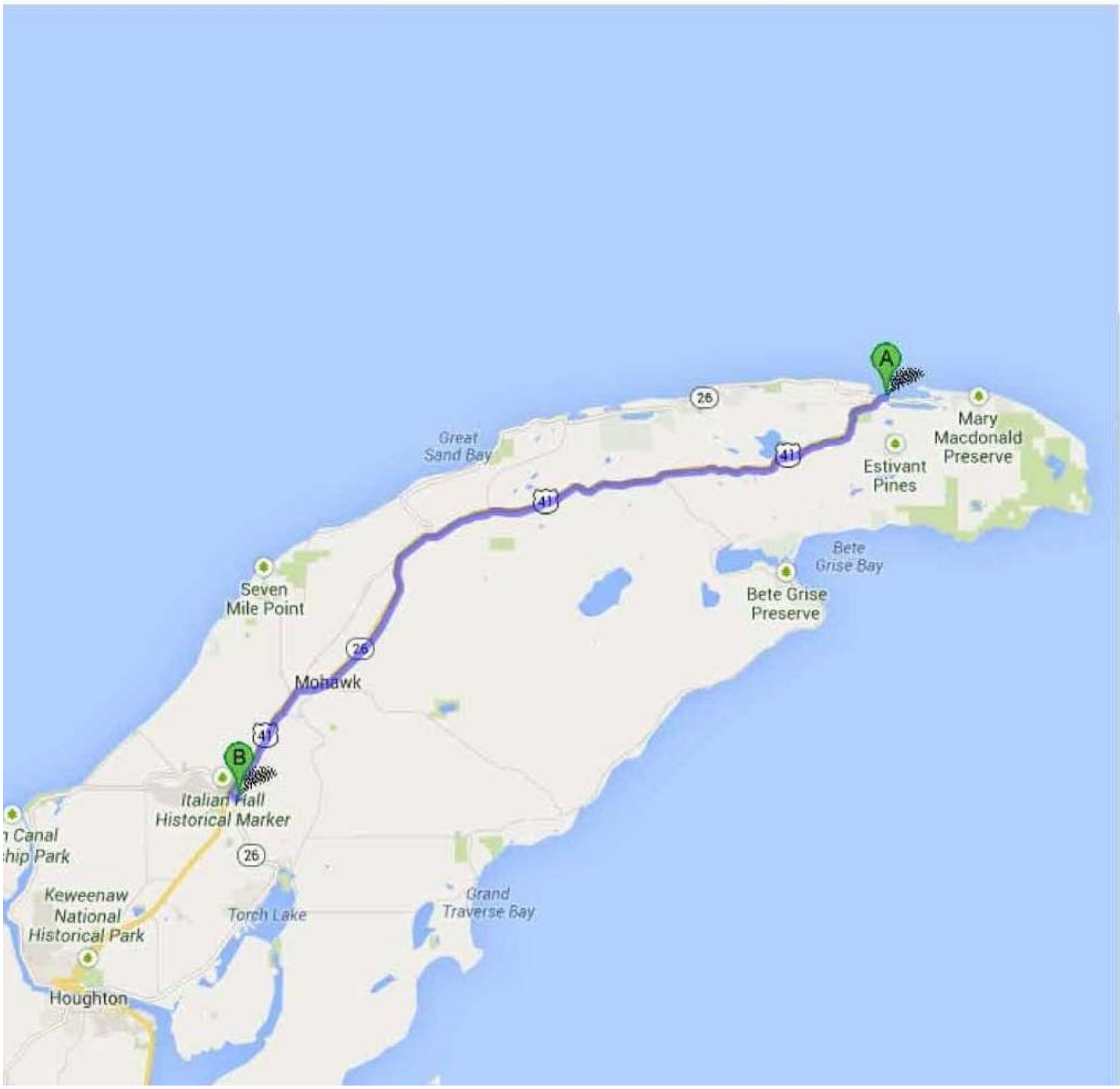
| Emergency Coordinators / Key Personnel | | | |
|---|---|---|---|
| **Name** | **Title/Workstation** | **Office Telephone Number** | **Mobile Phone** |
| Michelle Freimund | Project Manager | 920.36.6712 | 920.539.5829 |
| TBD | Site Supervisor | | |
| TBD | Site Safety Officer | | |
| Bill Looney | Safety Professional | 414.944.6182 | 262.893.0658 |
| Nash Doyle | Regional SH&E Manager | 312.373.7813 | 312.593.8489 |
| **Incident Reporting** | **Incident Reporting Line** | **800.348.5046** | |
| Bill Solberg | District Manager (Environment) | 651.367.2345 | |
| Greg Carpenter | Client Contact (USCG) | 216.902.6219 | |
| Greg Carpenter | Site Contact | 216.902.6219 | |

| Organization / Agency | |
|---|---|
| **Name** | **Telephone Number** |
| Police Department (local) | 911 |
| Fire Department (local) | 911 |
| | |
| Ambulance Service ***(EMT will determine appropriate hospital for treatment)*** | 911 |
| Emergency Hospital ***(Use by site personnel is only for non-emergency cases)*** | |
| Keweenaw Memorial Medical Center<br>205 Osceola Street<br>Laurium, MI 49913 | 906.337.6500 |
| Emergency Hospital Route: See Figure 11-1 | |
| Work Care: 24-hr On-Call Occupational Nurse **(*Non-Emergency assistance only – Employees must notify SH&E prior to calling*)** | 800.455.6155 |
| Poison Control Center | 800.222.1222 |
| Wisconsin Spill Reporting | 800.943.0003 |
| National Response Center | 800.424.8802 |
| INFOTRAC (AECOM Account #74984) | 800.535.5053 |
| Title 3 Hotline | 800.424.9346 |

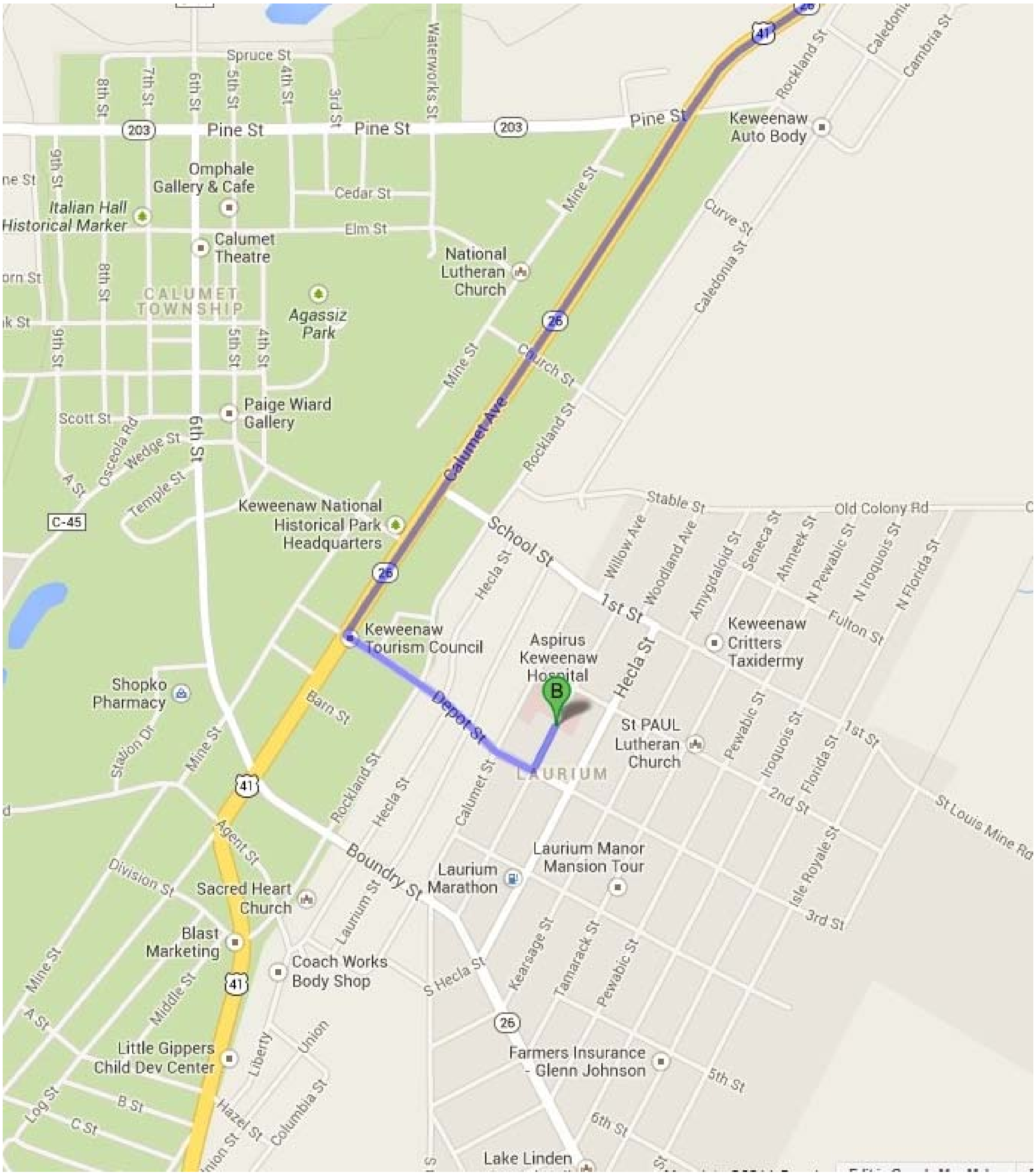
| Public Utilities | |
|---|---|
| **Name** | **Telephone Number** |
| Miss Dig System, Inc. | 800.842.7171 |

**Figure 11.1: Emergency Hospital Route/Detail Map**

**Directions to 205 Osceola St, Calumet Township, MI 49913**
**34.9 mi** – about **42 mins**
Keweenaw Memorial Medical Center
205 Osceola Street
Laurium, MI 49913




**Page 1 of 2**


Spruce St
Pine St
Pine St
Pine St
Omphale Gallery & Cafe
Italian Hall Historical Marker
Calumet Theatre
National Lutheran Church
CALUMET TOWNSHIP
Agassiz Park
Keweenaw Auto Body
Paige Wiard Gallery
Calumet Ave
Keweenaw National Historical Park Headquarters
Keweenaw Tourism Council
Aspirus Keweenaw Hospital
Keweenaw Critters Taxidermy
St PAUL Lutheran Church
Shopko Pharmacy
Depot St
LAURIUM
Boundry St
Laurium Manor Mansion Tour
Laurium Marathon
Sacred Heart Church
Blast Marketing
Coach Works Body Shop
Little Gippers Child Dev Center
Farmers Insurance - Glenn Johnson
Lake Linden
School St
Hecla St
Old Colony Rd
St Louis Mine Rd

Page 2 of 2

Driving directions to Keweenaw Memorial Medical Center 205 Osceola Street Laurium, MI 205 Osceola St, Calumet Township, MI 49913 to Fred's Charters (853 Bernard St, Copper Harbor, MI 49918)

A

**1.** Head **west** on **Brockway Ave** toward **3rd**
0.2 mi

**2.** Continue onto **6th**
0.1 mi

**3.** Continue straight onto **U.S. 41 S**
34.2 mi

**4.** Turn left onto **M-26 S/Depot St**
Continue to follow M-26 S
0.3 mi

**5.** Turn left onto **Osceola St**
Destination will be on the left
361 ft

B 205 Osceola St
Calumet Township, MI 49913

## Personnel Acknowledgement

By signing below, the undersigned acknowledges that he/she has read and reviewed the AECOM Health and Safety Plan for the **Environmental Investigation Activities at Manitou Island Lighthouse and Gull Rock Lighthouse sites. The sites are located in Lake Superior on the eastern tip of Manitou Island, roughly 6 miles from the eastern end of the Keweenaw Peninsula and the Gull Rock Lighthouse located on Gull Rock, 0.5 mile off the western end of Manitou Island and 2.5 miles from the eastern end of the Keweenaw Peninsula.** The undersigned also acknowledges that he/she has been instructed in the contents of this document and understands the information pertaining to the specified work, and will comply with the provisions contained therein.

| PRINT NAME | SIGNATURE | ORGANIZATION | DATE |
|---|---|---|---|
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# Attachment A

# Task Hazard Analyses

[attach THAs]

# Attachment B   Material Safety Data Sheets

**Alconox®**

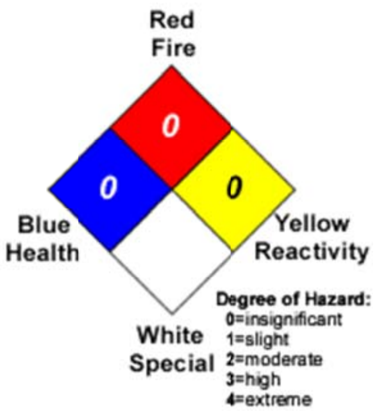
**Material Safety Data Sheet**
Alconox, Inc.
30 Glenn Street, Suite 309
White Plains, NY 10603

24 Hour Emergency Number - Chem-Tel (800) 255-3924

## I. Identification

| | |
|---|---|
| Product Name (shown on label): | ALCONOX |
| CAS Registry Number: | Not Applicable |
| Effective Date: | January 1, 1999 |
| Chemical Family: | Anionic Powdered Detergent |
| Mfr. Catalog #s for Sizes: | 1104, 1125, 1150, 1101, 1103, 1112 |

**National Fire Protection Association 704 Labeling**




## II. Hazardous Ingredients/Identity Information

There are no hazardous ingredients in ALCONOX as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

### III. Physical/Chemical Characteristics

| | |
|---|---|
| Boiling Point (F): | Not Applicable |
| Vapor Pressure (mm Hg): | Not Applicable |
| Vapor Density (AIR=1): | Not Applicable |
| Specific Gravity (Water=1): | Not Applicable |
| Evaporation Rate (Butyl Acetate=1): | Not Applicable |
| Melting Point: | Not Applicable |
| Solubility in Water: | Appreciable-Soluble to 10% at ambient conditions |
| Appearance: | White powder interspersed with cream colored flakes. |

### IV. Fire and Explosion Data

| | |
|---|---|
| Flash Point (Method Used): | None |
| Flammable Limits: | LEL: No Data<br>UEL: No Data |
| Extinguishing Media: | Water, dry chemical, CO2, foam |
| Special Fire fighting Procedures: | Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals. |
| Unusual Fire and Explosion Hazards: | None |

### V. Reactivity Data

| | |
|---|---|
| Stability: | Stable |
| Hazardous Polymerization: | Will not occur |

| | |
|---|---|
| Incompatibility (Materials to Avoid): | None |
| Hazardous Decomposition or Byproducts: | May release CO2 on burning |

**VI. Health Hazard Data**

| | |
|---|---|
| Route(s) of Entry: | Inhalation? Yes<br>Skin? No<br>Ingestion? Yes |
| Health Hazards (Acute and Chronic): | Inhalation of powder can prove locally irritating to mucous membranes. Ingestion can cause discomfort and/or diarrhea. Eye contact can prove irritating. |
| Carcinogenicity: | NTP? No<br>IARC Monographs? No<br>OSHA Regulated? No |
| Signs and Symptoms of Exposure: | Exposure may irritate mucous membranes. May cause sneezing. |
| Medical Conditions Generally Aggravated by Exposure: | Not established. Unnecessary exposure to this product or any industrial chemical should be avoided. Respiratory conditions may be aggravated by powder. |
| Emergency and First Aid Procedures: | Eyes: Immediately flush eyes with water for at least 15 minutes. Call a physician.<br>Skin: Flush with plenty of water.<br>Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs administer fluids. See a physician for discomfort. |

**VII. Precautions for Safe Handling and Use**

| | |
|---|---|
| Steps to be Taken if Material is Released or Spilled: | Material foams profusely. Recover as much as possible and flush remainder to sewer. Material is biodegradable. |
| Waste Disposal Method: | Small quantities may be disposed of in sewer. Large quantities should be disposed of in accordance with local ordinances for detergent products. |
| Precautions to be Taken in Storing and | Material should be stored in a dry area to |

| | |
|---|---|
| Handling: | prevent caking. |
| Other Precautions: | No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical. |

**VII. Control Measures**

| | |
|---|---|
| Respiratory Protection (Specify Type): | Dust mask - Recommended |
| Ventilation: | Local Exhaust-Normal<br>Special-Not Required<br>Mechanical-Not Required<br>Other-Not Required |
| Protective Gloves: | Impervious gloves are useful but not required. |
| Eye Protection: | Goggles are recommended when handling solutions. |
| Other Protective Clothing or Equipment: | None |
| Work/Hygienic Practices: | No special practices required |

THE INFORMATION HEREIN IS GIVEN IN GOOD FAITH BUT NO WARRANTY IS EXPRESSED OR IMPLIED.

# MATERIAL SAFETY DATA SHEET

*Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards*

## PART I *What is the material and what do I need to know in an emergency?*

### 1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: **NON-FLAMMABLE GAS MIXTURE**

Document Number: 002103

PRODUCT USE: For general analytical/synthetic chemical uses.
SUPPLIER/MANUFACTURER'S NAME: AIRGAS INC.
ADDRESS: 259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
BUSINESS PHONE: 1-610-687-5253
EMERGENCY PHONE: 1-800-949-7937
International: 1-423-479-0293
DATE OF PREPARATION: April 22, 2001

### 2. COMPOSITION and INFORMATION ON INGREDIENTS

| CHEMICAL NAME | CAS # | mole % | EXPOSURE LIMITS IN AIR | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | ACGIH | | OSHA | | NIOSH | OTHER |
| | | | TLV ppm | STEL ppm | PEL ppm | STEL ppm | IDLH ppm | ppm |
| Isobutylene | 115-11-7 | 1 ppm - 1.7% | There are no specific exposure limits for Isobutylene. Isobutylene is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%. | | | | | |
| Air | 25635-88-5 | Balance | There are no specific exposure limits applicable to Air. | | | | | |
| Air is a mixture of gases. The primary components of air, and the approximate concentration of each component, are listed below | | | | | | | | |
| Nitrogen | 7727-37-9 | 79% | There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%. | | | | | |
| Oxygen | 7782-44-7 | 21% | There are no specific exposure limits for Oxygen | | | | | |

NE = Not Established. See Section 16 for Definitions of Terms Used.

NOTE (1): ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

### 3. HAZARD IDENTIFICATION

**EMERGENCY OVERVIEW:** This product is a colorless, odorless, non-flammable gas. The main health hazards associated with releases of this gas are related to the high pressure within the cylinder. Air, the main component of this product, is generally considered non-flammable, however, Air will support combustion. The flammable component of this gas mixture is below the LEL. A cylinder rupture hazard exists when this product, which is under pressure, is subjected to heat or flames. Emergency responders must wear personal protective equipment appropriate for the situation to which they are responding.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for air is by inhalation at elevated or reduced pressure.

INHALATION: This product is non-toxic. Air, the main component of this product, is necessary for life.

OTHER POTENTIAL HEALTH EFFECTS: Contact with rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after contact with liquid can quickly subside.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in **Lay Terms**. Over-exposure to this product may cause the following health effects:

**ACUTE:** The most significant hazards associated with compressed air is the pressure hazard. Contact with rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after contact with liquid can quickly subside.

**CHRONIC:** There are currently no known adverse health effects associated with chronic exposure to this gas.

**TARGET ORGANS:** ACUTE: Respiratory system under ambient low pressure conditions. Central nervous system under ambient high pressure conditions. CHRONIC: None expected.

# PART II *What should I do if a hazardous situation occurs?*

## 4. FIRST-AID MEASURES

**RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS PRODUCT WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus equipment should be worn.**

Victim(s) must be taken for medical attention. Rescuers should be taken for medical attention, if ecessary. Take copy of label and MSDS to physician or other health professional with victim(s). Remove victim(s) to fresh air, as quickly as possible. In case of eye contact which leads to irritation, immediately flush eyes with copious amounts of water for at least 15 minutes. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Only trained personnel should administer supplemental oxygen.

In case of frostbite, place the frostbitten part in warm water. DO NOT USE HOT WATER. If warm water is not available, or is impractical to use, wrap the affected parts gently in blankets. Alternatively, if the fingers or hands are frostbitten, place the affected area in the armpit. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Acute or chronic respiratory conditions, as well as disorders involving the “Target Organs”, as listed in Section 3 (Hazard Information), may be aggravated by overexposure to the components of this product.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen as soon as possible, following exposure.

## 5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable.
AUTOIGNITION TEMPERATURE: Not applicable.
FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): Not applicable.
Upper (UEL): Not applicable.

## 5. FIRE-FIGHTING MEASURES (Continued)

FIRE EXTINGUISHING MATERIALS: Non-flammable gas. Use extinguishing media appropriate for surrounding fire.
UNUSUAL FIRE AND EXPLOSION HAZARDS: When involved in a fire, this material may decompose and produce toxic gases including carbon monoxide and carbon dioxide. Additionally, when involved in fire, the cylinders may rupture.
Explosion Sensitivity to Mechanical Impact: Not Sensitive.
Explosion Sensitivity to Static Discharge: Not Sensitive.
SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Move fire-exposed cylinders from area, if it can be done without risk to fire-fighters. Withdraw immediately in case of rising sounds from venting pressure relief devices or any discoloration of tanks or cylinders due to a fire.

## 6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a release, clear the affected area, protect people, and respond with trained personnel. Minimum Personal Protective Equipment should be **Level D: safety glasses, and mechanically-resistant gloves. Level B, which includes the use of Self- Contained Breathing Apparatus, should be worn when oxygen levels are below 19.5% or are unknown.** Locate and seal the source of the leaking gas. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in place or remove it to a safe area and allow the gas to be released there.

# PART III *How can I prevent hazardous situations from occurring?*

## 7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: Do not eat or drink while handling chemicals.
STORAGE AND HANDLING PRACTICES: Cylinders should be stored in dry, well-ventilated areas away from sources of heat. Compressed gases can present significant safety hazards. Store containers away from heavily trafficked areas and emergency exits.
SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Protect cylinders against physical damage. Store in cool, dry, well-ventilated, fireproof area, away from flammable or combustible materials and corrosive atmospheres. Store away from heat and ignition sources and out of direct sunlight. Do not store near elevators, corridors or loading docks. Do not allow area where cylinders are stored to exceed 52°C (125°F). Isolate from incompatible materials including flammable materials (see Section 10, Stability and Reactivity), which can burn violently. Use only storage containers and equipment (pipes, valves, fittings to relieve pressure, etc.) designed for the storage of Air. Do not store containers where they can come into contact with moisture. Cylinders should be stored upright and be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to

prevent rusting. Never tamper with pressure relief devices in valves and cylinders. The following rules are applicable to situations in which cylinders are being used:

**Before Use:** Move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap in-place until cylinder is ready for use.

**During Use:** Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

**After Use:** Close main cylinder valve. Replace valve protection cap. Mark empty cylinders "EMPTY".

**NOTE:** Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with this product. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Pamphlet P-1, *Safe Handling of Compressed Gases in Containers*. Additionally, refer to CGA Bulletin SB-2 "*Oxygen Deficient Atmospheres*".

## 7. HANDLING and STORAGE (Continued)

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged out safely. Purge gas handling equipment with inert gas (i.e. nitrogen) before attempting repairs. Always use product in areas where adequate ventilation is provided.

## 8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation.

RESPIRATORY PROTECTION: Maintain Oxygen levels above 19.5% in the workplace. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93 and applicable standards of Canadian Provinces. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).

EYE PROTECTION: Splash goggles, face-shields or safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133, or Canadian Standards.

HAND PROTECTION: Wear mechanically-resistant gloves when handling cylinders of this product. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: Use body protection appropriate for task. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR.

## 9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for **Air**, the main component of this product , unless otherwise stated:

RELATIVE VAPOR DENSITY: 1 EVAPORATION RATE (nBuAc = 1): Not applicable.

SPECIFIC GRAVITY: Not applicable. FREEZING POINT: -216.2°C (-357.2°F)

SOLUBILITY IN WATER: 1.49% (v/v) BOILING POINT @ 1 atmos: -194.3°C(-317.8°F)

VAPOR PRESSURE, mmHg @ 20°C:. pH: Not applicable.
EXPANSION RATIO: Not applicable. VAPOR PRESSURE: Not applicable.
SPECIFIC VOLUME: 13.3 $ft^3$/lb; (0.833 $m^3$/kg) ODOR THRESHOLD: Not applicable.
COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

The following information is pertinent to this gas mixture:
APPEARANCE, ODOR AND COLOR: This product is a colorless, odorless gas.
HOW TO DETECT THIS SUBSTANCE (warning properties): There are no distinctive properties to this product. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.

## 10. STABILITY and REACTIVITY

STABILITY: Normally stable.
DECOMPOSITION PRODUCTS: None known.
MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE. Air (the main component of this product) is not compatible with fuels, in that air will support combustion. The Isobutylene component of this mixture is incompatible with Strong oxidizers (e.g., chlorine, bromine pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride).
HAZARDOUS POLYMERIZATION: Will not occur.
CONDITIONS TO AVOID: Contact with incompatible materials and exposure to heat, sparks and other sources of ignition. Cylinders exposed to high temperatures or direct flame can rupture or burst.

# PART III *How can I prevent hazardous situations from occurring?*

## 11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are for the components of this gas mixture present at a level greater than 1 mole %:
**ISOBUTYLENE:**
LC50 (Inhalation-Rat) 620 gm/m3/4 hours LC50 (Inhalation-Mouse) 415 gm/m3/2 hours

SUSPECTED CANCER AGENT: No component of this gas mixture is found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, IARC, and therefore is not considered to be, nor suspected to be, cancer causing agents by these agencies.
IRRITANCY OF PRODUCT: Contact with rapidly expanding gases can cause frostbite and damage to exposed skin and eyes.
SENSITIZATION OF PRODUCT: No component of this product is a skin or respiratory sensitizer.
REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this product and its components on the human reproductive system.
Mutagenicity: This product is not reported to cause mutagenic effects in humans.
Embryotoxicity: This product is not reported to cause embryotoxic effects in humans.
Teratogenicity: This product is not reported to cause teratogenic effects in humans.

Reproductive Toxicity: This product is not reported to cause adverse reproductive effects in humans.
*A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.*

BIOLOGICAL EXPOSURE INDICES: Biological Exposure Indices (BEIs) have been determined for the components of this product are as follows:

## 12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: This gas will be dissipated rapidly in well-ventilated areas.
EFFECT OF MATERIAL ON PLANTS or ANIMALS: No adverse effect is anticipated to occur to plant-life, except for frost produced in the presence of rapidly expanding gases.
EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence of an adverse effect of this product on aquatic life is currently available.

## 13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Product removed from cylinder must be disposed of in accordance with appropriate U.S. Federal, State and local regulations or with regulations of Canada and its Provinces. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.

## 14. TRANSPORTATION INFORMATION

THIS GAS MIXTURE IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (Air, Isobutylene)
HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Compressed Gas)
UN IDENTIFICATION NUMBER: UN 1956
PACKING GROUP: Not Applicable
DOT LABEL(S) REQUIRED: Compressed Gas
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This gas mixture is considered as dangerous goods, per regulations of Transport Canada. Use the above information for the preparation of Canadian Shipments.

## 15. REGULATORY INFORMATION

**ADDITIONAL U.S. REGULATIONS:**
U.S. SARA REPORTING REQUIREMENTS: The components of this gas mixture are not subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act.
U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for this material. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.
U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.
U.S. TSCA INVENTORY STATUS: The components of this product are listed on the TSCA Inventory.
OTHER U.S. FEDERAL REGULATIONS: Not applicable.
U.S. STATE REGULATORY INFORMATION: The components of this gas mixture are covered under specific State regulations, as denoted below:

**Alaska - Designated Toxic and Hazardous Substances**: None.
**California - Permissible Exposure Limits for Chemical Contaminants:** None.
**Florida - Substance List:** Isobutylene. **Illinois - Toxic Substance List:** None.
**Kansas - Section 302/313 List:** None.
**Minnesota - List of Hazardous Substances:** Isobutylene.
**Massachusetts - Substance List:** None.
**Missouri - Employer Information/Toxic Substance List:** None.

**New Jersey - Right to Know Hazardous Substance List:** Isobutylene.
**North Dakota - List of Hazardous Chemicals, Reportable Quantities:** None.
**Pennsylvania - Hazardous Substance List:** Isobutylene.
**Rhode Island - Hazardous Substance List:** None.
**Texas - Hazardous Substance List:** None.
**West Virginia - Hazardous Substance List:** None.
**Wisconsin - Toxic and Hazardous Substances:** None.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): No component of this product is on the California Proposition 65 Lists.

LABELING: **CAUTION:** HIGH PRESSURE GAS.
MAY ACCELERATE COMBUSTION.
Keep oil and grease away.
Use equipment rated for cylinder pressure.
Close valve after each use and when empty.
Use in accordance with the Material Safety Data Sheet.

**FIRST-AID**: **IF INHALED**, remove to fresh air. If not breathing, give artificial respiration.

If breathing is difficult, give oxygen. Call a physician.
**IN CASE OF FROSTBITE,** obtain immediate medial attention.
DO NOT REMOVE THIS PRODUCT LABEL.

**ADDITIONAL CANADIAN REGULATIONS:**
CANADIAN DSL INVENTORY: The components of this product are listed on the DSL Inventory.
OTHER CANADIAN REGULATIONS: Not applicable.
CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: The components of this product are not on the CEPA Priorities Substances Lists.
CANADIAN WHMIS SYMBOLS: **Class A:** Compressed Gases

## 16. OTHER INFORMATION

**PREPARED BY:** CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
858/565-0302

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. AirGas, Inc. assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, AirGas, Inc. assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

## DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

**CAS #**: This is the Chemical Abstract Service Number which uniquely identifies each constituent.

**EXPOSURE LIMITS IN AIR:**

**ACGIH** - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV -** Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average **(TWA)**, the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level **(C)**. Skin absorption effects must also be considered.

**OSHA** - U.S. Occupational Safety and Health Administration. **PEL -** Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, “Vacated 1989 PEL,” is placed next to the PEL which was vacated by Court Order.

**IDLH -** Immediately Dangerous to Life and Health **-** This level represents a concentration from which one can escape within 30- minutes without suffering escape-preventing or permanent injury. **The DFG - MAK** is the Republic of Germany’s Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. **O**ccupational **S**afety and **H**ealth **A**dministration (**OSHA**). NIOSH issues exposure guidelines called **R**ecommended **E**xposure **L**evels (**REL**s). When no exposure guidelines are established, an entry of **NE** is made for reference.

**HAZARD RATINGS:**

**HAZARDOUS MATERIALS IDENTIFICATION SYSTEM:** Health Hazard: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]. Reactivity Hazard: **0** (normally stable); 1 (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures). **PERSONAL PROTECTIVE EQUIPMENT CODES: B:** Gloves and goggles; **C:** Gloves, goggles, rubber apron (appropriate body protection); **D:** Gloves, goggles, faceshield; rubber apron (appropriate body protection);. **X:** Special attention should be given to PPE Selection.

**NATIONAL FIRE PROTECTION ASSOCIATION:** Health Hazard: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure could cause death or major residual injury). Flammability Hazard and Reactivity Hazard: Refer to definitions for “Hazardous Materials Identification System”.

**FLAMMABILITY LIMITS IN AIR**:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (**NFPA**). Flash Point – Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL – the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

**TOXICOLOGICAL INFORMATION:**

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD50** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC50** – Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m3** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: EC is the effect concentration in water.

**REGULATORY INFORMATION:**

This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act **(SARA)**; the Canadian Domestic/Non-Domestic Substances List **(DSL/NDSL)**; the U.S. Toxic Substance Control Act **(TSCA)**; Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act **(CERCLA or Superfund)**; and various state regulations.

# Material Safety Data Sheet

**Methyl Alcohol**

ACC# 14280

## Section 1 - Chemical Product and Company Identification

**MSDS Name:** Methyl Alcohol
**Catalog Numbers:** S75959, S75965, S75965A, S75965HPLC, S75965SPEC, A142RS200, A33F-1GAL, A408 1, A408 4, A408-1, A408-4, A4081, A4084, A408SK 4, A408SK-4, A408SK4, A411 20, A411 4, A411-20, A411-4, A41120, A4114, A412 1, A412 20, A412 20 001, A412 200, A412 4, A412 500, A412-1, A412-20, A412-200, A412-4, A412-500, A41200LC, A4121, A41220, A41220 001, A412200, A41220001, A41220003, A41220005, A412200LC, A41220LC, A4124, A4124LC, A412500, A412500002, A412500LC, A412CU1300, A412FB115, A412FB19, A412FB200, A412FB50, A412J500, A412LC, A412P 4, A412P-4, A412P4, A412P4LC, A412RB115, A412RB19, A412RB200, A412RB50, A412RS115, A412RS200, A412RS28, A412RS50, A412SK 4, A412SK-4, A412SK4, A412SS 115, A412SS-11, A412SS-115, A412SS-20, A412SS-200, A412SS-30, A412SS-50, A412SS115, A412SS50, A413-20, A413-4, A413-500, A413200, A4134, A413500, A433P 4, A433P-4, A433P4, A433S 20, A433S 200, A433S 4, A433S-20, A433S-200, A433S-4, A433S20, A433S200, A433S20001, A433S4, A434 20, A434-20, A43420, A450 4, A450-4, A4504, A4504LOT011, A4504LOT012, A452 1, A452 4, A452 SS115, A452-1, A452-4, A4521, A4524, A4524LC, A452J1, A452RS19, A452RS200, A452RS28, A452RS50, A452SK 1, A452SK 4, A452SK-1, A452SK-4, A452SK1, A452SK4, A452SS 200, A452SS 50, A452SS-11, A452SS-115, A452SS-20, A452SS-200, A452SS-30, A452SS-50, A452SS115, A452SS200, A452SS28, A452SS50, A453 1, A453 500, A453 500 001, A453 500 002, A453 500 003, A453-500, A4531, A4531LC, A4531LOT001, A453500, A453500 001, A453500 002, A453500 003, A453500 004, A453500001, A453500002, A453500003, A453500004, A453500005, A453J1, A454 1, A454 4, A454 SS115, A454 SS30, A454 SS50, A454-1, A454-4, A4541, A4541LC, A4544, A4544LC, A4544LOT012, A4544LOT014, A45450%SS-115, A454RS115, A454RS19, A454RS200, A454RS28, A454RS50, A454SS 200, A454SS115, A454SS200, A454SS28, A454SS30, A454SS50, A457 4, A4574, A497RS28, A52RS28, A52RS50, A54RS115, A54RS200, A54RS28, A54RS50, A935 4, A935-4, A9354, A935RB200, A936-1, A936-4, A947 4, A947-4, A9474, A9474LC, A9474LOT002, A947RS115, A947RS200, A947RS28, A947SS115, A947SS200, A947SS28, A947SS50, BP1105 1, BP1105 4, BP1105-1, BP1105-4, BP11051, BP11054, BP1105SS115, BP1105SS200, BP1105SS28, BP1105SS50, BP2618100, BPA947RS-115, BPA947RS-200, BPA947RS-28, FLA412RS-115, FLA412RS-200, FLA412RS-28, FLA412RS-50, FLA452RS-115, FLA452RS-28, FLA452RS-50, FLA454RS-115, FLA454RS-200, FLA454RS-28, FLA454RS-50, HC 400 1GAL, HC400 1GAL, HC4001GAL, IEAA453500A, NC9475554, NC9500047, NC9548094, NC9633361, NC9766429, NC9780216, SC95 1, SC951, SW2 1, SW21, TIA9474, TIA947P200, TIA947P200L, XXA45220LI
**Synonyms:** Carbinol; Methanol; Methyl hydroxide; Monohydroxymethane; Pyroxylic spirit; Wood alcohol; Wood naptha; Wood spirit; Monohydroxymethane; Methyl hydrate
**Company Identification:**

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

**For information, call:** 201-796-7100
**Emergency Number:** 201-796-7100

**For CHEMTREC assistance, call:** 800-424-9300
**For International CHEMTREC assistance, call:** 703-527-3887

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 67-56-1 | Methyl alcohol | >99.0 | 200-659-6 |

**Hazard Symbols:** T F
**Risk Phrases:** 11 23/24/25 39/23/24/25

## Section 3 - Hazards Identification

**EMERGENCY OVERVIEW**

Appearance: clear, colorless. Flash Point: 12 deg C. **Danger!** **Flammable liquid and vapor.** Causes respiratory tract irritation. Harmful if inhaled. This substance has caused adverse reproductive and fetal effects in animals. May cause central nervous system depression. May be absorbed through the skin. Poison! Cannot be made non-poisonous. Causes eye and skin irritation. May be fatal or cause blindness if swallowed. May cause digestive tract irritation with nausea, vomiting, and diarrhea. May cause liver, kidney and heart damage.
**Target Organs:** Kidneys, heart, central nervous system, liver, eyes.

### Potential Health Effects

**Eye:** Produces irritation, characterized by a burning sensation, redness, tearing, inflammation, and possible corneal injury. May cause painful sensitization to light.
**Skin:** Causes moderate skin irritation. May be absorbed through the skin in harmful amounts. Prolonged and/or repeated contact may cause defatting of the skin and dermatitis.
**Ingestion:** May be fatal or cause blindness if swallowed. May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May cause systemic toxicity with acidosis. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. May cause cardiopulmonary system effects.
**Inhalation:** Harmful if inhaled. May cause adverse central nervous system effects including headache, convulsions, and possible death. May cause visual impairment and possible permanent blindness. Causes irritation of the mucous membrane.
**Chronic:** Prolonged or repeated skin contact may cause dermatitis. Chronic inhalation and ingestion may cause effects similar to those of acute inhalation and ingestion. Chronic exposure

may cause reproductive disorders and teratogenic effects. Laboratory experiments have resulted in mutagenic effects. Prolonged exposure may cause liver, kidney, and heart damage.

## Section 4 - First Aid Measures

**Eyes:** Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.
**Skin:** Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse.
**Ingestion:** If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately. Induce vomiting by giving one teaspoon of Syrup of Ipecac.
**Inhalation:** Get medical aid immediately. Remove from exposure to fresh air immediately. If breathing is difficult, give oxygen. Do NOT use mouth-to-mouth respiration. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and a mask.
**Notes to Physician:** Effects may be delayed. Ethanol may inhibit methanol metabolism.

## Section 5 - Firefighting Measures

**General Information:** Containers can build up pressure if exposed to heat and/or fire. As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Water runoff can cause environmental damage. Dike and collect water used to fight fire. Vapors can travel to a source of ignition and flash back. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Flammable Liquid. Can release vapors that form explosive mixtures at temperatures above the flashpoint. Use water spray to keep fire-exposed containers cool. Water may be ineffective. Material is lighter than water and a fire may be spread by the use of water. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. May be ignited by heat, sparks, and flame.
**Extinguishing Media:** For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. Use water spray to cool fire-exposed containers. Water may be ineffective. For large fires, use water spray, fog or alcohol-resistant foam. Do NOT use straight streams of water.

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.
**Spills/Leaks:** Scoop up with a nonsparking tool, then place into a suitable container for disposal. Use water spray to disperse the gas/vapor. Remove all sources of ignition. Absorb spill using an

absorbent, non-combustible material such as earth, sand, or vermiculite. Do not use combustible materials such as saw dust. Provide ventilation. A vapor suppressing foam may be used to reduce vapors. Water spray may reduce vapor but may not prevent ignition in closed spaces.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Do not breathe dust, vapor, mist, or gas. Do not get in eyes, on skin, or on clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Avoid contact with heat, sparks and flame. Do not ingest or inhale. Use only in a chemical fume hood. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.
**Storage:** Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a cool, dry, well-ventilated area away from incompatible substances. Flammables-area. Keep containers tightly closed. Do not store in aluminum or lead containers.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits. Use only under a chemical fume hood.
**Exposure Limits**

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Methyl alcohol | 200 ppm; 250 ppm STEL; skin - potential for cutaneous absorption | 200 ppm TWA; 260 mg/m3 TWA 6000 ppm IDLH | 200 ppm TWA; 260 mg/m3 TWA |

**OSHA Vacated PELs:** Methyl alcohol: 200 ppm TWA; 260 mg/m3 TWA
**Personal Protective Equipment**
**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
**Skin:** Wear appropriate protective gloves to prevent skin exposure.
**Clothing:** Wear appropriate protective clothing to prevent skin exposure.
**Respirators:** A respiratory protection program that meets OSHA's 29 CFR §1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

## Section 9 - Physical and Chemical Properties

**Physical State:** Liquid
**Appearance:** clear, colorless
**Odor:** alcohol-like - weak odor
**pH:** Not available.
**Vapor Pressure:** 128 mm Hg @ 20 deg C
**Vapor Density:** 1.11 (Air=1)
**Evaporation Rate:**5.2 (Ether=1)
**Viscosity:** 0.55 cP 20 deg
**Boiling Point:** 64.7 deg C @ 760.00mm Hg
**Freezing/Melting Point:**-98 deg C
**Decomposition Temperature:**Not available.
**Autoignition Temperature:** 455 deg C ( 851.00 deg F)
**Flash Point:** 12 deg C ( 53.60 deg F)
**NFPA Rating:** (estimated) Health: 1; Flammability: 3; Reactivity: 0
**Explosion Limits, Lower:**7.30 vol %
**Upper:** 36.00 vol %
**Solubility:** miscible
**Specific Gravity/Density:**.7910g/cm3
**Molecular Formula:**$CH_4O$
**Molecular Weight:**32.04

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.
**Conditions to Avoid:** High temperatures, incompatible materials, ignition sources, oxidizers.
**Incompatibilities with Other Materials:** Acids (mineral, non-oxidizing, e.g. hydrochloric acid, hydrofluoric acid, muriatic acid, phosphoric acid), acids (mineral, oxidizing, e.g. chromic acid, hypochlorous acid, nitric acid, sulfuric acid), acids (organic, e.g. acetic acid, benzoic acid, formic acid, methanoic acid, oxalic acid), azo, diazo, and hydrazines (e.g. dimethyl hydrazine, hydrazine, methyl hydrazine), isocyanates (e.g. methyl isocyanate), nitrides (e.g. potassium nitride, sodium nitride), peroxides and hydroperoxides (organic, e.g. acetyl peroxide, benzoyl peroxide, butyl peroxide, methyl ethyl ketone peroxide), epoxides (e.g. butyl glycidyl ether), Oxidants (such as barium perchlorate, bromine, chlorine, hydrogen peroxide, lead perchlorate, perchloric acid, sodium hypochlorite)., Active metals (such as potassium and magnesium)., acetyl bromide, alkyl aluminum salts, beryllium dihydride, carbontetrachloride, carbon tetrachloride + metals, chloroform + heat, chloroform + sodium hydroxide, cyanuric chloride, diethyl zinc, nitric acid, potassium-tert-butoxide, chloroform + hydroxide, water reactive substances (e.g. acetic anyhdride, alkyl aluminum chloride, calcium carbide, ethyl dichlorosilane).
**Hazardous Decomposition Products:** Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide, formaldehyde.
**Hazardous Polymerization:** Will not occur.

## Section 11 - Toxicological Information

**RTECS#:**
**CAS#** 67-56-1 unlisted.
**LD50/LC50:**
CAS# 67-56-1:
Draize test, rabbit, eye: 40 mg Moderate;
Draize test, rabbit, eye: 100 mg/24H Moderate;
Draize test, rabbit, skin: 20 mg/24H Moderate;
Inhalation, rat: LC50 = 64000 ppm/4H;
Oral, mouse: LD50 = 7300 mg/kg;
Oral, rabbit: LD50 = 14200 mg/kg;
Oral, rat: LD50 = 5628 mg/kg;
Skin, rabbit: LD50 = 15800 mg/kg;<BR.

**Carcinogenicity:**
CAS# 67-56-1: Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
**Epidemiology:** Methanol has been shown to produce fetotoxicity in the embr yo or fetus of laboratory animals. Specific developmenta l abnormalities include cardiovascular, musculoskeletal, and urogenital systems.
**Teratogenicity:** Effects on Newborn: Behaviorial, Oral, rat: TDLo=7500 mg/kg (female 17-19 days after conception). Effects on Embryo or Fetus: Fetotoxicity, Inhalation, rat: TCLo=10000 ppm/7H (female 7-15 days after conception). Specific Developmental Abnormalities: Cardiovascular, Musculoskeletal, Urogenital, Inhalation, rat: TCLo=20000 ppm/7H (7-14 days after conception).
**Reproductive Effects:** Paternal Effects: Spermatogenesis: Intraperitoneal, mouse TDLo=5 g/kg ( male 5 days pre-mating). Fertility: Oral, rat: TDLo = 35295 mg/kg (female 1-15 days after conception). Paternal Effects: Testes, Epididymis, Sperm duct: Oral, rat: TDLo = 200 ppm/20H (male 78 weeks pre-mating).
**Neurotoxicity:** No information available.
**Mutagenicity:** DNA inhibition: Human Lymphocyte = 300 mmol/L. DNA damage: Oral, rat = 10 umol/kg. Mutation in microorganisms: Mouse Lymphocyte = 7900 mg/L. Cytogenetic analysis: Oral, mouse = 1 gm/kg.
**Other Studies:** Standard Draize Test(Skin, rabbit) = 20 mg/24H (Moderate) S tandard Draize Test: Administration into the eye (rabbit) = 40 mg (Moderate). Standard Draize test: Administration int o the eye (rabbit) = 100 mg/24H (Moderate).

## Section 12 - Ecological Information

**Ecotoxicity:** Not available.
**Environmental Fate:** Dangerous to aquatic life in high concentrations. Aquatic toxicity rating: TLm 96>1000 ppm. May be dangerous if it enters water intakes. Methyl alcohol is expected to biodegrade in soil and water very rapidly. This product will show high soil mobility and will be degraded from the ambient atmosphere by the reaction with photochemically produced hyroxyl radicals with an estimated half-life of 17.8 days. Bioconcentration factor for fish (golden ide) < 10. Based on a log Kow of -0.77, the BCF value for methanol can be estimated to be 0.2.

**Physical/Chemical:** No information available.
**Other:** None.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
**RCRA P-Series:** None listed.
**RCRA U-Series:** CAS# 67-56-1: waste number U154; (Ignitable waste).

## Section 14 - Transport Information

| | US DOT | IATA | RID/ADR | IMO | Canada TDG |
|---|---|---|---|---|---|
| **Shipping Name:** | METHANOL | | | | METHANOL |
| **Hazard Class:** | 3 | | | | 3(6.1) |
| **UN Number:** | UN1230 | | | | UN1230 |
| **Packing Group:** | II | | | | II |
| **Additional Info:** | | | | | FLASHPOINT 11 C |

## Section 15 - Regulatory Information

### US FEDERAL

**TSCA**
CAS# 67-56-1 is listed on the TSCA inventory.
**Health & Safety Reporting List**
None of the chemicals are on the Health & Safety Reporting List.
**Chemical Test Rules**
None of the chemicals in this product are under a Chemical Test Rule.
**Section 12b**

None of the chemicals are listed under TSCA Section 12b.

**TSCA Significant New Use Rule**

None of the chemicals in this material have a SNUR under TSCA.

**SARA**

**Section 302 (RQ)**

CAS# 67-56-1: final RQ = 5000 pounds (2270 kg)

**Section 302 (TPQ)**

None of the chemicals in this product have a TPQ.

**SARA Codes**

CAS # 67-56-1: acute, flammable.

**Section 313**

This material contains Methyl alcohol (CAS# 67-56-1, 99 0%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

**Clean Air Act:**

CAS# 67-56-1 is listed as a hazardous air pollutant (HAP). This material does not contain any Class 1 Ozone depletors. This material does not contain any Class 2 Ozone depletors.

**Clean Water Act:**

None of the chemicals in this product are listed as Hazardous Substances under the CWA. None of the chemicals in this product are listed as Priority Pollutants under the CWA. None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

**OSHA:**

None of the chemicals in this product are considered highly hazardous by OSHA.

**STATE**

CAS# 67-56-1 can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

California No Significant Risk Level: None of the chemicals in this product are listed.

## European / International Regulations

**European Labeling in Accordance with EC Directives**

**Hazard Symbols:**

T F

**Risk Phrases:**

R 11 Highly flammable. R 23/24/25 Toxic by inhalation, in contact with skin and if swallowed. R 39/23/24/25 Toxic : danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.

**Safety Phrases:**

S 16 Keep away from sources of ignition - No smoking. S 36/37 Wear suitable protective clothing and gloves. S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S 7 Keep container tightly closed.

**WGK (Water Danger / Protection)**

CAS# 67-56-1: 1

**Canada**

CAS# 67-56-1 is listed on Canada's DSL/NDSL List.

This product has a WHMIS classification of B2, D1A, D2A.

CAS# 67-56-1 is listed on Canada's Ingredient Disclosure List.

**Exposure Limits**

CAS# 67-56-1: OEL-ARAB Republic of Egypt:TWA 200 ppm (260 mg/m3);Ski
n OEL-AUSTRALIA:TWA 200 ppm (260 mg/m3);STEL 250 ppm;Skin OEL-BELGIU
M:TWA 200 ppm (262 mg/m3);STEL 250 ppm;Skin OEL-CZECHOSLOVAKIA:TWA 10
0 mg/m3;STEL 500 mg/m3 OEL-DENMARK:TWA 200 ppm (260 mg/m3);Skin OEL-
FINLAND:TWA 200 ppm (260 mg/m3);STEL 250 ppm;Skin OEL-FRANCE:TWA 200
ppm (260 mg/m3);STEL 1000 ppm (1300 mg/m3) OEL-GERMANY:TWA 200 ppm (2
60 mg/m3);Skin OEL-HUNGARY:TWA 50 mg/m3;STEL 100 mg/m3;Skin JAN9 OEL
-JAPAN:TWA 200 ppm (260 mg/m3);Skin OEL-THE NETHERLANDS:TWA 200 ppm (

260 mg/m3);Skin OEL-THE PHILIPPINES:TWA 200 ppm (260 mg/m3) OEL-POLAND:TWA 100 mg/m3 OEL-RUSSIA:TWA 200 ppm;STEL 5 mg/m3;Skin OEL-SWEDEN:TWA 200 ppm (250 mg/m3);STEL 250 ppm (350 mg/m3);Skin OEL-SWITZERLAND:TWA 200 ppm (260 mg/m3);STEL 400 ppm;Skin OEL-THAILAND:TWA 200 ppm (260 mg/m3) OEL-TURKEY:TWA 200 ppm (260 mg/m3) OEL-UNITED KINGDOM:TWA 200 ppm (260 mg/m3);STEL 250 ppm;Skin OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

## Section 16 - Additional Information

**MSDS Creation Date:** 7/21/1999
**Revision #6 Date:** 1/24/2001

*The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages*

# Material Safety Data Sheet

**Hydrochloric Acid, 0.1N Standard Solution**

ACC# 95550

## Section 1 - Chemical Product and Company Identification

**MSDS Name:** Hydrochloric Acid, 0.1N Standard Solution
**Catalog Numbers:** AC124200000, AC124200010
**Synonyms:** Muriatic acid; Anhydrous hydorchloric acid; Chlorohydric acid; Hydrochloride; Hydrogen chloride; Spirits of salt
**Company Identification:**
Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410
**For information in North America, call:** 800-ACROS-01
**For emergencies in the US, call CHEMTREC:** 800-424-9300

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 7647-01-0 | Hydrochloric Acid | <1.0 | 231-595-7 |
| 7732-18-5 | Water | Balance | 231-791-2 |

**Hazard Symbols:** C
**Risk Phrases:** 34

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: colorless liquid. **Danger!** Corrosive. Mutagen. May cause fetal effects based upon animal studies. Causes eye and skin burns. May cause severe respiratory tract irritation with possible burns. May cause severe digestive tract irritation with possible burns. Possible sensitizer.
**Target Organs:** Respiratory system, teeth, eyes, skin, circulatory system.

### Potential Health Effects

**Eye:** May cause irreversible eye injury. Vapor or mist may cause irritation and severe burns. Contact with liquid is corrosive to the eyes and causes severe burns. May cause painful sensitization to light.

**Skin:** May cause skin sensitization, an allergic reaction, which becomes evident upon re-exposure to this material. Contact with liquid is corrosive and causes severe burns and ulceration.
**Ingestion:** May cause circulatory system failure. Causes severe digestive tract burns with abdominal pain, vomiting, and possible death. May cause corrosion and permanent tissue destruction of the esophagus and digestive tract.
**Inhalation:** May cause severe irritation of the respiratory tract with sore throat, coughing, shortness of breath and delayed lung edema. Causes chemical burns to the respiratory tract. Exposure to the mist and vapor may erode exposed teeth. Causes corrosive action on the mucous membranes.
**Chronic:** Prolonged or repeated skin contact may cause dermatitis. Repeated exposure may cause erosion of teeth. May cause fetal effects. Laboratory experiments have resulted in mutagenic effects. Prolonged exposure may cause conjunctivitis, photosensitization, and possible blindness.

## Section 4 - First Aid Measures

**Eyes:** Get medical aid immediately. Do NOT allow victim to rub or keep eyes closed. Extensive irrigation is required (at least 30 minutes). SPEEDY ACTION IS CRITICAL!
**Skin:** Get medical aid immediately. Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Destroy contaminated shoes.
**Ingestion:** Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately. Give milk of magnesia.
**Inhalation:** Get medical aid immediately. Remove from exposure to fresh air immediately. If breathing is difficult, give oxygen. DO NOT use mouth-to-mouth respiration. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and a mask.
**Notes to Physician:** Do Not use sodium bicarbonate in an attempt to neutralize the acid.
**Antidote:** Do Not use oils or ointments in eye.

## Section 5 - Firefighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Water runoff can cause environmental damage. Dike and collect water used to fight fire. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Not flammable, but reacts with most metals to form flammable hydrogen gas. Use water spray to keep fire-exposed containers cool. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. Reaction with water may generate much heat which will increase the concentration of fumes in the air. Containers may explode when heated.
**Extinguishing Media:** For large fires, use water spray, fog, or alcohol-resistant foam. Substance is nonflammable; use agent most appropriate to extinguish surrounding fire. Do NOT get water inside containers. Do NOT use straight streams of water. Most foams will react with the material and release corrosive/toxic gases. Cool containers with flooding quantities of water until well after

fire is out. For small fires, use carbon dioxide (except for cyanides), dry chemical, dry sand, and alcohol-resistant foam.

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.
**Spills/Leaks:** Large spills may be neutralized with dilute alkaline solutions of soda ash, or lime. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Remove all sources of ignition. Provide ventilation. Do not get water inside containers. A vapor suppressing foam may be used to reduce vapors. Cover with dry earth, dry sand, or other non-combustible material followed with plastic sheet to minimize spreading and contact with water.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well-ventilated area. Contents may develop pressure upon prolonged storage. Do not breathe dust, vapor, mist, or gas. Do not get in eyes, on skin, or on clothing. Keep container tightly closed. Do not ingest or inhale. Discard contaminated shoes. Use caution when opening. Keep from contact with moist air and steam.
**Storage:** Do not store in direct sunlight. Keep container closed when not in use. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Corrosives area. Do not store in metal containers. Do not store near flammable or oxidizing substances (especially nitric acid or chlorates).

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
**Exposure Limits**

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Hydrochloric Acid | C 5 ppm | 50 ppm IDLH | C 5 ppm; C 7 mg/m3 |
| Water | none listed | none listed | none listed |

**OSHA Vacated PELs:** Hydrochloric Acid: No OSHA Vacated PELs are listed for this chemical. Water: No OSHA Vacated PELs are listed for this chemical.
**Personal Protective Equipment**
**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's

eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
**Skin:** Wear neoprene or polyvinyl chloride gloves to prevent exposure.
**Clothing:** Wear appropriate protective clothing to prevent skin exposure.
**Respirators:** A respiratory protection program that meets OSHA's 29 CFR §1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

## Section 9 - Physical and Chemical Properties

**Physical State:** Clear liquid
**Appearance:** colorless liquid
**Odor:** strong, pungent
**pH:** 1.10 (0.1 N)
**Vapor Pressure:** 190225 mm Hg
**Vapor Density:** Not available.
**Evaporation Rate:**Not available.
**Viscosity:** Not available.
**Boiling Point:** Not available.
**Freezing/Melting Point:**Not available.
**Decomposition Temperature:**Not available.
**Autoignition Temperature:** Not applicable.
**Flash Point:** Not applicable.
**NFPA Rating:** Not published.
**Explosion Limits, Lower:**Not available.
**Upper:** Not available.
**Solubility:** soluble in water.
**Specific Gravity/Density:**1.0000g/cm3
**Molecular Formula:**HCl
**Molecular Weight:**36.45

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.
**Conditions to Avoid:** Mechanical shock, incompatible materials, metals, excess heat, exposure to moist air or water, bases.
**Incompatibilities with Other Materials:** Acetates, acetic anhydride, alcohols + hydrogen cyanide, 2-aminoethanol, ammonium hydroxide, calcium carbide, calcium phosphide, cesium acetylene carbide, cesium carbide, chlorosulfonic acid, 1,1-difluoroethylene, ethylene diamine, ethyleneimine, fluorine, lithium silicides, magnesium boride, mercuric sulfate, oleum, perchloric acid, potassium permanganate, beta-propiolactone, propylene oxide, rubidium acetylene carbide, rubidium carbide, silver perchlorate + carbon tetrachloride, sodium, sodium hydroxide, sulfuric acid, uranium phosphide, vinyl acetate, zinc, metal oxides, aluminum, amines, carbonates, iron, steel, copper alloys, copper, alkali metals, bases.
**Hazardous Decomposition Products:** Hydrogen chloride, chlorine, carbon monoxide, carbon dioxide, hydrogen gas.
**Hazardous Polymerization:** Has not been reported.

## Section 11 - Toxicological Information

**RTECS#:**
**CAS#** 7647-01-0: MW4025000
**CAS#** 7732-18-5: ZC0110000
**LD50/LC50:**
CAS# 7647-01-0:
Inhalation, mouse: LC50 =1108 ppm/1H;
Inhalation, rat: LC50 =3124 ppm/1H;
Oral, rabbit: LD50 = 900 mg/kg;<BR.

CAS# 7732-18-5:
Oral, rat: LD50 = >90 mL/kg;<BR.

**Carcinogenicity:**
CAS# 7647-01-0:
**IARC:** Group 3 carcinogen CAS# 7732-18-5: Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
**Epidemiology:** Experimental reproductive effects have been reported.
**Teratogenicity:** Embryo or Fetus: Stunted fetus, Inhalation, rat TCL0=450 mg/m3/1H Specific Developmental Abnormalities: homeostatis, ihl-rat TCL0=450 mg/m3/1H (female 1 days pre-mating).
**Reproductive Effects:** No information available.
**Neurotoxicity:** No information available.
**Mutagenicity:** Cytogenetic analysis: Hamster, lung = 30 mmol/L.; Cytogenetic analysis: Hamster, ovary = 8 mmol/L.
**Other Studies:** No data available.

## Section 12 - Ecological Information

**Ecotoxicity:** Not available.
**Environmental Fate:** Rapidly hydrolyzes when exposed to water. Will exhibit extensive evaporation from soil surfaces. Upon transport through the soil, hydrochloric acid will dissolve some of the soil materials (especially those with carbonate bases) and the acid will neutralize to some degree.
**Physical/Chemical:** Not available.
**Other:** Not available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.
**RCRA U-Series:** None listed.

## Section 14 - Transport Information

| | US DOT | IATA | RID/ADR | IMO | Canada TDG |
|---|---|---|---|---|---|
| **Shipping Name:** | HYDROCHLORIC ACID | | | | HYDROCHLORIC ACID SOLUTION |
| **Hazard Class:** | 8 | | | | 8(9.2) |
| **UN Number:** | UN1789 | | | | UN1789 |
| **Packing Group:** | II | | | | II |

## Section 15 - Regulatory Information

### US FEDERAL

**TSCA**
CAS# 7647-01-0 is listed on the TSCA inventory.
CAS# 7732-18-5 is listed on the TSCA inventory.
**Health & Safety Reporting List**
None of the chemicals are on the Health & Safety Reporting List.
**Chemical Test Rules**
None of the chemicals in this product are under a Chemical Test Rule.
**Section 12b**
None of the chemicals are listed under TSCA Section 12b.
**TSCA Significant New Use Rule**
None of the chemicals in this material have a SNUR under TSCA.
**SARA**

**Section 302 (RQ)**
CAS# 7647-01-0: final RQ = 5000 pounds (2270 kg)
**Section 302 (TPQ)**
CAS# 7647-01-0: TPQ = 500 pounds; RQ = 5000 pounds (does not meet toxi city criteria but because of high production volume and recognized tox icity is considered a chemical of concern)
**SARA Codes**
CAS # 7647-01-0: acute.
**Section 313**
This chemical is not at a high enough concentration to be reportable under Section 313. No chemicals are reportable under Section 313.
**Clean Air Act:**
CAS# 7647-01-0 is listed as a hazardous air pollutant (HAP). This material does not contain any Class 1 Ozone depletors. This material does not contain any Class 2 Ozone depletors.
**Clean Water Act:**

CAS# 7647-01-0 is listed as a Hazardous Substance under the CWA. None of the chemicals in this product are listed as Priority Pollutants under the CWA. None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

**OSHA:**

CAS# 7647-01-0 is considered highly hazardous by OSHA.

**STATE**

CAS# 7647-01-0 can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

CAS# 7732-18-5 is not present on state lists from CA, PA, MN, MA, FL, or NJ.

California No Significant Risk Level: None of the chemicals in this product are listed.

### European/International Regulations

**European Labeling in Accordance with EC Directives**

**Hazard Symbols:**

C

**Risk Phrases:**

R 34 Causes burns.

**Safety Phrases:**

S 26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S 36/37/39 Wear suitable protective clothing, gloves and eye/face protection. S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S 9 Keep container in a well-ventilated place.

**WGK (Water Danger/Protection)**

CAS# 7647-01-0: 1

CAS# 7732-18-5: No information available.

**Canada**

CAS# 7647-01-0 is listed on Canada's DSL/NDSL List.

CAS# 7732-18-5 is listed on Canada's DSL/NDSL List.

This product has a WHMIS classification of E, D2A.

CAS# 7647-01-0 is not listed on Canada's Ingredient Disclosure List.

CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosure List.

**Exposure Limits**

CAS# 7647-01-0: OEL-AUSTRALIA:TWA 5 ppm (7 mg/m3) OEL-AUSTRIA:TWA 5 ppm (7 mg/m3) OEL-BELGIUM:STEL 5 ppm (7.7 mg/m3) OEL-DENMARK:STEL 5 ppm (7 mg/m3) OEL-FINLAND:STEL 5 ppm (7 mg/m3);Skin OEL-FRANCE:STEL 5 ppm (7.5 mg/m3) OEL-GERMANY:TWA 5 ppm (7 mg/m3) OEL-HUNGARY:STEL 5 mg/m3 OEL-JAPAN:STEL 5 ppm (7.5 mg/m3) OEL-THE NETHERLANDS:TWA 5 p pm (7 mg/m3) OEL-THE PHILIPPINES:TWA 5 ppm (7 mg/m3) OEL-POLAND:TWA 5 mg/m3 OEL-RUSSIA:STEL 5 ppm (5 mg/m3) OEL-SWEDEN:STEL 5 ppm (8 mg/ m3) OEL-SWITZERLAND:TWA 5 ppm (7.5 mg/m3);STEL 10 ppm (15 mg/m3) OEL -THAILAND:TWA 5 ppm (7 mg/m3) OEL-TURKEY:TWA 5 ppm (7 mg/m3) OEL-UNI TED KINGDOM:TWA 5 ppm (7 mg/m3);STEL 5 ppm (7 mg/m3) OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPOR E, VIETNAM check ACGI TLV

## Section 16 - Additional Information

**MSDS Creation Date:** 4/14/1999

**Revision #2 Date:** 8/02/2000

losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

## NITRIC ACID, 50-70%

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1. Product Identification

Synonyms: Aqua Fortis; Azotic Acid; Nitric Acid 50%; Nitric Acid 65%; nitric acid 69-70%

CAS No.: 7697-37-2

Molecular Weight: 63.01

Chemical Formula: HNO3

Product Codes:

J.T. Baker: 411D, 412D, 5371, 5796, 5801, 5826, 5856, 5876, 5896, 9597, 9598, 9600, 9601, 9602, 9603, 9604, 9606, 9607, 9608, 9610, 9616, 9617, 9670

Mallinckrodt: 1409, 2704, 2705, 2716, 6623, H862, H988, H993, H998, V077, V650

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2. Composition/Information on Ingredients

| Ingredient | CAS No | Percent | Hazardous |
|---|---|---|---|
| Nitric Acid | 7697-37-2 | 50 - 70% | Yes |
| Water | 7732-18-5 | 30 - 50% | No |

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3. Hazards Identification

Emergency Overview

--------------------------

POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

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Health Rating: 4 - Extreme (Poison)

Flammability Rating: 0 - None

Reactivity Rating: 3 - Severe (Oxidizer)

Contact Rating: 4 - Extreme (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

Storage Color Code: White (Corrosive)

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Potential Health Effects

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Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison.

Inhalation:

Corrosive! Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract.

Ingestion:

Corrosive! Swallowing nitric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.

Skin Contact:

Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.

Eye Contact:

Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.

Chronic Exposure:

Long-term exposure to concentrated vapors may cause erosion of teeth and lung damage. Long-term exposures seldom occur due to the corrosive properties of the acid.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders, eye disease, or cardiopulmonary diseases may be more susceptible to the effects of this substance.

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4. First Aid Measures

Immediate first aid treatment reduces the health effects of this substance.

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:

DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

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5. Fire Fighting Measures

Fire:

Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Can react with metals to release flammable hydrogen gas.

Explosion:

Reacts explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc. Reacts with most metals to release hydrogen gas which can form explosive mixtures with air.

Fire Extinguishing Media:

Water spray may be used to keep fire exposed containers cool. Do not get water inside container.

Special Information:

Increases the flammability of combustible, organic and readily oxidizable materials. In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

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6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® acid neutralizers are recommended for spills of this product.

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7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

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8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):

2 ppm (TWA), 4 ppm (STEL)

-ACGIH Threshold Limit Value (TLV):

2 ppm (TWA); 4 ppm (STEL)

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, Industrial Ventilation, A Manual of Recommended Practices, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Nitric acid is an oxidizer and should not come in contact with cartridges and canisters that contain oxidizable materials, such as activated charcoal. Canister-type respirators using sorbents are ineffective.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:

Colorless to yellowish liquid.

Odor:

Suffocating, acrid.

Solubility:

Infinitely soluble.

Specific Gravity:

1.41

pH:

1.0 (0.1M solution)

% Volatiles by volume @ 21C (70F):

100 (as water and acid)

Boiling Point:

122C (252F)

Melting Point:

-42C (-44F)

Vapor Density (Air=1):

2-3

Vapor Pressure (mm Hg):

48 @ 20C (68F)

Evaporation Rate (BuAc=1):

No information found.

---

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Containers may burst when heated.

Hazardous Decomposition Products:

When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate. Will react with water or steam to produce heat and toxic and corrosive fumes.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.

Conditions to Avoid:

Light and heat.

---

11. Toxicological Information

Nitric acid: Inhalation rat LC50: 244 ppm (NO2)/30M; Investigated as a mutagen, reproductive effector. Oral (human) LDLo: 430 mg/kg.

--------\Cancer Lists\------------------------------------------------------

| | ---NTP Carcinogen--- | | |
| --- | --- | --- | --- |
| Ingredient | Known | Anticipated | IARC Category |
| ------------------------------------ | ----- | ----------- | ------------- |
| | | | XL |

| | | | |
|---|---|---|---|
| Nitric Acid (7697-37-2) | No | No | None |
| Water (7732-18-5) | No | No | None |

---

12. Ecological Information

Environmental Fate:

No information found.

Environmental Toxicity:

No information found.

---

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

14. Transport Information

Domestic (Land, D.O.T.)

-----------------------

Proper Shipping Name: NITRIC ACID

Hazard Class: 8

UN/NA: UN2031

Packing Group: II

Information reported for product/size: 6.5GL

International (Water, I.M.O.)

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Proper Shipping Name: NITRIC ACID (WITH NOT MORE THAN 70% NITRIC ACID)

Hazard Class: 8

UN/NA: UN2031

Packing Group: II

Information reported for product/size: 6.5GL

---

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

| Ingredient | TSCA | EC | Japan | Australia |
|---|---|---|---|---|
| Nitric Acid (7697-37-2) | Yes | Yes | Yes | Yes |
| Water (7732-18-5) | Yes | Yes | Yes | Yes |

--------\Chemical Inventory Status - Part 2\---------------------------------

| Ingredient | Korea | --Canada-- DSL | NDSL | Phil. |
|---|---|---|---|---|
| Nitric Acid (7697-37-2) | Yes | Yes | No | Yes |
| Water (7732-18-5) | Yes | Yes | No | Yes |

--------\Federal, State & International Regulations - Part 1\----------------

-SARA 302- ------SARA 313------

| Ingredient | RQ | TPQ | List | Chemical Catg. |
| --- | --- | --- | --- | --- |
| Nitric Acid (7697-37-2) | 1000 | 1000 | Yes | No |
| Water (7732-18-5) | No | No | No | No |

--------\Federal, State & International Regulations - Part 2\----------------

| | | -RCRA- | -TSCA- |
| --- | --- | --- | --- |
| Ingredient | CERCLA | 261.33 | 8(d) |
| Nitric Acid (7697-37-2) | 1000 | No | No |
| Water (7732-18-5) | No | No | No |

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No

SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No

Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2PE

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 0 Other: Oxidizer

Label Hazard Warning:

POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe vapor or mist.

Use only with adequate ventilation.

Wash thoroughly after handling.

Keep from contact with clothing and other combustible materials.

Do not store near combustible materials.

Store in a tightly closed container.

Remove and wash contaminated clothing promptly.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

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Prepared by: Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

# Attachment C Supervisor's Accident Investigation Report and Near Miss Reporting Form

# S3NA-004-FM1
# SUPERVISOR'S REPORT OF INCIDENT

AECOM

1. SEEK IMMEDIATE MEDICAL ATTENTION IF NECESSARY
2. EMPLOYEE MUST REPORT ALL INCIDENTS TO THEIR SUPERVISOR IMMEDIATELY.
3. REPORT THE INCIDENT TO THE APPROPRIATE INCIDENT REPORTING LINE. **(800) 348-5046**

## ORGANIZATION INFORMATION

| | |
|---|---|
| **REGION:** ☐ CAN-EAST ☐ CAN-CENTRAL ☐ CAN-WEST ☐ MID-ATLANTIC ☐ MIDWEST ☐ NORTHEAST ☐ South ☐ WEST | **DISTRICT:**<br>**PROJECT NUMBER:** ▫▫▫▫▫ |
| **BUSINESS LINE:** ☐ AECOM CORP ☐ CONSTRUCTION SERVICES ☐ ENERGY&POWER ☐ ENVIRONMENT ☐ PDD ☐ TRANSPORTATION ☐ WATER | |
| **CLIENT NAME:** | **PROJECT NAME:** |

## ADMINISTRATIVE

| | |
|---|---|
| **EMPLOYEE NAME:** | **EMPLOYEE NUMBER:** |
| **WORK PHONE:** ▫▫▫▫▫ | **CELL PHONE:** |
| **EMPLOYEE STATUS** ☐ FULL TIME ☐ PART TIME ☐ SUB ☐ TEMP AGENCY ☐ THIRD PARTY | **HOME OFFICE ADDRESS:**<br>**JOB TITLE:** |

## DESCRIPTION OF EVENT

| | |
|---|---|
| **TYPE OF OCCURRENCE:** ☐ INJURY/ILLNESS ☐ PROPERTY DAMAGE ☐ ENV DAMAGE/SPILL ☐ REGULATORY INSPECTION ☐ MOTOR VEHICLE ACCIDENT ☐ BOATING INCIDENT ☐ NOV/CITATION ☐ REPUTATIONAL (AECOM, CLIENT, OTHER) ▫▫▫▫▫ | |
| **DATE OF INCIDENT:** ▫▫▫▫▫ | **TIME OF INCIDENT:** ▫▫▫▫▫ |
| **DATE REPORTED TO SUPERVISOR:** ▫▫▫▫▫ | **TIME REPORTED TO SUPERVISOR:** ▫▫▫▫▫ |
| **INCIDENT ADDRESS/LOCATION:** | **CITY:** |
| **STATE/PROVINCE/TERRITORY:** ▫▫▫▫▫ | **ZIP/POSTAL CODE:** ▫▫▫▫▫ |

**WERE THERE ANY SUBCONTRACTORS, WITNESSES OR OTHER PERSONS INVOLVED:** ☐ YES ☐ NO

**IF YES, PLEASE PROVIDE DETAILS TO INCLUDE NAMES AND CONTACT INFORMATION**▫▫▫▫▫

# S3NA-004-FM1
# SUPERVISOR'S REPORT OF INCIDENT

**PERSONAL INJURY**

**TYPE OF INJURY:** ☐ FIRST AID (TREATED ON-SITE) ☐ MEDICAL AID (TREATED BY PROFESSIONAL) ☐ FATALITY

**DESCRIBE THE INJURY AND BODY PART AFFECTED:**

| | |
|---|---|
| **WAS A DOCTOR OR HOSPITAL VISITED?** ☐ **YES** ☐ **NO** | **IF YES, WHEN:** □□□□□ |
| **MEDICAL RECEIVED:** | **DOCTOR/HOSPITAL NAME:** |
| **PROVIDER ADDRESS:** | **PHONE NUMBER:** □□□□□ |

**PROPERTY DAMAGE** **(COMPLETE FOR PROPERTY DAMAGE ONLY)**

**TYPE OF DAMAGE:** ☐ AECOM PROPERTY ☐ MOTOR VEHICLE (COMPLETE MVA REPORT PAGE 3)

☐ SPILL OR RELEASE OF A HAZARDOUS SUBSTANCE ☐ MAJOR STRUCTURAL FAILURE ☐ CLIENT, SUBCONTRACTOR, OTHER: □□□□□

**DESCRIBE THE SPECIFIC DAMAGE, STRUCTURAL FAILURE OR HAZARDOUS RELEASE:**

**RANK THE SEVERITY OF THE DAMAGE:** ☐ MINOR ☐ SERIOUS ☐ MAJOR

**WHERE CAN THE PROPERTY BE SEEN?**

**PROPERTY OWNER NAME:** **CONTACT INFORMATION:**

**IS THERE ANY POTENTIAL FOR CIVIL, CRIMINAL OR REGULATORY LIABILITY AGAINST AECOM OR AN EMPLOYEE?** ☐ **YES** ☐ **NO**

IF YES, DISCUSS WITH AECOM REGIONAL COUNSEL BEFORE PROCEEDING WITH ANY FURTHER REPORTING.

**INDICATE WHO HAS BEEN NOTIFIED OF THE EVENT (E.G., OWNER/OPERATOR, STATE (US) OR GOVERNING BODY OF LABOUR, ETC?** □□□□□

**EMPLOYEE DESCRIPTION OF INCIDENT:**

*What, when, where, why, how? Attached notes/diagrams as required and list any machinery or equipment involved.*

**ON-SITE/CORRECTIVE ACTIONS**

**INCIDENT IMMEDIATELY REPORTED ON-SITE TO:** □□□□□

**WHAT CORRECTIVE ACTIONS WERE IMMEDIATELY IMPLEMENTED ON-SITE?**

**WHAT LONG-TERM OR PERMANENT CORRECTIVE ACTIONS ARE RECOMMENDED?**

**ACKNOWLEDGEMENTS**

| | |
|---|---|
| **EMPLOYEE PRINTED NAME AND PHONE** | **SIGNATURE AND DATE** |

# S3NA-004-FM1
# SUPERVISOR'S REPORT OF INCIDENT

AECOM

| | |
|---|---|
| **SUPERVISOR REVIEW OF INCIDENT:** | |
| **SUPERVISORS PRINTED NAME AND PHONE** | **SIGNATURE AND DATE** |
| **MANAGER COMMENTS:** | |
| **MANAGER PRINTED NAME AND PHONE** | **SIGNATURE AND DATE** |
| **FOR REGIONAL SH&E MANAGER USE ONLY:** | |
| **CORRECTIVE ACTIONS REQUIRING IMPLEMENTATION BY SH&E MANAGER:** ▫▫▫▫▫ | **RATIONALE:** ▫▫▫▫▫ |
| **NAME AND SIGNATURE:** | **DATE:** |
| **RECORDABILITY DETERMINATION** ☐ FIRST AID ☐ RECORDABLE ☐ RECORDABILITY UNDETERMINED ☐ NON WORK<br>☐ PROPERTY DAMAGE ☐ GENERAL LIABILITY ☐ VANDALISM<br>COMMENTS: | |

# Near-Miss/Observation Report

Please use this form to report any observation (e.g., at-risk acts/ at-risk conditions, or positive observations), as well as near-misses, you encounter as a part of your work. This may include office or field locations.

| ADMINISTRATIVE | |
|---|---|
| PROJECT NAME & NUMBER: ☐ N/A | LOCATION: |
| EMPLOYEE NAME: | EMPLOYEE NUMBER: |
| HOME OFFICE: | DEPARTMENT NUMBER: |
| MANAGER: | JOB TASK/PROJECT DESCRIPTION: |
| DATE AND TIME OF NEAR MISS/OBSERVATION : | DATE AND TIME REPORTED: |

| Work Activity | ☐ Office | ☐Driving | ☐Field | ☐Lab | ☐Other: ________________ |
|---|---|---|---|---|---|

*REMEMBER: IDENTIFYING A NEAR MISS DOES NOT IMPLY GUILT BUT ASSISTS IN PREVENTING INCIDENTS OR INJURIES.*

**OBSERVATION, RISK OR NEAR MISS DETAILS**

**NEAR MISS POTENTIAL OUTCOME:** ☐ INJURY/ILLNESS ☐ PROPERTY DAMAGE ☐ ENVIRONMENTAL DAMAGE

**POTENTIAL SEVERITY:** ☐ MINOR ☐ SERIOUS ☐ FATAL

**DESCRIPTION OF NEAR MISS, OBSERVATION, RISK, OR POTENTIAL LIABILITY:**

## Potential Immediate Causes

- ☐ Procedures not followed
- ☐ Use of tools or equipment
- ☐ Use of protective measures
- ☐ Inattention/Lack of awareness
- ☐ Protective systems
- ☐ Tools, equipment, & vehicles
- ☐ Work exposures to…
- ☐ Work place environmental/layout

## Corrective Actions

Corrective Action Category Identified to Prevent Future Reoccurrence

(*Identify relevant issues in checkboxes and provide detail below, as applicable*)

## Potential System Causes

- ☒ Physical capacity
- ☒ Physical condition
- ☐ Mental state
- ☐ Behavior
- ☐ Skill level
- ☐ Training/Knowledge transfer
- ☐ Mngmt/Supervision/Employee leadership
- ☐ Contractor selection & design
- ☐ Engineering/Design
- ☐ Work planning
- ☐ Purchasing, material handling/controls
- ☐ Tools & equipment
- ☐ Work rules/policies/stds/procedures
- ☐ Communication
- ☐ Other:__________________________

- ☐ Different/New PPE needed
- ☐ New tool(s)/equipment needed
- ☐ Additional/proper personnel needed
- ☐ Change in working procedure
- ☐ New STOP WORK trigger identified
- ☐ Additional training/skills needed
- ☐ Improved housekeeping efforts
- ☐ Modified working behaviors
- ☐ Improved work planning
- ☐ Other:__________________________

**Were immediate corrective actions implemented?** ☐ **Yes** ☐ **No** If yes, please describe:

**What long-term corrective actions are recommended?**

| **For SH&E Management Use Only:** | |
|---|---|
| **Corrective Actions requiring implementation:** | **Rationale:** |
| **Communicated back to Employee:** ☐ | **Communicated back to Manager:** ☐ |
| **Completed by:** | **Date:** |

# Attachment D Applicable SH&E SOPs

## Americas SHE Standard Operating Procedures

**Potentially applicable SOPs related to the project field activities are highlighted below**

| **000 Series - SH&E Essentials** | **Publication Date** |
|---|---|
| S3NA-000-MN SH&E Manual | October 1, 2010 |
| S3NA-001-PR Safe Work Standards and Rules | October 1, 2010 |
| S3NA-002-PR Stop Work Authority for Unsafe Work | December 1, 2010 |
| S3NA-003-PR SH&E Training | October 1, 2010 |
| S3NA-004-PR Incident Reporting | October 1, 2010 |
| S3NA-005-PR Driver and Vehicle Safety Program | October 1, 2010 |
| **100 Series - Office** | **Publication Date** |
| S3NA-101-PR Emergency Response Planning, Office S3NA- | March 1, 2011 |
| 102-PR Ergonomics, Office | December 1, 2010 |
| S3NA-103-PR Housekeeping, Office | December 1, 2010 |
| S3NA-104-PR Manual Lifting, Office | December 1, 2010 |
| S3NA-105-PR Office Safety Programs | October 1, 2010 |
| S3NA-106-PR Fire Protection, Office | December 1, 2010 |
| S3NA-107-PR Violence in the Workplace | December 1, 2010 |
| S3NA(Cal)-108-PR California Injury and Illness Prevention Program | June 1, 2011 |
| **200 Series - Project Management** | **Publication Date** |
| S3NA-201-PR Client Site Requirements | October 1, 2010 |
| S3NA-202-PR Competent Person Designation | October 1, 2010 |
| S3NA-203-PR Emergency Response Planning, Field | March 1, 2011 |
| S3NA-204-PR Environmental Compliance | June 1, 2011 |
| S3NA-205-PR Equipment Inspections & Maintenance | December 1, 2010 |
| S3NA-206-PR Fire Protection, Field | December 1, 2010 |
| S3NA-207-PR Medical Services and First Aid | October 1, 2010 |
| S3NA-208-PR Personal Protective Equipment Program | December 1, 2010 |
| S3NA-209-PR Project Hazard Assessment and Planning | October 1, 2010 |
| S3NA-210-PR Project Safety Meetings | October 1, 2010 |
| S3NA-211-PR Regulatory Inspections | October 1, 2010 |
| S3NA-212-PR Site Inspections | October 1, 2010 |
| S3NA-213-PR Subcontractors | October 1, 2010 |
| S3NA-214-PR Site Safety Officer | October 1, 2010 |

| 300 Series - Field (Common) | Publication Date |
|---|---|
| S3NA-301-PR Confined Spaces | December 1, 2010 |
| S3NA-302-PR Electrical, General | December 1, 2010 |
| S3NA-303-PR Excavation and Trenching | March 1, 2011 |
| S3NA-304-PR Fall Protection/Working from Heights | March 1, 2011 |
| S3NA-305-PR Hand and Power Tools | March 1, 2011 |
| S3NA-306-PR Highway and Road Work | December 1, 2010 |
| S3NA-307-PR Housekeeping, Worksite | December 1, 2010 |
| S3NA-308-PR Manual Lifting, Field | December 1, 2010 |
| S3NA-309-PR Mobile or Heavy Equipment | March 1, 2011 |
| S3NA-310-PR Rigging, Hoisting, Cranes and Lifting Devises | December 1, 2010 |
| S3NA-311-PR Scaffolding | March 1, 2011 |
| S3NA-312-PR Stairways and Ladders | March 1, 2011 |
| S3NA-313-PR Wildlife, Plants and Insects | March 1, 2011 |
| S3NA-314-PR Working Alone & Remote Travel | March 1, 2011 |
| S3NA-315-PR Water, Working Around | March 1, 2011 |
| **400 Series - Field (Uncommon)** | **Publication Date** |
| S3NA-401-PR Aircraft Charters | October 1, 2010 |
| S3NA-402-PR All Terrain Vehicles (ATVs) | March 1, 2011 |
| S3NA-403-PR Avalanches | March 1, 2011 |
| S3NA(US)-404-PR Commercial Motor Vehicles | June 1, 2011 |
| S3NA-405-PR Drilling, Boring and Direct Push Probing | March 1, 2011 |
| S3NA-406-PR Electrical Lines, Overhead | March 1, 2011 |
| S3NA-407-PR Electrofishing | March 1, 2011 |
| S3NA-408-PR Elevated Work Platforms and Aerial Lifts | March 1, 2011 |
| S3NA-409-PR Forklifts (operation of) | March 1, 2011 |
| S3NA-410-PR Hazardous Energy Control | March 1, 2011 |
| S3NA-411-PR Machine Guarding | March 1, 2011 |
| S3NA-412-PR Power-Actuated Tools | March 1, 2011 |
| S3NA(US)-413-PR Process Safety Management | June 1, 2011 |
| S3NA-414-PR Railway Sites | December 1, 2010 |
| S3NA(US)-415-PR RCRA Regulated Facilities | October 1, 2010 |
| S3NA-416-PR Tunnel and Underground Work | March 1, 2011 |
| S3NA-417-PR Utilities, Underground | March 1, 2011 |
| S3NA-418-PR Welding, Cutting and Other Hot Work | March 1, 2011 |
| S3NA-419-PR Water, Marine Operations/Boating | March 1, 2011 |
| S3-NA420-PR Water/Underwater Diving | October 1, 2010 |

| 500 Series - Industrial Hygiene (Chemical, Biological, Radiological, Nuclear) | Publication Date |
|---|---|
| S3NA-501-PR Asbestos | March 1, 2011 |
| S3NA-502-PR Benzene | March 1, 2011 |
| S3NA-503-PR Blood borne Pathogen Program | March 1, 2011 |
| S3NA-504-PR Cadmium | March 1, 2011 |
| S3NA-505-PR Cold Stress Prevention | March 1, 2011 |
| S3NA-506-PR Compressed Gases | March 1, 2011 |
| S3NA-507 PR Hazardous Materials Communication / WHMIS | October 1, 2010 |
| S3NA-508-PR Hazardous Materials Handling and Shipping | October 1, 2010 |
| S3NA-509-PR Hazardous Waste Operations and Emergency Response | October 1, 2010 |
| S3NA-510-PR Hearing Conservation Program | December 1, 2010 |
| S3NA-511-PR Heat Stress Prevention | December 1, 2010 |
| S3NA-512-PR Laboratory Safety | March 1, 2011 |
| S3NA-513-PR Lead | March 1, 2011 |
| S3NA-514-PR Munitions and Explosives of Concern / Unexploded Ordnance | March 1, 2011 |
| (MEC-UXO) | March 1, 2011 |
| S3NA-515-PR Nanotechnology | March 1, 2011 |
| S3NA-516-PR Radiation Safety Programs | March 1, 2011 |
| S3NA-517-PR Radiation, Non-Ionizing | March 1, 2011 |
| S3NA-518-PR Radiation, Gauge Source program | March 1, 2011 |
| S3NA-519-PR Respiratory Protection Program | December 1, 2010 |
| S3NA-520-PR Spill Response, Incidental | December 1, 2010 |
| S3NA-521-PR Decontamination | October 2011 |
| S3NA-522-PR Hydrogen Sulfide | October 2011 |
| **600 Series - Incident & Medical Management** | **Publication Date** |
| S3NA-601-PR Recordkeeping | October 1, 2010 |
| S3NA-602-PR Exposure Monitoring | October 1, 2010 |
| S3NA-603-PR Incident Investigation and Review | October 1, 2010 |
| S3NA-604-PR Medical Records | October 1, 2010 |
| S3NA-605-PR Medical Surveillance Program | October 1, 2010 |
| S3NA-606-PR Modified Duty Program | October 1, 2010 |
| S3NA-607-PR Post Incident Medical Management | October 1, 2010 |
| **700 Series - SH&E Program Management** | **Publication Date** |
| S3NA-701-PR Rules and Regulatory Review | October 1, 2010 |
| S3NA-702-PR SH&E Organizational Reporting Structure & Supporting Roles | October 1, 2010 |
| S3NA-703-PR SH&E Manual and Procedures Review | October 1, 2010 |
| S3NA-704-PR SH&E Program Auditing | March 1, 2011 |
| S3NA-705-PR SH&E Program Monitoring and Reporting | October 1, 2010 |

# Safety, Health, and Environment Manual

## Americas

## Preface

AECOM is a leading global provider of professional technical and management support services for government and commercial clients around the world. We provide our services through our global network of more than 45,000 employees in more than 100 countries to a broad range of end markets, including transportation, water, facilities, environmental management and energy.

AECOM believes that responsible stewardship of the built and natural environment as well as the safety and health of our employees is a critical element to business growth and success. AECOM demonstrates commitment to this fundamental responsibility by embracing Safety, Health and Environment as a Core Value.

The Americas Safety, Health and Environmental (SH&E) Program is an integral part of AECOM's overall Americas business plan. The SH&E Program is based on proven management principles and practices. It consists of an organized framework that is continually monitored and periodically reviewed in response to changing internal and external factors. The program establishes the minimum requirements for management involvement, responding to SH&E incidents, monitoring SH&E performance, and communicating with staff regarding their occupational health and safety obligations. It is meant to supplement the standards set by AECOM's clients and state, provincial, territorial, and federal regulatory agencies.

Through implementation of this SH&E Program Manual, AECOM has established a uniform, systematic and cost-effective approach to administrating SH&E issues and concerns associated with AECOM personnel and services. The SH&E Program Management System has been structured to align itself with the key elements of OHSAS 18001 (Occupational Health and Safety Assessment Series), ISO 14001 (the International Standard for Environmental Management Systems), CSA Z1000-06 (Canadian Standards Association OH&S Management System), COR (Provincial Certificate of Recognition programs in Canada) and Regulatory Agency Requirements.

All AECOM employees in the Americas are responsible for maintaining compliance with the SH&E Policy, Program Manual, and Standard Operating Procedures. Subject to the scope of a contract, elements of this SH&E Program may be applied to subcontractors and equipment suppliers to maintain an adequate level of SH&E awareness, control and cooperation with AECOM and with our clients' needs.

**Where there is potential for criminal, civil or regulatory action against AECOM or any of its employees or subcontractors, all AECOM employees must notify AECOM's Americas Chief Legal Counsel before documenting an incident or conducting an investigation.**

TABLE OF CONTENTS

## 1.0 Terms and Definitions

**Acceptable Risk:** A risk that has been reduced to a level that can be tolerated or effectively managed by the organization.

**Audit:** Systematic examination to determine whether activities and related results conform to established AECOM policies and whether such policies have been implemented and are being effectively followed.

**Compliance:** Meeting with statutory and AECOM procedural requirements.

**Corrective Action:** Action to eliminate the cause of a detected deviation from established policies and procedures.

**Control Measures:** Precautions and arrangements taken to eliminate or reduce the hazards.

**Contractor:** A company or organization that performs on-site activities that are, or will be, governed by a contract between the client (not AECOM) and that organization. In some cases, the contractor may also have the responsibility as the Prime Contractor, Construction Manager, Constructor, or other entity responsible for SH&E on-site.

**Emergency:** An unplanned situation or event requiring the involvement of public emergency services or regulatory authorities.

**Environmental Impact:** Any change to the environment, whether adverse or beneficial, wholly or partially resulting from AECOM's activities, products, or services.

**Hazard:** Any situation or condition that may be pose a risk of personal injury, environmental impact or damage to property.

**Hazard Assessment:** A process by which workplace hazards are identified and evaluated. Existing and potential hazards are identified through inspections and/or during the proposal or planning stage of a project or task.

**Incident:** A work-related event which is unplanned, potentially harmful or damaging, and which may result in personal injury, environmental impact, or loss or may impact the reputation of AECOM or its clients or may result in an investigation by a regulatory agency or insurer.

**Near Miss:** A near-miss or risk is the identified *potential* for an incident to occur, but which produces no visible injury or damage.

**Non-conformance:** Any deviation from work standards, practices, procedures, regulations, management system performance, etc., that could either directly or indirectly lead to injury or illness, property damage, damage to the workplace environment, or a combination of these.

**Objectives:** Goals, in terms of SH&E performance, that an organization or individual sets itself to achieve.

**Personal Protective Equipment (PPE):** Equipment or clothing worn by a person for protection from health or safety hazards associated with conditions at a work site.

**Regulatory Agency:** With respect to this document, a Government Agency with authority and jurisdiction over safety, health and/or environmental laws and regulations.

**Regulatory Inspection:** An inspection completed by a Regulatory Agency.

**Risk:** Combination of the likelihood and severity of the consequence(s) of a specified hazardous event.

**Risk Assessment:** Overall process of estimating the magnitude of risk and deciding whether or not the risk is tolerable.

**Safety, Health & Environment (SH&E):** Safety (Protection from unacceptable risk of harm). Health (Protection from occupational contaminants and diseases). Environment (Protection of the environment from AECOM's activities).

**Safety, Health and Environmental (SH&E) Department:** Support function within AECOM that assists management personnel in controlling conditions and factors that affect the well-being of employees.

**Safety Inspections:** Workplace, office or site inspections of work practices and controls as they apply to project or program specific SH&E requirements.

**Senior Management:** Employees with a title of Senior Vice President or above who are expressly authorized to make management decisions for AECOM's Americas Geography.

**SH&E Management System (MS):** Part of the overall SH&E Program that facilitates the management of the SH&E risks associated with the business of the organization. This includes the organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the organization's SH&E Policy.

**SH&E Performance:** Measurable results of the SH&E Management System related to the organization's control of safety and health risks, and environmental impacts based on its policies and objectives.

**Safety, Health and Environmental Policy Statement:** Overall intentions and direction of an organization related to its SH&E Program as formally expressed by Senior Management.

**Significant:** In this context, used to denote those SH&E aspects in relative terms that warrant action by Senior Management.

**Site:** Any location where AECOM employees perform work for AECOM, whether or not owned by AECOM, including, without limitation: offices, buildings, plant facilities, project sites or work sites.

**Stakeholders:** Individuals such as employees, client, suppliers, investors, and the public with a vested interest in the organization's achievements.

**Stop Work Orders:** A directive to cease work on a project, work site or office.

**Subcontractors:** On-site activities that are or will be governed by a contractual arrangement between AECOM (or its subsidiaries) and another entity involving hours worked by non-AECOM employees and not directly controlled or supervised by AECOM employees. This excludes office-based contract services (e.g. janitorial, copy machine, etc.) delivery/pickup services performed by mail, motor/rail/air freight carriers, and vendor vehicles. Subcontracted services include Subconsultant Services and Independent Contractors.

**Supervisor or Project Manager:** Management personnel who represent AECOM at any particular office, project or worksite and who are responsible for overseeing all aspects of the work performed while maintaining compliance with SH&E Policy and Procedures.

**Target:** A target is a detailed performance requirement derived from a goal or objective.

**Temporary Employee:** Individuals hired on a temporary basis to perform a limited task under the direction of an AECOM employee. All temporary employees must provide proof of workers' compensation coverage.

## 2.0 Introduction

This SH&E Program is based on the four-step problem solving process of “Plan-Do-Check-Act” methodology.

**Plan:** SH&E Management will establish the objectives and processes (SH&E Program) necessary to deliver results in accordance with the AECOM SH&E policy.

**Do:** AECOM operations management provides the resources, including human and financial, for implementing an effective SH&E Program.

**Check:** SH&E Management will monitor and measure processes against SH&E policy, objectives, legal and other requirements, and report the results.

**Act:** AECOM operations management and SH&E Management will take actions to continually improve the SH&E program and performance.

## 3.0 SH&E Policy and Guiding Principles

### 3.1 SH&E Policy Statement

3.1.1 A policy statement which outlines AECOM's commitment to SH&E has been developed and signed by AECOM's Chairman and CEO. This policy is communicated to all employees in the Americas and is posted at each permanent and temporary office site. An electronic version of this policy is also available on AECOM's intranet.

3.1.2 This policy will be formally reviewed and authorized annually as part of the Management Review process. However, if substantial changes occur in legislation, organization and/or other business drivers, changes may be made on an interim basis.

### 3.2 SH&E Guiding Principles

3.2.1 AECOM's Senior Executives have developed "SH&E Guiding Principles" to help employees understand and implement the SH&E Policy Statement and achieve the SH&E Core Values.

3.2.2 The SH&E Guiding Principles are:

- **Risk Management -** We will only undertake activities that we have evaluated thoroughly from an SH&E risk standpoint. Where risks are identified, we will develop and implement appropriate mitigation strategies to reduce the possibility of injuring people, damaging property, or impairing the environment**.**
- **Resources** - We will provide the necessary human, financial and material resources to implement, maintain and monitor the AECOM SH&E Program.
- **Leadership** - Management will be directly involved in the SH&E program. All supervisors will lead by example and through appropriate decision-making.
- **Compliance** - We will comply with all relevant and applicable rules and regulations pertaining to SH&E issues as well as those voluntary requirements to which we subscribe.
- **Involvemen**t - All employees will be encouraged to provide continual feedback on the effectiveness of our existing programs and to provide recommendations for the development of new ones that can advance our SH&E program.
- **Sustainability** - We will promote environmental sustainability through the efficient use of energy, conservation of natural resources, and prevention of pollution through reuse, recycling, and reduction whenever practical throughout our company.
- **Training** - We will provide thorough and effective training programs to employees. Our management teams will evaluate the training needs for all projects and only assign competent personnel. Industry Leaders We will work with clients, partners, suppliers, competitors and regulators to raise the SH&E standards of our industry.
- **Industry Leadership** - We will work with clients, partners, suppliers, competitors and regulators to raise the SH&E standards of our industry.
- **Work With Others** - We will assess the competencies and capabilities of our contractors, suppliers, vendors and partners prior to selecting them to perform work on our behalf. We will also monitor their implementation of SH&E programs during all phases of their activities.
- **Performance** - We will establish short and long-term performance targets relative to SH&E and regularly report on our progress toward these goals to our employees and other stakeholders.
- **Assessment** - We will routinely assess our programs at the corporate, business unit and individual project levels to enable continual improvement of our programs and systems.
- **Reporting** - Every employee is expected to report any occupational injury, illness, environmental release, near-miss incident and property damage incident in a timely, open and thorough manner. Information gained from this reporting will be communicated throughout the organization to enhance our ability to prevent future incidents.

## 4.0 Plan

### 4.1 Hazard Identification, Risk Assessment and Determining Controls

4.1.1 AECOM is committed to managing services and activities that pose a potential risk to our employees' safety and health or impact the environment.

4.1.2 The SH&E Management System evaluates, manages and controls these risks through the following safety hierarchy:

- Recognition
- Elimination
- Substitution
- Engineering Controls
- Administrative Controls
- Personal Protective Equipment

### 4.2 Project Delivery System

4.2.1 AECOM has established a detailed Project Delivery System that plans and delivers projects while effectively controlling risk. This delivery system requires significant involvement from most all levels of the organization and departments. A discussion of this process is as follows.

4.2.2 **Business Development (BD) -** The Region SH&E Managers participate in key regional marketing meetings, and coordinate with regional market segment managers to provide guidance on key SH&E issues associated with specific client needs and company pursuits, typically prior to the client's issuance of a request for proposal (RFP). In this way SH&E-related issues can be adequately incorporated into proposals, subcontractor agreements and equipment supplier purchases.

4.2.3 **Business Risk Assessment -** All projects are developed, planned and executed by Supervisors/ Project Managers within the AECOM "Delegation of Authority" and the "Sub-Delegations of Authority" for the Americas Geography (collectively the "DOA"). AECOM projects that have the potential for a specific risk, as identified in the DOA (e.g. working with hazardous materials, project safety responsibilities for non-AECOM employees) require that a "Request for Approval" and "Risk Analysis" be submitted to the AECOM "Hub" for senior management review, input, and approval. The Hub is managed by the Chief Risk Officer (CRO) and for issues involving safety, health and/or environmental compliance, is supported by the AECOM SH&E Vice-President. Once a project is approved by the Hub, the Chief Executive for Americas (CE) can instruct his/her organization to proceed with the proposal.

4.2.4 **Major Project Risk Assessment -** As part of AECOM's Major Project Business Development Guidelines and Project Approval process, certain projects that present a significant risk or involve a substantial long-term client commitment require an additional level of management assessment and approval by the Major Project Review Committee (MPRC). These projects require an extensive five-phase senior management review and approval process prior to moving forward. As part of this review process, the Americas SH&E Director and Region SH&E Managers are required to assist the business development team in identifying and evaluating unique SH&E risks and to propose appropriate mitigation strategies. This SH&E assessment is then evaluated by the MPRC as part of their overall project pursuit approval process. AECOM's Global SH&E VP participates as a key advisor on the Major Project Review Committee.

4.2.5 **Project Specific Hazard Analysis and Planning**

4.2.5.1 Every AECOM project with work outside of an AECOM office must have, at a minimum, a task hazard analysis (THA) in place that effectively deals with all known or anticipated hazards and provides for emergency response and evacuation as needed.

4.2.5.2 In addition, high risk activities, complex projects, or regulated sites must have a Safe Work Plan (SWP) or Health and Safety Plan (HASP) reviewed and approved by the Supervisor/Project Manager and the Region SH&E Manager (or designee) prior to the start of activities. All site employees involved in field work must read and acknowledge compliance with the THA, SWP or HASP as required, prior to performing work.

4.2.6 **Subcontractors Hazard Analysis and Planning Subcontractors** are responsible for generating their own project-specific hazard analysis that addresses their specific SH&E issues. Subcontractors are solely responsible for evaluating the hazards and potential hazards to their employees and shall adhere to their own hazard analysis. Additionally, subcontractors shall be required, at a minimum, to follow all SH&E requirements established in the AECOM project-specific hazard analysis.

4.2.7 **Contractors Hazard Analysis and Planning** Prior to the start of site activities, Supervisors/Project Managers are responsible for coordinating with other project site contractors to minimize the potential for conflicting plan elements. AECOM's project hazard analysis (and appropriate planning documents) will be distributed to other site contractors as appropriate.

4.2.8 **Continuous Risk Management Projects** that present a significant risk or impact to AECOM may require monthly management reviews for the life of the project. The Region SH&E Manager, or their designate, participate in this process and routinely review and evaluate project-specific risks and the effectiveness of the implemented control strategies. This is accomplished through reviewing the project-specific THAs, SWP and/or HASP, conducting project-specific SH&E audits, incident reviews and by reviewing additional SH&E data generated by the project.

### 4.3 Access to Applicable Codes, Regulations and Standards

4.3.1 AECOM is committed to remain current with, and endeavors to maintain access to, relevant national, state, provincial and local environmental, occupational health and safety laws, legislation and regulations and other requirements. In addition to regulations, many of our services require access to and knowledge of consensus standards established by many non-governmental agencies. Access to non-governmental and professional association and industrial standards is provided by AECOM's Information Handling Services (IHS) link in the United States. In Canada, access to government regulations and standards is provided through the CCOHS (Canadian Centre for Occupational Health and Safety).

4.3.2 Management procedures provide a practical means of identification and access to current legislation and information on proposed legislation. Information is communicated internally to provide an awareness of legal obligations. Responsibility and authorities are defined to achieve and maintain statutory and regulatory compliance.

### 4.4 Client Requirements

4.4.1 Many of AECOM's clients have additional SH&E requirements specific to their needs and operations that must be addressed. In order to comply with those requirements, AECOM may develop client specific manuals, programs, procedures, training and/or documentation to effectively implement and manage these special requirements. Identification of client SH&E requirements is accomplished during the project risk assessment phases and project teams are responsible for complying with client SH&E requirements where they exceed AECOM standards.

### 4.5 Objectives and Targets

4.5.1 SH&E objectives and targets are established for all relevant levels of management and are compatible with AECOM's overall business plan. Tracking of the objectives and targets are coordinated within the AECOM performance management program that defines responsibility and timeframes for completion.

4.5.2 At the Americas organizational level, AECOM will establish performance targets using numerous indicators, such as:

- Global SH&E Assessment Score Improvement
- SH&E Training Compliance
- regulatory citations and Notices of Violation
- Recordable Injury Rate (RIR)
- lost time incident rate, and
- days away from work

4.5.3 At the operations level, AECOM will establish targets using performance indicators and activity objectives such as:

- Direct involvement in SH&E-related activities
- project management reviews
- staff interviews
- Global SH&E Assessment Score Improvement
- SH&E Training Compliance
- regulatory citations and Notices of Violation

- Recordable Injury Rate (RIR)
- lost time incident rates, and
- days away from work

4.5.4 At the employee level, AECOM will establish targets using performance indicators and activity objectives such as:

- direct involvement in SH&E-related activities
- training needs assessment, and
- SH&E training compliance

## 5.0 Do

### 5.1 Resources, Roles, and Responsibilities

5.1.1 AECOM is committed to establishing an organizational structure that defines roles, responsibility, authority and accountability necessary to effectively manage the SH&E function and to define and provide the resources needed to implement and sustain the SH&E Management System.

5.1.2 Primary responsibility for SH&E performance belongs to the Chief Executive, Region Executives and District General Managers within operational management. Technical assistance, hands on support, guidance, and monitoring are provided to operations by the SH&E department.

5.1.3 The SH&E department consists of Region SH&E Managers, their support staff, the Americas SH&E Administrative Manager and the Americas SH&E Director.

### 5.2 SH&E Committees

5.2.1 AECOM and Occupational Safety and Health legislation in many jurisdictions require that a health and safety committee program be established to encourage the active participation of all employees in the prevention of incidents and the promotion of health and safety activities in the workplace.

5.2.2 AECOM will establish SH&E Committee programs in those states, provinces and territories where it is required by legislation or regulation.

5.2.3 In order to provide senior level guidance to the SH&E function, AECOM has established an Americas Executive SH&E Council. The council is co-chaired by two Region Executives and includes members representing both business lines and various organizational management levels. The council is charged with providing specific recommendations to the Americas SH&E Director and Chief Executive regarding all aspects of the program, including the contents of this manual.

5.2.4 AECOM encourages, but does not mandate, the formation of local SH&E Committees in all locations as an effective means to increase participation by all staff in the program.

### 5.3 Training

5.3.1 All AECOM employees shall receive training on AECOM's SH&E Policy, SH&E Guiding Principles, and Standard Operating Procedures applicable to their job assignments, as well as complying with applicable regulations, codes, and standards. All employees shall receive training in:

- Compliance with applicable SH&E regulations and AECOM specific requirements
- Fulfilling SH&E responsibilities
- Understanding how their actions can influence SH&E performance

5.3.2 In particular, employees shall be trained to recognize, evaluate and manage the risks associated with their current position.

5.3.3 All employees will be assessed for their job specific training. AECOM will provide training to meet SH&E program requirements and AECOM will track the completed training to confirm that staff are adequately trained for the duties they are required to perform.

5.3.4 Employees and their supervisor must review their SH&E Training Needs Assessment on an annual basis. This review must also occur any time an employee is reassigned to a task or work function that is substantially different in order to identify appropriate SH&E training. Upon completion of the Training Needs Assessment the employee will be required to request enrollment into the appropriate safety training program. Employees must not perform tasks without completing the appropriate training.

5.3.5 Project Managers/Supervisors are responsible for ensuring that employees are trained to perform specific work assignments and tasks in conformance with SH&E Policy and Standard Operating Procedures through one or more of the following:

- Formal and informal instruction
- On-the-job training
- Attendance at technical and professional seminars and conferences

## 5.4 Project Site Orientation

5.4.1 All AECOM employees assigned to a project site receive an initial Project Site Orientation that introduces the employee to the site, client specific requirements and the project hazard assessment.

5.4.2 Additionally, specific hazards of the project may be explained as well as the resources dedicated to mitigate the hazards.

## 5.5 Project/Employee Safety Meetings

5.5.1 All AECOM employees performing work at a project site are required to participate in routine safety meetings in accordance with the project hazard assessment.

5.5.2 A sign-off sheet recording the date, subject(s) covered, presenter and names of attendees is required to be generated after each project safety meeting. Office employees are also required to participate in routine employee safety meetings as appropriate.

## 5.6 Subcontractors

5.6.1 Subcontractors and suppliers involved with field work are provided with copies of the project hazard assessment for their projects.

5.6.2 Subcontractors are also encouraged to participate in Project Safety Meetings so that they may actively contribute to a safe working environment.

### 5.7 Communication and Participation

5.7.1 AECOM will maintain effective communications relevant to SH&E both internally and externally, and we will solicit and encourage input from employees and other interest parties.

5.7.2 AECOM's SH&E Department will communicate with employees to keep them informed, share lessons learned, hear about concerns, keep safety at the forefront of day to day actions and inspire a culture of safety within AECOM.

5.7.3 Communication bulletins as listed below will be issued by or from the senior management, local safety committee or SH&E management as appropriate and for the greatest impact. All leaders will be expected to regularly communicate to their teams about safety.

5.7.4 **Internal Communications -** Internal communications are established between all management levels to maintain awareness and understanding of SH&E Policy, Standard Operating Procedures and to provide a pathway for feedback of operational experience and SH&E performance. Internal SH&E communications will be maintained through direct, electronic and written media. All communications will be coordinated through the SH&E Department and, as appropriate and necessary, Americas Communications Department. Communications relevant to SH&E will include, but not be limited to: Lessons Learned, Safety Awareness programs, Incident Investigations, and revised and/or new SH&E Procedures.

5.7.5 **Employee Participation -** All AECOM employees are provided the opportunity to participate and have frequent and open SH&E communications at all levels of the organization. Employees are to be asked for their input at projects, meetings and during training sessions.

5.7.6 All AECOM employees will have the option to anonymously communicate any SH&E concern.

5.7.7 **External Communications – Stakeholders - AECOM's** internet web site provides general information such as the SH&E Policy statement, projects and services to external stakeholders. All communications related to the SH&E Policy received from stakeholders are forwarded to AECOM's Corporate Communications Department for recording, directing and response generation. Occasionally, these communications may be under the control of a client contract or regulatory requirement in which case they will also be involved in the communications process. Frequently projects will require a project-specific "Public Outreach Program" to maintain open and effective dialogue with stakeholders throughout a project.

### 5.8 Standard Operating Procedures

5.8.1 AECOM will establish and maintain a series of Standard Operating Procedures which guide operations in the safe work practices and safe job procedures in their daily functions.

5.8.2 SH&E Standard Operating Procedures (SOP) are considered administrative controls and are an integral part of the Safety, Health and Environment Program. The SOPs describe how operations are to be carried out, including responsibility, authority, planning, communications, work programs and methods. They are written for operations to maintain ongoing compliance with the SH&E Management System.

5.8.3 Where applicable, SH&E SOPs will be integrated into AECOM's Project Delivery System (PDS) to promote use and application of procedures during project delivery.

5.8.4 Forms and documents essential to the SH&E Management System are carefully generated, managed and catalogued. They demonstrate compliance with SH&E Policy, Standard Operating Procedures, legal and other requirements. Some examples of forms and documents include:

- SH&E Audit Reports
- Incident Investigation Reports
- Injury/Illness Records
- Medical Surveillance Records
- SH&E Training Records
- Respirator Fit Testing Records
- Exposure Monitoring Results

### 5.9 Document Control

5.9.1 AECOM will verify that all documentation associated with the SH&E Management System is under effective management control, and all document formats used are approved by the Americas SH&E Director prior to issuance. The prefix"S" will designate a safety, health, or environmental document that relates to an aspect of the Management System.

5.9.2 SH&E Standard Operating Procedures shall identify all documents required to be controlled and define authorization, generation, availability, approval, updating and storage of such documents. In addition, all SH&E documents shall be controlled in accordance with AECOM's Records Retention Policy and Quality Management System.

### 5.10 Operational Controls & Preventative Maintenance

5.10.1 Operational procedures are written for site and/or activity-specific operations, including equipment maintenance. Operational and control criteria are included in the Operational procedures to verify that the SH&E aspects of operations are managed appropriately.

5.10.2 Operational programs and procedures are provided to mitigate the risk of harming personnel, property, and the environment. Expectations for SH&E performance are communicated to subcontractors and equipment suppliers, mainly through the obligations set forth in our subcontract agreements with such parties. In addition to this, AECOM may, at its discretion, supply guidance notes to subcontractors and equipment suppliers to aid in compliance with this SH&E Management System. However, such general guidance does not relieve the subcontractors and suppliers from their primary responsibility for performing services and providing materials in a way that does not create SH&E risks.

### 5.11 Emergency Preparedness and Response

5.11.1 Each office and project site is to have a written site-specific emergency action plan which identifies potential emergency situations, alarm systems, external emergency response agencies, shut-down procedures, location of emergency equipment, personal protective equipment, how to obtain medical treatment, personal decontamination, accountability of personnel and temporary sheltering of employees.

5.11.2 Some project operations may also require AECOM employees to perform an actual response to an emergency situation, in which case more extensive emergency response training and equipment are provided. Emergency action plans for office locations are evaluated annually, and are reviewed prior to the start of all project site operations.

5.11.3 The Americas Business Continuity Team, along with individual Regional Business Continuity Teams, will coordinate appropriate actions and communications in the event of a natural or man-made situation that could have a significant impact on the safety of AECOM staff, property loss, or significant business interruption. Examples of these situations include, but are not limited to: hurricanes, severe wind/rain/snow events, earthquakes, potential pandemic outbreaks, civil disturbances, etc. SH&E Department members are integral members of the Americas and Regional Business Continuity Teams.

### 5.12 Modified Work Program

5.12.1 AECOM supports a Modified Work Program for all of its employees.

5.12.2 A Modified Work Program is a program designed to return injured employees to the workplace as quickly as possible by providing modified duties or meaningful alternative work for an injured employee, until such time as the employee can functionally return to their regular duties.

### 5.13 Medical Surveillance and Information

5.13.1 Employees who are assigned specific tasks may be required to enroll in AECOM's Medical Surveillance Program. Enrollment is based on regulatory or client requirements as well as potential for exposure to hazardous materials, substances, and/or conditions.

5.13.2 Employees have the right to accept or deny enrolment into this program, provided it was not a condition of their employment. An employee choosing not to participate in the program may be restricted from working in certain locations or on certain projects requiring medical surveillance.

### 5.14 Personal Protective Equipment

5.14.1 AECOM will provide personal protective equipment (PPE) where and when it is required by:

- Provincial, state or federal legislation
- analysis of workplace hazards as documented in a THA, SWP or HASP and/or
- Site specific rules of the controlling contractor or client

5.14.2 AECOM employees must wear and use all required PPE and are responsible for the inspection, care and maintenance of PPE assigned to them**.**

5.14.3 Employees must immediately correct or report any problems, damage or loss of this equipment. Supervisors must verify that employees have, know how to use and wear the appropriate PPE for each job, task and work site.

### 5.15 Incident Reporting

5.15.1 All work-related injuries, illnesses, and near-miss situations, including environmental impacts, vehicular incidents, instances of permit non-compliance, citation by a regulatory agency must be immediately reported by the employee, or their designee, to their Supervisor/Project Manager. If this initial reporting is done electronically (i.e. text, email, etc.) it must be confirmed verbally as soon as practical to ensure receipt and understanding between the employee and Supervisor/Project Manager.

5.15.2 The Supervisor/Project Manager shall immediately notify SH&E through the Americas SH&E Incident Reporting Line. When necessary based on the severity and/or nature of the incident, as defined in our Incident Reporting SOP, the Supervisor/Project Manager may also be required to notify AECOM Legal Counsel.

## 6.0 Check

The following section describes the programs that AECOM utilizes to continually check and assess the effectiveness of the SH&E Management System.

### 6.1 Performance Measurement, Monitoring & Statistics

6.1.1 SH&E Performance data is collected, reviewed and summarized to monitor conformance with SH&E Policy, Standard Operating Procedures, Objectives, and Targets and to confirm legal compliance.

6.1.2 AECOM has established methods to measure and monitor SH&E Management System performance and effectiveness on a regular basis. SH&E Management System performance is measured through a set of metrics of lagging and leading indicators. All AECOM Americas lagging and leading indicator metrics and targets are established on an annual basis and approved by the CE. Regions and Districts can also establish additional metrics as appropriate. An example of some of these indicators includes the following:

**Lagging Indicators**

- regulatory citations and Notices of Violation
- Recordable Injury Rate (RIR)
- lost time incident rate, and
- days away from work

**Leading Indicators**

- Exposure monitoring
- Completed Task Hazard Analyses
- Completed Project Review
- Completed office or site inspections
- Internal & External SH&E audits
- Near miss and safety observations reporting and investigation
- Employee surveys (generated by human resources)
- Completed Training Needs Assessment
- SH&E Training completed

6.1.3 The SH&E Department will identify trends and generate reports for both leading and lagging indicators across Regions, Districts and/or business lines. These reports will be distributed to the appropriate operations management levels for consideration.

### 6.2 Incident Investigation

6.2.1 The responsible AECOM manager must initiate an incident investigation, invite the appropriate participants to the investigation proceedings and coordinate an investigation review call in accordance with established SH&E SOP.

6.2.2 An incident investigation may also require attendance by AECOM Legal Counsel, SH&E Management, the SH&E Committee (or SH&E Representative), or by the AECOM Senior Management, Regional or Business Line manager of the staff who was involved in the incident.

6.2.3 Investigation results should have identified the systemic root causes and result in the development of corrective actions aimed at preventing a reoccurrence of the incident. Management must ensure corrective actions are completed in a timely manner, and complete the required internal and external reports.

### 6.3 Internal Audit Program

6.3.1 As part of the SH&E Management System AECOM has established procedures to continually monitor and measure the effectiveness of SH&E Policy and Standard Operating Procedures and determine when action is needed to improve upon the Objectives and Targets used to establish performance expectations.

6.3.2 Audits are an essential independent check on the effectiveness of the SH&E Management System. Formal and informal audits are performed at AECOM offices, sites and projects on a regular basis. Audits are performed to certify:

- Organizational conformance with SH&E Policy, Standard Operating Procedures, Objectives and Targets
- Effective functioning of the SH&E Management System

### 6.4 Management Audits

6.4.1 The Supervisor/Project Manager is responsible for conducting regular and ongoing audits of their projects. Corrective and preventative actions shall be taken when identified.

6.4.2 The SH&E Department conducts formal and informal audits of offices, sites and projects.

6.4.3 The results of audits are communicated to AECOM Americas senior management, supervisors/ project managers to confirm areas of non-conformance and to facilitate the implementation of corrective actions.

### 6.5 Inspections

6.5.1 Inspections are an integral part of the SH&E Program. They are used to identify and recommend controls for existing and potential hazards in the workplace.

6.5.2 Every office will coordinate office inspections on a regular basis in compliance with SH&E SOPs and applicable local legislation.

6.5.3 Project supervisors must conduct, at a minimum, formal monthly safety inspections on active construction sites, carry out ongoing informal visual inspections and correct any identified deficiencies in their assigned work areas.

### 6.6 Management Review

6.6.1 An annual Management Review is conducted to evaluate the performance results of the SH&E Management System and to approve program Objectives and Targets for the next fiscal year. The meeting is chaired by the Americas Chief Executive and attended by members of the Americas SH&E Executive Council.

6.6.2 The Americas SH&E Director generates and presents a summary report of the SH&E Management System performance results for the fiscal year. Americas senior management review data to determine the program's continuing suitability, adequacy and effectiveness, provide input, and come to consensus on any corrective actions.

6.6.3 The Management Review may consider all relevant SH&E issues to determine the need for change and continuous improvement. Any changes to SH&E Policy, Standard Operating Procedures, Objectives or Targets may arise due to circumstances, including:

- New or developing concerns of clients and stakeholders
- New or revised statutory/regulatory requirements
- Availability of improved technology to address SH&E risk

6.6.4 An additional Management Review may be held at any time if special circumstances arise. For example, major restructuring of operations or management responsibilities, new processes that introduce significantly new SH&E risks, major external concerns from stakeholders or statutory/ regulatory obligations.

## 7.0 Act

### 7.1 Corrective and Preventative Action

7.1.1 The SH&E Management System includes procedures to identify and control several types of non-conformance.

7.1.2 Responsibility and authorities are defined for taking corrective action to control non-conformance and for initiating and completing preventative actions to eliminate the causes of non-conformance.

7.1.3 The Region SH&E Managers work with supervisors and managers to identify and implement corrective and preventative actions on SH&E-related issues, including changes to practices and procedures.

7.1.4 Priority for the allocation of resources is related to the magnitude of the non-conformance and the need for mitigation.

# 8.0 Appendices

## 8.1 SH&E Standard Operating Procedures

| **000 Series - SH&E Essentials** |
|---|
| S3NA-001-PR Safe Work Standards and Rules<br>S3NA-002-PR Stop Work Authority for Unsafe Work<br>S3NA-003-PR SH&E Training<br>S3NA-004-PR Incident Reporting<br>S3NA-005-PR Driver and Vehicle Safety Program<br>S3NA-006-PR Safety Moments |
| **100 Series - Office** |
| S3NA-101-PR Emergency Response Planning, Office<br>S3NA-102-PR Ergonomics, Office<br>S3NA-103-PR Housekeeping, Office<br>S3NA-104-PR Manual Lifting, Office<br>S3NA-105-PR Office Safety Programs<br>S3NA-106-PR Fire Protection, Office<br>S3NA-107-PR Violence in the Workplace |
| **200 Series - Project Management** |
| S3NA-201-PR Client Site Requirements<br>S3NA-202-PR Competent Person Designation<br>S3NA-203-PR Emergency Response Planning, Field<br>S3NA-204-PR Environmental Compliance<br>S3NA-205-PR Equipment Inspections & Maintenance<br>S3NA-206-PR Fire Protection, Field<br>S3NA-207-PR Medical Services and First Aid<br>S3NA-208-PR Personal Protective Equipment Program<br>S3NA-209-PR Project Hazard Assessment and Planning<br>S3NA-210-PR Project Safety Meetings<br>S3NA-211-PR Regulatory Inspections<br>S3NA-212-PR Site Inspections<br>S3NA-213-PR Subcontractors<br>S3NA-214-PR Site Safety Officer |
| **300 Series - Field (Common)** |
| S3NA-301-PR Confined Spaces<br>S3NA-302-PR Electrical, General<br>S3NA-303-PR Excavation and Trenching<br>S3NA-304-PR Fall Protection<br>S3NA-305-PR Hand and Power Tools<br>S3NA-306-PR Highway and Road Work<br>S3NA-307-PR Housekeeping, Worksite<br>S3NA-308-PR Manual Lifting, Field<br>S3NA-309-PR Mobile or Heavy Equipment<br>S3NA-310-PR Rigging, Hoisting, Cranes and Lifting Devices<br>S3NA-311-PR Scaffolding<br>S3NA-312-PR Stairways and Ladders<br>S3NA-313-PR Wildlife, Plants and Insects<br>S3NA-314-PR Working Alone & Remote Travel<br>S3NA-315-PR Water, Working Around |

| 400 Series - Field (Uncommon) |
|---|
| S3NA-401-PR Aircraft Charters<br>S3NA-402-PR All Terrain Vehicles (ATVs)<br>S3NA-403-PR Avalanches<br>S3NA(US)-404-PR Commercial Motor Vehicles<br>S3NA-405-PR Drilling and Boring<br>S3NA-406-PR Electrical Lines, Overhead<br>S3NA-407-PR Electrofishing<br>S3NA-408-PR Elevated Work Platforms and Aerial Lifts<br>S3NA-409-PR Forklifts (operation of)<br>S3NA-410-PR Hazardous Energy Control<br>S3NA-411-PR Machine Guarding<br>S3NA-412-PR Powder-Actuated Tools<br>S3NA(US)-413-PR Process Safety Management<br>S3NA-414-PR Railway Sites<br>S3NA(US)-415-PR RCRA Regulated Facilities<br>S3NA-416-PR Tunnel and Underground Work<br>S3NA-417-PR Utilities, Underground<br>S3NA-418-PR Welding, Cutting and Other Hot Work<br>S3NA-419-PR Water, Marine Operations Boating<br>S3-NA420-PR Water Underwater Diving |
| **500 Series - Industrial Hygiene (Chemical, Biological, Radiological, Nuclear)** |
| S3NA-501-PR Asbestos<br>S3NA-502-PR Benzene<br>S3NA-503-PR Blood borne Pathogen Program<br>S3NA-504-PR Cadmium<br>S3NA-505-PR Cold Stress Prevention<br>S3NA-506-PR Compressed Gases<br>S3NA-507 PR Hazardous Materials Communication / WHMIS<br>S3NA-508-PR Hazardous Materials Handling and Shipping<br>S3NA-509-PR Hazardous Waste Operations and Emergency Response<br>S3NA-510-PR Hearing Conservation Program<br>S3NA-511-PR Heat Stress Prevention<br>S3NA-512-PR Laboratory Safety<br>S3NA-513-PR Lead<br>S3NA-514-PR Munitions and Explosives of Concern / Unexploded Ordnance (MEC-UXO)<br>S3NA-515-PR Nanotechnology<br>S3NA-516-PR Radiation Safety Programs<br>S3NA-517-PR Radiation, Non-Ionizing<br>S3NA-518-PR Radiation, Gauge Source Program<br>S3NA-519-PR Respiratory Protection Program<br>S3NA-520-PR Spill Response, Incidental |
| **600 Series - Incident & Medical Management** |
| S3NA-601-PR Recordkeeping<br>S3NA-602-PR Exposure Monitoring<br>S3NA-603-PR Incident Investigation and Review<br>S3NA-604-PR Medical Records<br>S3NA-605-PR Medical Surveillance Program<br>S3NA-606-PR Modified Duty Program<br>S3NA-606-FM4 Claims Management Record of Events<br>S3NA-607-PR Post Incident Medical Management |
| **700 Series - SH&E Program Management** |
| S3NA-701-PR Rules and Regulatory Review<br>S3NA-702-PR SH&E Organizational Reporting Structure & Supporting Roles<br>S3NA-703-PR SH&E Manual and Procedures Review<br>S3NA-704-PR SH&E Program Auditing<br>S3NA-705-PR SH&E Program Monitoring and Reporting |

# S3NA-001-PR Safe Work Standards and Rules

## 1.0 Purpose and Scope

1.1 Demonstrates AECOM's commitment to the establishment and maintenance of workplaces free from recognized hazards.

1.2 This procedure applies to all AECOM North America based employees and operations.

## 2.0 Terms and Definitions

2.1 **Safety Violation:** Not following verbal or written safety policies, rules and procedures (e.g., guidelines, rules, horse play, failure to wear selected PPE, abuse of selected PPE, etc.).

2.2 **Safe Work Practices:** The do's and don'ts about carrying out a task or use of equipment, informing the worker about the hazards present and providing direction on how to safeguard against the hazard. Safe Work Practices are generally guidelines only.

2.3 **Safe Job Procedures:** Written step-by-step set of instructions about completing a specific task safely including control measures and responding to emergency situations.

## 3.0 Attachments

3.1 S3NA-001-ST Safety Rules

## 4.0 Procedure

### 4.1 Standard Operating Procedures (SOPs)

4.1.1 Safe Work Practices and Safe Job Procedures are embodied in the SH&E Standard Operating Procedures and are available on AECOM's Americas SH&E website.

4.1.2 Specific Safe Work Practices and Safe Job Procedures have been developed in conjunction with employees and with particular input from those who have significant experience.

4.1.3 Standard Operating Procedures have been developed to provide clear instruction regarding the safety and reporting requirements of staff and operations.

### 4.2 Inspections and Audits

4.2.1 **Project Managers,** supervisors and **Office Managers** shall conduct project audits and office inspections to identify safe work practices and potential safety violations.

### 4.3 Roles and Responsibilities

4.3.1 All managers and supervisors are responsible for compliance with all SOP's and governmental requirements, and will be held responsible to prevent or bring any violations to the attention of the appropriate level of Management for corrective actions as per AECOM HR policies.

4.3.2 **District, Office, and Project Managers** (Including field task managers, supervisors) have overall responsibility for implementation of, and compliance with, this procedure.

4.3.3 **Region SH&E Managers** provide guidance as to safe work standards, rules, requirements and guidelines.

4.3.4 **Human Resource Managers** provide guidance and direction to managers and supervisors implementing the disciplinary process for safety violations (as defined in the Employee Handbook).

4.3.5 **Employees** are responsible for adhering to all AECOM safe work standards, rules, requirements and instructions and to provide input as appropriate.

4.4 Any employee who wilfully disregards AECOM or client safety standards, rules or requirements is subject to disciplinary action.

## 5.0 Records

None.

## 6.0 References

6.1 AECOM Employee Handbook

AECOM

# S3NA-001-ST Safety Rules

## 1.0 Rules for all Employees

1.1 Work in a manner that will not put oneself, other personnel or equipment or facilities at risk.

1.2 Identify hazardous conditions and activities in the work environment consistent with the job and training.

1.3 If a hazard cannot be eliminated, report it to the manager or supervisor promptly.

1.4 Implement established control methods consistent with project procedures and/or training.

1.5 Cooperate and comply with all AECOM Policies and Standard Operating Procedures.

1.6 Immediately report all acts of aggression, verbal or physical threats, assaults, sexual or other harassment to your supervisor, manager or the AECOM Hotline 1 888-299-9602.

1.7 Complete a Training Needs Assessment and take any safety training required for your job function or tasks.

1.8 Use or wear all personal protective equipment, devices or clothing required in accordance with manufacturers' instructions and AECOM training and/or procedures.

1.9 Do not perform any work task or activity which you believe is unsafe. Inform your supervisor immediately.

1.10 Immediately report all incidents (including near misses), injuries, property damage, spills, hazards, safety concerns and safety violations to your supervisor.

1.11 Report all observed unsafe acts, conditions, or behaviors that compromise the safety of AECOM employees, its clients, sub consultants, general contractors, or the public to your supervisor.

1.12 Keep all personal work areas clean from debris and tripping hazards.

1.13 Complete AECOM Vehicle and Driver Safety Program before operating any vehicle on AECOM business.

1.14 Operate all vehicles and mobile equipment in accordance with applicable regulations.

1.15 Do not use or operate any equipment, machine or device that may endanger you or another worker.

1.16 Do not remove damage, disable or make ineffective any protective safety, fire fighting or first aid equipment or devices.

1.17 Use only vehicles, equipment and tools that are in safe operating condition and maintained in accordance with manufacturer's specifications. Report, remove from service, or have repaired, any tool or equipment that is damaged, not working properly or may otherwise be hazardous if used.

1.18 Do not use any hand-held wireless device while driving a vehicle or performing other safety critical tasks like working near traffic or working with power tools.

1.19 When travelling, working alone or working away from the AECOM office, particularly in remote areas, follow applicable call-in procedures.

1.20 Do not bring firearms onto AECOM property or allow them on AECOM projects unless expressed permission is provided by management for the use in wildlife protection.

1.21 Do not smoke in areas designated as "NO SMOKING" or in any AECOM facility.

1.22 Do not use, sell or distribute, be under the influence, or have in their possession any controlled substances, drugs, or alcohol while performing work duties.

## 2.0 Project or Field Work

2.1 Always report to site supervisor before performing work on site to determine specific requirements for the site or project. Follow all safety requirements, including AECOM's, or that of a client or prime contractor, as applicable.

2.2 Use only designated project entrances, parking areas and facilities.

2.3 Show or produce evidence of identification or required training if requested to gain entry to or while on a project.

2.4 Obey all warning signs (e.g., "Do Not Enter," "Eye, Hearing or Respiratory Protection Required," "Permit Required Confined Space," "Authorized Personnel Only").

2.5 Do not block, deface or remove any signage, barricade or fencing without approval.

2.6 Keep passageways clean and clear of debris, materials, hoses, cords, and tripping obstructions. Items should be moved to low activity areas or storage.

2.7 Verify with the **Project Manager** that all required Permits are in place prior to commencing work.

2.8 Be aware of work going on, around or above you including contractor activities and public motor vehicles.

2.9 Do not work alone when performing high risk or remote work. Examples of high risk work activities include, but are not limited to:

2.9.1 Entering trenches/excavations

2.9.2 Entering permit-required confined spaces

2.9.3 Working at-height (i.e., donning a full-body harness)

2.9.4 Operating an aerial lift

2.9.5 Working over water

2.9.6 Boating

2.9.7 Working in atmospheres that have the potential to contain highly hazardous chemicals (e.g. hydrogen sulphide, explosive atmospheres, etc.)

2.9.8 Working near operating mobile and heavy equipment

2.9.9 Working in or adjacent to work zones containing vehicular activity

2.10 Personal cameras, video recorders, and other photographic equipment shall not be permitted on site without the **Project Manager** and client's approval.

2.11 Plan work tasks before beginning work and consider any hazards that may exist and how to avoid them through safe work practices or safe work procedures.

# S3NA-002-PR Stop Work Authority for Unsafe Work

## 1.0 Purpose and Scope

1.1 This procedure establishes the requirements for AECOM personnel to stop work if they believe there is an imminent safety, health, or environmental risk as described below that will affect them, their co-workers, the public, or the environment.

1.2 This procedure applies to all AECOM North America-based employees and operations.

## 2.0 Terms and Definitions

2.1 **Discrepancy/Deficiency**: An omission or commission, a condition, or a situation that is in conflict with the procedures and requirements of AECOM's SH&E standards.

2.2 **Imminent Danger**: An impending or threatening situation that, if left uncorrected, is likely to result in serious injury, property damage, or environmental impairment.

2.3 **Potentially Dangerous**: Minor violations that present a low potential for serious injury, property damage, or environmental impairment.

2.4 **Stop Work Order**: A directive to cease AECOM-controlled work issued for failure to follow procedures, imminent danger situations/conditions, accumulation of safety violations, etc. The Stop Work Order will apply to AECOM and its direct subcontractors placed at risk by the situations or conditions.

## 3.0 Attachments

3.1 S3NA-002-FM Stop Work Order

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Employees** are responsible for stopping all AECOM-directed work and for bringing it to the attention of the appropriate manager, Site Safety Officer, **Project Manager**, and/or Contractor representative any time an employee identifies a discrepancy, deficiency, or potentially dangerous condition or act that is likely to cause an unsafe or unhealthy situation or an imminent danger situation.

4.1.2 **Employees** may report unsafe working conditions anonymously, but they must provide sufficient detail and promptness to allow AECOM management and the SH&E staff to initiate corrective action.

4.1.3 **The Site Safety Officer** or **Local SH&E Representative** must initiate the development and implementation of corrective actions to eliminate the condition causing the Stop Work Order for AECOM employees and other personnel under AECOM's direct control affected by such condition. Report the details of the Stop Work Order and any corrective actions implemented to the **Project Manager** and the appropriate **Region SH&E Manager**

4.1.4 **Project managers (field task managers, supervisors)**

- Verify that corrective actions taken appropriately address the conditions leading to the Stop Work Order.
- If AECOM has control over the circumstance that led to the condition, initiate additional corrective actions necessary to correct the conditions leading to the Stop Work Order. Otherwise, remain in communication with the persons or entities that are taking the corrective measures.
- Communicate such corrective actions and the effects of such corrective actions on the project/office to the client and/or Region Management.
- Ensure that documentation related to the Stop Work Order and corrective actions is placed in the project/office file.

4.1.5 **Region Business line Managers (regional, district and office managers)**

- Provide support, in accordance with our contractual responsibilities for the project, for the implementation of corrective actions and communications with clients.
- Ensure that no reprimand or reprisal is associated with the initiation of a Stop Work Order.

4.1.6 **Region SH&E Managers**

- Provide technical guidance for the development and implementation of corrective actions.
- Communicate with the SH&E group and assist with the development of Shared Learning and Safety Alert notices.

## 4.2 Commitment

4.2.1 It is AECOM's policy and firm commitment that employees are expected to stop their work to prevent unacceptable exposure to workplace hazards, including unsafe conditions or worker behaviors, without fear of reprimand or reprisal.

4.2.2 Cases involving reprisal, reprimand, or any attempt to discourage the initiation of Stop Work Orders or reporting of unsafe or unhealthy conditions or situations within AECOM should be immediately reported to the employee's **Manager, Human Resources Representative**, and **Region SH&E Manager**.

## 4.3 Authority

4.3.1 AECOM's stop work authority applies to all work controlled by AECOM, its employees, and AECOM-controlled subcontractor work activities. All AECOM personnel are authorized to stop work in the event of an identified unsafe condition. If the responsible organization fails to provide resolution, or if at any time their acts or failure to act cause substantial harm or imminent danger to the health and safety of project employees, the public, or the environment, AECOM may issue an order stopping work in whole or in part. In the event that AECOM issues a Stop Work Order, an order issued by AECOM authorizing the resumption of work must be in place prior to restarting work.

4.3.2 In most cases, a Stop Work Order affects only those areas immediately involved in the hazardous situation. AECOM may issue a Stop Work Order for a portion of the work area(s) or for an entire work area when unacceptable risks exist that cannot be mitigated by reasonable engineering controls, administrative actions, or personal protective equipment. The Stop Work Order will remain in effect until the responsible organization resolves the problem(s) and brings the work area(s) to satisfactory conformance with established SH&E requirements. Work will not resume until appropriate corrective actions have been completed, ensuring that the condition has been rectified. The Stop Work Order will apply to AECOM and its direct subcontractors placed at risk by the situations or conditions.

## 4.4 Severity of Hazards

4.4.1 Imminent Danger Situations

- Upon becoming aware of an imminently dangerous situation that AECOM does not control, the employee should immediately inform the persons or entities in control of such imminently dangerous activities and his or her project manager about the situation. If the activities pertain to work that is controlled by AECOM, then the employee may stop the work upon discovering an imminently dangerous situation and then immediately notify his project manager, who may determine the appropriate further action to be taken (including the issuance of a formal Stop Work Order).
- "Stopping work" for AECOM-controlled work includes stabilizing an imminent danger situation to the extent that it can be left unattended for a prolonged period of time until the issue is resolved.
- The person requesting the work stoppage will notify the organization responsible for the work.
- The responsible organization will notify AECOM project/office management immediately of any stop work action(s) taken to rectify the situation.
- An AECOM's failure to comply with any Stop Work Order in whole or in part may result in disciplinary action. An AECOM subcontractor employee's failure to comply with any Stop Work Order may result in immediate removal from the project and/or office location.

4.4.2 Potentially Dangerous Situations

- Informal stop work interventions to correct minor conditions (e.g., to remind workers to put on their hard hats, safety glasses, etc.) do not require formal notification.
- If the minor condition cannot be corrected, a formal Stop Work Order must be issued and work must not be resumed until the situation has been eliminated.

### 4.5 Management-issued Stop Work Orders

4.5.1 **Region, District**, and **Office Managers, Project Managers** and/or **SH&E Managers** may issue a formal Stop Work Order for AECOM-controlled work in the following situations:

- Imminent danger exists involving the public or employee's safety and health or damage to the environment, facilities, or property.
- Continuing work or equipment usage will result in significant repair, rework, or removal.
- A project, or any segment of the project, is executed improperly or is out of compliance with applicable regulations or standards.

### 4.6 Resuming Work

4.6.1 Work associated with the affected area or operation will not resume unless all corrective actions identified in the applicable Stop Work Order have been completed and closed.

4.6.2 All personnel affected by the Stop Work Order will be instructed on the corrective actions and preventative measures taken.

## 5.0 Records

5.1 The completed Stop Work Order and any corrective action reports generated will be maintained at the project site for the duration of the project and placed in the closed project file.

## 6.0 References

6.1 None

# S3NA-002-FM Stop Work Order

This form must be completed if any of the following Criteria are met:

1. Imminent danger exists involving the public or employees' safety and health, the environment, facilities, or property.
2. Continuing work or equipment usage will result in significant repair, rework, or removal.
3. There is a discrepancy, deficiency, or potentially dangerous condition or act that is likely to cause an unsafe or unhealthy situation or an imminent danger situation.

| **Project Name:** | | | |
|---|---|---|---|
| **Project Manager:** | | **Project #:** | |
| **Reported by:** | | **Date/Time:** | |
| **Office:** | | **Address:** | |
| **Stop Work Order is the result of the following:** | | | |
| **Inspection/Audit** ☐ | **Environmental Impairment** ☐ | **Injury/Incident** ☐ | |
| **Unsafe Condition** ☐ | **Unsafe Behavior/Act** ☐ | **Improper Scope of Work** ☐ | |
| **Other** ☐ | | | |
| **Stop Work Order (Describe):** | | | |
| | | | |

***All Stop Work Orders will be sent to the Regional SH&E Manager for Review***

### Return to Work

The above Stop Work Order issues/concerns have been corrected and documented. By signing below, I certify that the above Stop Work Order scenario has been corrected and work is safe to resume.

| Title | Print Name | Signature |
|---|---|---|
| Project Manager: | | |
| Individual/party issuing Stop Work Order: | | |
| Sub-Contractor Supervisor (if applicable): | | |

# S3NA-003-PR SH&E Training

## 1.0 Purpose and Scope

1.1 AECOM's Safety, Health and Environmental (SH&E) Training Program is designed to provide training for all personnel which address the safety needs of their assigned job duties and responsibilities.

1.2 This procedure establishes procedure and standards through which training content is developed, delivered and documented.

1.3 This procedure applies to all AECOM North America based employees and operations.

1.4 Major objectives of the SH&E Training Program includes:

- Identify accountability, responsibility, and authority pertaining to the SH&E training program requirements.
- Establish minimum training course and/or instructor criteria to support compliance with applicable regulatory requirements as well as AECOM's SH&E Program requirements.
- Provide a framework to assess participant competency and understanding.
- Define documentation and corresponding archive requirements for the training program.
- Maintain consistency in SH&E training content throughout North America for AECOM.

## 2.0 Terms and Definitions

2.1 **Compliance Training**: Training meant to provide a safe and healthy workplace for AECOM employees and others through adherence to legislative and regulatory mandates (e.g. federal, state, provincial, territorial, local/municipal governments and agencies thereof), AECOM's SH&E policy and procedure, and client-specified requirements as defined in project specifications and contracts.

2.2 **Conformance Training**: Training developed by AECOM intended to further develop the AECOM SH&E culture, but is not required by legislative or regulatory requirements, SH&E policy and procedure, or client requirements.

2.3 **Competent Person**: One who is capable of identifying existing and predictable hazards in surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization and resources to take prompt corrective measures to eliminate them.

2.4 **Learning Management System (LMS):** An electronic data management system for recording the requirements of the TNA and the successful completion of assigned SH&E training.

2.5 **SH&E Administrators:** Employees that are located in various offices who coordinate the staff and/or trainers for delivery of SH&E training and record training completion data in the LMS or maintain hard copy files of training data for the location(s).

2.6 **Training Needs Assessment (TNA):** A tool in which a selection process identifies an employees' SH&E training requirements based on their job role(s), responsibility(s) and associated hazards, and reviews the selected course(s) with his/her supervisor for approval and provision.

## 3.0 Attachments

3.1 S3NA-003-FM1 SH&E Training Sign in Sheet

3.2 S3NA-003-FM2 Training Needs Assessment

3.3 S3NA-003-FM3 Training Needs Assessment – Administrative Employees

3.4 S3NA-003-FM4 Training Needs Assessment – Technical Employees

3.5 S3NA-003-FM5 Training Needs Assessment – Employee Supervisors & Project Managers

3.6 S3NA-003-FM6 Training Needs Assessment – On-Site Project Supervisors

3.7 S3NA-003-FM7 Training Needs Assessment – Line Managers

3.8 S3NA-003-FM8 SH&E Training Course and Instructor Evaluation

3.9 S3NA-003-WI1 Training Needs Assessment Process

3.10 S3NA-003-WI2 Training Delivery

3.11 S3NA-003-WI3 Training Documentation

3.12 S3NA-003-TP1 SH&E Training Syllabus Template

3.13 S3NA-003-TP2 SH&E Training Certificate Template

# 4.0 Procedure

The requirements included in this procedure are the minimum applicable for AECOM SH&E training activities. Further training may be identified to meet local jurisdiction or client requirements.

## 4.1 Roles and Responsibilities

4.1.1 **Region Executives** are responsible for establishing adequate resources (budget, training staff, etc.) to implement the identified SH&E training.

4.1.2 **Region Business Line Managers** are responsible for supporting the SH&E training program, and for the implementation and enforcement of this procedure within their region. This includes:

- Allocating resources (budget, training staff, etc.) for the effective implementation of this program.
- Participating with the **Region SH&E Manager** in the development of tools to identify, track and monitor the implementation of SH&E training.

4.1.3 **District or Office Managers, Project Managers** (including field task managers, employee supervisors) are responsible for verifying that all assigned personnel comply with the requirements of this program. They will also:

- Identify local **SH&E Administrators** to coordinate SH&E training and to handle the training program data for their district/department.
- Confirm that training requirements are reviewed with each employee, based upon anticipated hazards associated with current and probable job functions and past performance if the job has not changed.
- Confirm that a SH&E TNA is completed by each employee and their supervisor as part of an employee's new hire orientation and during annual review.
- Identify supplemental employee training courses based on local/client requirements.
- Identify additional employee SH&E training requirements based upon prudent risk management considerations and local performance issues.
- Implement corrective actions when employees fail to meet training requirements.
- Confirm that the appropriate level of training is being assigned to the employee with regard to their specific job and task assignments and client needs.

4.1.4 **Americas SH&E Director** is responsible for the following**:**

- Establishing SH&E Training Program parameters and communicating with group executive management on training performance.
- Providing the necessary tools, support, and staff for development of the SH&E training program.
- Reporting/communicating training status to senior management.

4.1.5 **SH&E Training Manager** is responsible for the following:

- Developing and maintaining the LMS.
- Developing a list and schedule of training courses, including routine recurring training for standard courses. Communicating such information accordingly.
- Developing a resource of AECOM online, vendor or classroom training materials.

- Developing a library of approved SH&E courses and syllabi.
- Reviewing and approving qualifications of AECOM employees providing internal safety training.
- Collaborating with the **Region SH&E Managers** in course development and content.
- Auditing for compliance with training program parameters.
- Reviewing training evaluations to verify quality of training provided.
- Reporting the status of the SH&E Training Program to the **Americas SH&E Director** and **Region SH&E Managers.**

4.1.6 **Region SH&E Manager** is responsible for the following:

- Working with Region and Business Line management to verify all SH&E training needs are identified and captured in the LMS.
- Developing a schedule and performing internal safety training classes as requested by region, district, office or **Project Managers**.
- Reviewing and approving qualifications of AECOM employees providing internal safety training.
- Approving training lesson plans and course agendas for all internal training courses.
- Approving external safety training vendors and on-line (Internet) training providers.
- Offering all training participants the opportunity to evaluate training events.
- Reporting compliance with training program requirements to line management.

4.1.7 **SH&E Administrators** are responsible for the following:

- Inputting and maintaining records pertaining to all SH&E training courses into the LMS.
- Assigning training courses to employees, based on approved TNA results.
- Maintaining a file, hardcopy or electronic, of employee training records, sign-in sheets and other SH&E records related to training (such as quizzes and course evaluations where available).
- Supporting employees in obtaining refresher training prior to expiration.
- Providing office, department, location or business line managers training compliance reports at an interval agreed upon by manager.

4.1.8 **Employees** are responsible for the following**:**

- Reviewing with their supervisor the SH&E hazards they may be exposed to in their day-to-day functions, and requesting the training for that hazard by completing a SH&E TNA.
- Coordinating with their supervisor to take the required SH&E training course prior to performing tasks with identified hazards.
- Monitoring their own training expiration dates and coordinating with their local **SH&E Administrator** (and supervisor) for refresher training to prevent expiration of any required training certifications.
- Maintaining a personal record of all training certifications.
- Supplying copies of training completion certificates to the **SH&E Administrator** for inclusion in the LMS.
- Providing feedback on training through the evaluation process.

## 4.2 Training Needs Assessment

4.2.1 The purpose of the TNA is to provide employees with the ability to identify the job tasks that they perform and training associated with these tasks that is meant to provide employees with the knowledge and skills needed to work safely, control hazards and reduce the potential for an incident to occur.

4.2.2 Upon employment and annually thereafter in conjunction with their annual performance review, employees will review their SH&E training requirements by completing/updating their SH&E TNA.

4.2.3 The employee's supervisor will review, modify and/or confirm training recommendations identified on the TNA and confirm enrolment into the required training programs. Details for completing a TNA may be found in *S3NA-003-WI1 Training Needs Assessment Process*.

4.2.4 Training Needs Assessments must be reviewed if any employee has been assigned a significantly different job with new hazards or project reassignment.

4.2.5 A list of training approved by the supervisor will be provided to the employee's SH&E Administrator and assigned in AECOM's LMS.

## 4.3 Training Delivery

4.3.1 SH&E Training is delivered in several methods to meet AECOM's wide diversity of staff, office and project locations. The **Region or District SH&E Manager** will coordinate with local operations and **SH&E Administrators** to develop a region training schedule and appropriate methods of delivery.

4.3.2 Every employee must attend the required training to meet the requirement established in the TNA and to demonstrate successful participation and knowledge transfer by completing and passing the associated quizzes, examinations or other form of assessment.

4.3.3 Standards for developing and delivering training courses, as well as certification criteria are provided in Work Instruction *S3NA-003-WI2 Training Delivery*.

## 4.4 Internal Training

4.4.1 Internal training represents training that is performed by AECOM's internal resources and may include intranet and classroom-based training. Generally this training material is customized to meet the specific requirements of AECOM, a location or a project.

4.4.2 Courses that are self-taught, individually paced and delivered via AECOM's intranet are developed and maintained by the **SH&E Training Manager**. AECOM's intranet may also be used to provide training by an SH&E Instructor in a WebEx format to facilitate personnel training for multiple locations.

4.4.3 Courses taught by an AECOM instructor in a classroom format will be delivered by trainers that are SH&E Department-approved personnel using materials developed specifically to train AECOM employees. All training course curricula is reviewed and approved by the **SH&E Department** prior to provision of training.

## 4.5 External Training

4.5.1 External vendors conduct training that is not available through internal training sources. All external vendors are to be selected and pre-approved by the **SH&E Department** prior to any employee attending a training class.

4.5.2 AECOM will use Internet training to supplement internal training courses. All Internet-based safety training courses and providers must be approved by the **SH&E Department** prior to any employee participating in training. Employees will be provided sign-on privileges once approved.

## 4.6 Project Specific Training

4.6.1 In the course of employment with AECOM, employees may be asked to participate in project work incorporating activities new to them or activities for which they have let their SH&E training expire. Should this occur, they must immediately inform their supervisor and not participate in any tasks with hazards for which they have not been trained.

4.6.2 **Project Managers** must review all employees scheduled to work on their projects for compliance with SH&E training for hazards present or anticipated on their particular project. **Project Managers** must not let any employee that does not have current training for the identified hazards work on their projects.

## 4.7 Training Evaluation

4.7.1 At the conclusion of a training event, participants will be provided with the opportunity to anonymously evaluate the training session.

4.7.2 The training instructor will provide participants with a copy of *S3NA-003-FM8 SH&E Training Course and Instructor Evaluation*. Alternately, and for training conducted virtually and/or through teleconference, the training instructor will provide participants with a link to the online version of the form and provide instruction on how to complete the form.

4.7.3 Training instructors will collect evaluations at the conclusion of training, review feedback, and when appropriate, contact the **SH&E Training Manager** to request assistance addressing consistently noted deficiencies.

## 4.8 Training Tracking

4.8.1 Records documenting employee participation safety training will be maintained in accordance with applicable regulatory and AECOM SH&E Program requirements.

4.8.2 Each employee is responsible for maintaining a personal file that contains their history of training certifications.

4.8.3 Each region/district is responsible for maintaining documentation of course completion by each individual employee. **SH&E Administrators** will generally maintain such documentation.

4.8.4 For any employee who cannot be entered into the electronic database, i.e.: contract employees, sub consultant employees, or client personnel, the **District or Office SH&E Administrator** is required to maintain an individual non-employee training file with hard copies of certification from any safety training records.

### 4.9 Training Expiration

4.9.1 Training will expire in accordance with requirements specified on the training subject syllabus.

4.9.2 Expiration of training will be tracked electronically using the AECOM LMS.

4.9.3 Employees who are not managed within the AECOM LMS are responsible for tracking their individual training expiration dates.

4.9.4 If training expires for an employee, they will be disqualified from performing tasks associated with the training when training is required by legislation/regulation to perform the tasks. Once training has been renewed, the employee will be qualified to perform associated tasks.

### 4.10 Training Program Management

4.10.1 **Region SH&E Managers** will be responsible for verifying training vendors, Internet training courses, or any other external training programs used by their operating units to comply with applicable regulatory or legislative requirements and AECOM SH&E Program parameters. AECOM will not consider any training received through an unapproved vendor to be valid until reviewed and accepted by a **Region SH&E Manager.**

4.10.2 AECOM Americas Office of **Organization and Employee Development** may provide training support services for AECOM-approved programs in addition to training provided by individual business lines and outside vendors.

## 5.0 Records

5.1 None

## 6.0 References

6.1 S3NA-003-WI1 Training Needs Assessment Process

6.2 S3NA-003-WI2 Training Delivery

6.3 S3NA-003-FM8 SH&E Training Course and Instructor Evaluation

# S3NA-003-FM1 SH&E Training Sign-In Sheet

| | | | | | |
|---|---|---|---|---|---|
| **Course Name:** | | | | | |
| **Region:** | | **District:** | | | |
| **Business Line:** | | **Dept #:** | | | |
| **Office:** | | **Address:** | | | |
| **Date:** | | **Start Time:** | | **Stop Time:** | |

**Certification Level (Check One):** Awareness ☐ Performance ☐ Competent Person ☐

| **Lead Instructor:** | **Instructor 1:** | **Instructor 2:** |
|---|---|---|
| | | |

| | **Employee Name: (PRINT LEGIBLY)** | **Employee Signature** | **Region/Office Company** (if not AECOM) | **Employee ID #:** | **Instructor Initials verifying completion** |
|---|---|---|---|---|---|
| 1. | | | | | |
| 2. | | | | | |
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| 19. | | | | | |
| 20. | | | | | |

# Course Agenda

| Course Name/ Module | Approximate Duration | Learning Objectives | Comprehension Assessment | Certification |
|---|---|---|---|---|
| | | • | • | • |
| | | • | • | • |
| | | • | • | • |

**Lead Instructor's Signature** **Date**

**Instructor 1 Signature** **Date**

**Instructor 2 Signature** **Date**

# S3NA-003-FM2 Training Needs Assessment

| | | | |
|---|---|---|---|
| **First Name:** | **Last Name:** | **Employee Number:** | **Department Number:** |
| **Home Office:** | **Date Completed:** | **Supervisor:** | |
| **Region:** | **Business Line:** | **District:** | |

**Instructions**

- Answer each question as it pertains to your job now and for the coming year.
- Consider any potential changes to your job, new roles that you may be performing, and your business goals for the coming year.
- If you are uncertain if a job role or function applies to you now, or in the coming year, contact your Supervisor for assistance in making this determination.
- During completion of the Trainnig Needs Assessment (TNA) similar and/or duplicate training may be identified. When this occurs contact your SH&E Manager to discuss opportunities where training may be consolidated to avoid redundant training.

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **BASIC EMPLOYEE SH&E TRAINING** | | | | | | |
| | Are you in the Environment Business Line? | Behavior Based Safety (all three modules) | Initial - Training does not require renewal | | US, Canada | 2.5 |
| | Do you only work in the office, i.e. you do not conduct Field Work (any work outside the office)? Work outside the office may include traveling to AECOM project and office locations, traveling to client locations and performing general administrative task | Office Ergonomics - Awareness Training | 2 | 102 | US | 0.5 |
| | Are you an employee of Canada? | SH&E Fundamentals - Awareness Training | Annual | 003, 209 | Canada | 2 |
| | Are you an employee of the US? | SH&E Fundamentals - Awareness Training | 3 | 003, 209 | US | 2 |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **OFFICE SAFETY** | | | | | | |
| | Do you spend at least 1 full day, or at least 10 total hours per week, working in an office setting? NOTE: This can be your assigned AECOM office, a client site office, a home office, or a job-site trailer or similar field office location if that is your | Office Ergonomics - Awareness Training | 2 | 102 | US | 0.5 |
| | Does your work ever involve using a computer for at least 2 hours continuously, a total of 4 hours in any work day, or at least half of your time in the office? | Office Ergonomics - Awareness Training | 2 | 102 | US | 0.5 |
| | Does your work ever involve using a computer for at least 2 hours continuously, a total of 4 hours in any work day, or at least half of your time in the office? | Office Ergonomics - Awareness Training* | 2 | 102 | Canada | 0.5 |
| | Is your office equipped with portable fire extinguisher for use on small, initial-stage fires (no larger than an office trash receptacle)? | OPTIONAL TRAINING - Fire Extinguisher - Awareness Training; AECOM will not require you to operate a fire extinguisher in the office, only evacuate the office safely. | Annual | 106 | US, Canada | 0.5 |
| | Are you designated as a First Aid certified employee in the office? | First Aid - Performance Training* | 2 | 101, 207 | US | 2.5 |
| | Are you designated as a CPR certified employee in the office? | CPR - Performance Training* | 2 | 101, 207 | US | 2.5 |
| | Are you designated as an AED trained employee within the office? | AED - Performance Training | 2 | 101, 203, 207 | US | 0.5 |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **OFFICE SAFETY** | | | | | | |
| | Do you receive and process shipments for your office (by FedEx, UPS, etc.) and/or are you the person who signs for incoming shipments and packages? NOTE: Regardless of shipment contents. | HzM(US)/TDG(CAN) Shipping - Awareness Training* | 3 | 508 | US, Canada | 0.5 |
| | Do you receive shipments of hazardous materials or dangerous goods? NOTE: This can include analytical laboratory samples, waste materials, calibration gases, other compressed-gas items, or any hazardous materials/wastes. | Level 1 Shipper - HzM(US)/TDG(CDN) - Performance Training* | 3 | 508 | US, Canada | 4 |
| | Do you co-chair an office Occupational Health & Safety (OHS) committee? | Workplace Safety & Health Committee - Performance Training (as per local jurisdictions)* | Initial - Training does not require renewal | | Canada | 16 |
| | Do you perform office-based work for Shell (an AECOM Client), i.e. project oversight, planning, design, any billed labor, etc.? | Shell 12 Life Saving Rules | Initial - Training does not require renewal | 201, Shell | US, Canada | 1 |
| | Are you a Fire Warden for your office and/or are you responsible for the inspection and maintenance of fire extinguishers? | Fire Extinguisher - Awareness Training* | 1 | 106, 206 | US, Canada | 0.5 |
| | Are you listed in an Office Safety Plan as a provider of First Aid, CPR, AED and other advanced life saving skills? | Standard First Aid, with CPR & AED Performance Training* | 3 | 101 | Canada | 16 |
| | Do you routinely (i.e. daily or more frequently) perform activities involving lifting heavy objects, repetitive motions and/or awkward postures? | Industrial Ergonomics - Awareness Training | 3 | 308 | US, Canada | 0.7 |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **VEHICLE OPERATIONS AND MOBILE EQUIPMENT** | | | | | | |
| | Do you regularly drive for work AND your supervisor has identified the need for expanded driver safety training; example: you have been assigned an AECOM owned or leased vehicle? | Complete AECOM Driver's Acknowledgement Form | 2 | 5 | US, Canada | 0 |
| | | Driver & Vehicle Safety - Awareness Training | 2 | 5 | US, Canada | 0.5 |
| | Has AECOM provided you with a company owned or leased vehicle for long-term use, i.e. >30 days/year? | Def. Driver NSC(U.S.)/CMA(CAN) - Awareness Training | Initial - Training does not require renewal | 005, 404 | US, Canada | 4 |
| | Do you drive an ATV? | ATV Safety Performance Training | 3 | 402 | US, Canada | 6 |
| | Do you drive a Commercial Motor Vehicle (>10,001 GVWR U.S.) for business purposes? | Commercial Motor Vehicle (CMV) - Performance Training* | 3 | 404 | US | 4 |
| | | Def. Driver NSC(U.S.)/CMA(CAN) - Awareness Training | Initial - Training does not require renewal | 005, 404 | US, Canada | 4 |
| | Do you work for a client that requires you complete Smith System Defensive Driver training? | Smith System Driver - Performance Training | 3 | 201 | US, Canada | 8 |

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **EMPLOYEE MANAGEMENT** | | | | | | |
| | Do you Manage or Supervise AECOM Employees, or do you work unsupervised? | Canadian Due Diligence - OH&S Training* | Initial - Training does not require renewal | C45 | Canada | 3 |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **EMPLOYEE MANAGEMENT** | | | | | | |
| | | Incident Investigation - Awareness Training* | Initial - Training does not require renewal | Varied depending upon province | Canada | 2 |

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **HAZWOPER AND EMERGENCY RESPONSE** | | | | | | |
| | Are you a HAZWOPER worker, are you Project Manger for HAZWOPER projects, or are you required to visit any designated HAZWOPER site AND enter into any Exclusion Zone areas? | HazCom(US)/WHMIS(CDN) - Awareness Training* | Annual | 507 | US, Canada | 0.5 |
| | | HAZWOPER 40-Hour - Performance Training*. Consult your RSH&EM about the need for Medical Surveillance. | Initial - Training does not require renewal | 509 | US, Canada | 40 |
| | | HAZWOPER 8-Hour Refresher - Awareness Training*. Consult your RSH&EM about the need for Medical Surveillance. | Annual | 509 | US, Canada | 8 |
| | Do you perform field management of HAZWOPER work (including supervising a work/investigation team) or people on a HAZWOPER site, and/or serve as a Site Safety Officer for any HAZWOPER site/activity? | HAZWOPER 8-Hour Supervisor - Awareness Training* | Initial - Training does not require renewal | 509 | US, Canada | 8 |
| | Do you perform HAZWOPER emergency response work, have you been issued respiratory protection PPE, have you been required to wear | Hearing Protection - Awareness Training*. Consult your RSH&EM about the need for Medical Surveillance. | Annual | 207 | US, Canada | 0.8 |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **HAZWOPER AND EMERGENCY RESPONSE** | | | | | | |
| | respiratory protection PPE by AECOM, and/or do you wear a respirator inside an Exclusion Zone for more than 30 days in any yea | Respiratory Protection - Awareness Training*. Consult your RSH&EM about the need for Medical Surveillance. | Annual | 519 | US, Canada | 0.8 |
| | Do you perform HAZWOPER Emergency Response services as defined in 29 CFR 1910.120(q)(3)? | HAZWOPER Emergency Response Performance Training in accordance with assigned role, i.e. First Responder Operations Level, Hazardous Materials Technician, Hazardous Materials Specialist, and/or On Scene Incident Comander.* Consult your RSH&EM about the ne | Annual | 509 | US | 8 |

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **FIELD WORK** | | | | | | |
| | Do you perform any Field work NOT associated with Environmental Clean-up? | Field Safety - Awareness Training. Consult your RSH&EM about the need for Medical Surveillance. | 2 | 209 | US, Canada | 4 |
| | | Natural Biological Hazards - Awareness Training | 2 | 503 | US, Canada | 1 |
| | Do you work in a location where First Aid and CPR skills were needed wherein emergency services were either unavailable or remote as defined in SH&E SOP 208, and/or have you been identified as the First Aid/CPR Responder in a project Safe Work Plan? | CPR - Performance Training* | 2 | 101, 207 | US | 2.5 |
| | | First Aid - Performance Training* | 2 | 101, 207 | US | 2.5 |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **FIELD WORK** | | | | | | |
| | Do you routinely (i.e. daily or more frequently) perform field activities involving lifting heavy objects, repetitive motions and/or awkward postures? | Industrial Ergonomics - Awareness Training | 3 | 308 | US, Canada | 0.7 |
| | Do you work in close proximity to heavy equipment (i.e. skid steers, back hoes, excavators, bulldozers and other yellow iron)? | Heavy/Mobile Equipment Safety Awareness Training* | 3 | 309 | US, Canada | 0.5 |
| | Do you work on a project equipped with an AED where you are designated as an AED trained employee for the project? | AED - Performance Training | 2 | 101, 203, 207 | US | 0.5 |
| | Do you wear hearing protection (ear plugs, ear muffs, etc.) for a total of 2 hours or more in a single work shift on average at least two times per month, have you been issued hearing protection by AECOM, have you been required to wear hearing protection | Hearing Protection - Awareness Training*. Consult your RSH&EM about the need for Medical Surveillance. | Annual | 207 | US, Canada | 0.8 |
| | Do you perform a task where a fire extinguisher is a required piece of equipment for the job (e.g., fire watch)? NOTE: The presence of fire extinguishers in the workplace does not indicate that you are required to use one. | Fire Extinguisher - Awareness Training* | 1 | 106, 206 | US, Canada | 0.5 |
| | Do you regularly work in remote and isolated locations where you have the potential to be isolated overnight? | Wilderness Survival - Awareness Training | Initial - Training does not require renewal | 313, 503 | Canada | 16 |
| | Do you work in locations where bears may be encountered? | Bear Safety - Awareness Training | 2 | 313, 503 | Canada | 1 |
| | Do you conduct or supervise permitted fish | AED - Performance Training | 2 | 203, 207 | Canada | |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **FIELD WORK** | | | | | | |
| | sampling/salvaging with the use of an electro-fisher? | Electrofishing Certification* | Initial - Training does not require renewal | 407 | US, Canada | 16 |
| | Do you work on or adjacent to a roadway that has live traffic? | Traffic Safety - Awareness Training | 3 | 306 | US, Canada | 0.7 |
| | Do you prepare Traffic Control Plans for the direction of traffic on an AECOM controlled project? | Traffic Control Planner, contact your RSH&EM to obtain training.* | Varied | 306 | Canada | |
| | Are you listed in a project Safe Work Plan as a provider of First Aid, CPR, AED and other advanced life saving skills? | Standard First Aid, with CPR & AED Performance Training* | 3 | 101 | Canada | 16 |
| | Do you use power tools, extension cords and other electrically powered devices on the job? | Electrical Safety - Awareness Training* | 2 | 302, 410 | US | 0.8 |
| | Do you work in a location with exposure to a fall of 6ft/2m or greater? | Fall Protection - Awareness Training* | 3 | 304 | US, Canada | 0.8 |
| | Do you wear a Personal Fall Arrest System (PFAS) while working at heights in excess of 6ft/2m, or on an elevated working platform or access way with an unprotected edge in excess of 1.2m/4ft and exposure to water, heavy equipment, chemicals, or other reco | Fall Protection - Performance Training* | 3 | 304 | US, Canada | 4 |
| | Do you work near open excavations and/or trenches, or do you enter an open excavation/trench >1.5m/5ft in depth? | Trenching & Excavation Safety - Awareness Training* | 3 | 303 | US, Canada | 0.8 |
| | Will you work outside for longer than one (1) hour exposed to temperatures at or below 40 F/4.5 C? | Cold Stress Prevention Awareness Training | 3 | 505 | US, Canada | 0.5 |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **HAZARDOUS MATERIALS (HZM), HAZARDOUS WASTE (HZW) & DANGEROUS GOODS HANDLING, TRANSPORT AND SHIPMENT** | | | | | | |
| | Individually or on behalf of your office, do you offer for shipment, potentially package for shipment, or receive shipments (by FedEx, UPS, etc.)? NOTE: Regardless of shipment contents. | HzM(US)/TDG(CAN) Shipping - Awareness Training* | 3 | 508 | US, Canada | 0.5 |
| | Do you handle or work with any type of controlled materials, hazardous materials or chemicals? NOTE: Consider only materials procured or brought to the work site by AECOM, NOT environmental contaminants, asbestos, lead, commonly available consumer prod | HazCom(US)/WHMIS(CDN) - Awareness Training* | Annual | 508 | US, Canada | 0.5 |
| | Do you request that someone ship on your behalf, receive shipments of, or are you required to personally package, prepare for shipment, or fill out/complete shipping documents or paperwork (by FedEx, UPS, etc.) for any types of hazardous materials or dang | Level 1 Shipper - HzM(US)/TDG(CDN) - Performance Training* | 3 | 508 | US, Canada | 4 |
| | Are you required to develop, oversee, or direct the process for packaging/shipping any hazardous, dangerous, or radioactive materials, devices or items? NOTE: Checking YES here will require that you complete HAZMAT Level 2 shipper training. This traini | Level 2 Shipper - HzM(US)/TDG(CDN) - Performance Training* | 3 | 508 | US, Canada | 6 |
| | Are you required to personally package or prepare for shipment (by FedEx, UPS, etc.) any meters that contain radioactive materials? This includes transport within an AECOM owned or leased vehicle, or personal vehicle used for AECOM business purposes NOT | Level 1 - Nuclear Density Gauge Shipping- Performance Training* | 2 | 508 | US, Canada | 6 |
| | Do you sign HzM/HzW manifests or bills of lading while acting as an Authorized Agent on Behalf of | Level 1 Shipper - HzM(US)/TDG(CDN) - Performance Training* | 3 | 508 | US, Canada | 4 |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **HAZARDOUS MATERIALS (HZM), HAZARDOUS WASTE (HZW) & DANGEROUS GOODS HANDLING, TRANSPORT AND SHIPMENT** | | | | | | |
| | a Client? | RCRA Part B Annual Training - Awareness Training* | Annual | 415 | US | 2 |
| | Do you ship HzM(US)/TDG(CAN) by Air Transportation/Courier Methods? | IATA - International Air Transportation Association HzM(US)/TDG(CAN) Training | 2 | 508 | US, Canada | 6 |

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **CONSTRUCTION, ENGINEERING & INSPECTION OVERSIGHT, MANAGEMENT AND PERFORMANCE** | | | | | | |
| | Do you perform work on active or inactive Construction, Engineering & Inspection projects? | Petroleum Safety Training Systems (PSTS) and/or Construction Safety Training System (CSTS) as required by the Client.* | PSTS/ CSTS - Initial | | Canada | |
| | Do you work on active construction projects in MA or RI? | OSHA 10-Hour Construction - Awareness Training* | Initial - Training does not require renewal | State/Project Requirement | US | 10 |
| | Do you work on active construction projects in NV? | OSHA 10-Hour Construction - Awareness Training* | 5 | State/Project Requirement | US | 10 |
| | Do you work on PUBLICLY FUNDED projects in NH, CT, NY, MO? | OSHA 10-Hour Construction - Awareness Training* | Initial - Training does not require renewal | State/Project Requirement | US | 10 |
| | Are you the Site Safety Officer on an Army Corps of Engineers Project? | OSHA 30-Hour Construction - Awareness Training* | Initial - Training does not require renewal | State/Project Requirement | US | 30 |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **CONSTRUCTION, ENGINEERING & INSPECTION OVERSIGHT, MANAGEMENT AND PERFORMANCE** | | | | | | |
| | Are you a site manager, foreman, or Site Safety Officer for job sites involving construction or demolition activities? NOTE: This can include HAZWOPER/environmental sites where significant construction/demolition is required. | Construction Awareness; consult your RSHE&M and Supervisor to determine specific training topics. | Initial - Training does not require renewal | Varied depending on job tasks | US | 4 |
| | Do you spend at least one day a week, or one-third of your total overall work time, on construction/demolition sites? NOTE: In this case, check YES whether you manage/perform the work, or provide inspector, engineering, or other support functions, as lo | Construction Awareness; consult your RSHE&M and Supervisor to determine specific training topics. | Initial - Training does not require renewal | Varied depending on job tasks | US | 4 |
| | Does your work have the potential to be affected by Lockout/Tagout? | Lockout/Tagout - Awareness Training* | 3 | 302, 410 | US, Canada | 0.8 |
| | Do you perform Lockout/Tagout Operations on systems (i.e. electrical, pressurized, equipment maintenance, etc.)? | Lockout/Tagout - Performance Training* | 2 | 302, 410 | US, Canada | 4 |
| | Do you ever work on electrically-energized (live) systems/circuits? | Arc-FLASH (NFPA 70E) Training* | Initial - Training does not require renewal | 302, 410 | US | 1 |
| | | Electrical Safety - Awareness Training* | 2 | 302, 410 | US | 0.8 |
| | Do you have the potential to access scaffolding? | Scaffolding Safety - Awareness Training* | 3 | 311 | US, Canada | 0.8 |
| | Do you work near open excavations and/or trenches, or do you enter an open excavation/trench >1.5m/5ft in depth? | Trenching & Excavation Safety - Awareness Training* | 3 | 303 | US, Canada | 0.8 |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **CONSTRUCTION, ENGINEERING & INSPECTION OVERSIGHT, MANAGEMENT AND PERFORMANCE** | | | | | | |
| | Do you wear a Personal Fall Arrest System (PFAS) while working at heights in excess of 6ft/2m, or on an elevated working platform or access way with an unprotected edge in excess of 1.2m/4ft and exposure to water, heavy equipment, chemicals, or other reco | Fall Protection - Performance Training* | 3 | 304 | US, Canada | 4 |
| | Do you perform or manage Quality Control (QC) oversight on U.S. Army Corps of Engineer (USACE) projects? | USACE CQC - Performance Training* | 5 | 201 | US | 8 |
| | Do you work in a location with exposure to a fall of 6ft/2m or greater? | Fall Protection - Awareness Training* | 3 | 304 | US, Canada | 0.8 |

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **CHEMICAL EXPOSURE** | | | | | | |
| | Do you have potential to be exposed to Chemical Hazards? | HazCom(US)/WHMIS(CDN) - Awareness Training* | Annual | 507 | US, Canada | 0.5 |
| | Do you handle or work with any type of controlled materials, hazardous materials or chemicals? NOTE: Consider only materials procured or brought to the work site by AECOM, NOT environmental contaminants, asbestos, lead, commonly available consumer prod | HazCom(US)/WHMIS(CDN) - Awareness Training* | Annual | 507 | US, Canada | 0.5 |
| | Do you have potential to be exposed to Lead? | Lead Safety - Awareness Training* | Annual | 513 | US, Canada | 0.8 |
| | Do you have potential to be exposed to Asbestos? | Asbestos - Awareness Training* | Annual | 501 | US, Canada | 0.8 |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **CHEMICAL EXPOSURE** | | | | | | |
| | Do you perform Asbestos inspections of buildings or other facilities? | Asbestos Inspector (State Specific) - Performance Training*. Consult your RSH&EM about the need for Medical Surveillance. | Annual | 501 | US, Canada | 8 |
| | Do you write Asbestos Management Plans? | Asbestos Planner (State Specific) - Performance Training*. Consult your RSH&EM about the need for Medical Surveillance. | Annual | 501 | US, Canada | 8 |
| | Do you perform Lead inspections of buildings or other facilities? | Lead Based Paint Inspector/Assessor (State Specific) - Performance Training*. Consult your RSH&EM about the need for Medical Surveillance. | Annual | 513 | US, Canada | 8 |
| | Do you write Lead Management Plans? | Lead Based Planner (State Specific) - Performance Training*. Consult your RSH&EM about the need for Medical Surveillance. | Annual | 513 | US, Canada | 8 |
| | Do you have the potential to be exposed to Hydrogen Sulfide (H2S), (i.e. Oil & Gas support services, WWTP, Landfills, etc.)? | H2S - Awareness Training* | Annual | 507 | US | 0.8 |

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **CONFINED SPACE ENTRY** | | | | | | |
| | Do you have a responsibility to identify and characterize Confined Spaces? | Confined Space - Awareness Training* | 3 | 301 | US | 1 |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **CONFINED SPACE ENTRY** | | | | | | |
| | Do you have a responsibility to identify and characterize Confined Spaces? | Confined Space - Awareness Training* | 3 | 301 | Canada | 1 |
| | Do you perform any of the following roles during a Confined Space Entry operation: Entrant, Attendant, Entry Supervisor? | Confined Space - Performance Training*. Consult your project Safety Plan and Regional SH&E Manager to determine training required per your job role and function. | 2 | 301 | US | 8 |
| | Do you perform any of the following roles during a Confined Space Entry operation: Entrant, Attendant, Supervisor? | Confined Space - Performance Training* | 2 | 301 | Canada | 8 |

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **MSHA** | | | | | | |
| | Do you work on any sites regulated by the Mine Safety and Health Administration (MSHA) that require miner training in accordance with 30 CFR 46? | MSHA Initial Miner Safety - Performance Training*. Consult your RSH&EM about the need for Medical Surveillance. | Initial - Training does not require renewal | 30 CFR 46.5-.6 | US | 24 |
| | | MSHA Miner Safety Refresher - Awareness Training*. Consult your RSH&EM about the need for Medical Surveillance. | Annual | 30 CFR 46.8 | US | 8 |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **WORK IN/OVER WATER** | | | | | | |
| | Do you work near, on, in or over water? | Pleasure Craft Operator Card* | Initial - Training does not require renewal | | Canada | |
| | | Working Around Water Safety Awareness Training | 3 | 315 | US, Canada | 1 |
| | Do you work on, or operate, a powered vessel? | Boating Safety - Consult your project Safety Plan and Regional SH&E Manager to determine training required per your job role and function, i.e. Boater Safety, Water Rescue, etc. | Initial - Training does not require renewal | 417 | US | 8 |
| | Do you work on frozen water bodies infrequently? | Water Safety Awareness Training | Initial - Training does not require renewal | 24 | Canada | |
| | Do you work on frozen water bodies frequently or for extended periods of time? | Ice Rescue Training | Initial - Training does not require renewal | | Canada | |
| | Do you regularly work in or on large and fast-flowing creeks, rivers, streams? | Swift Water Rescue Training | Initial - Training does not require renewal | | Canada | |
| | Do you perform electo-fishing sampling operations? | Electrofishing Certification* | Initial - Training does not require renewal | 407 | US, Canada | 16 |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **RADIATION SAFETY** | | | | | | |
| | Does your work expose you to Ionizing Radiation (i.e. NORM, radioactive sources in manufacturing/O&G industry, etc.)? | Radiation Safety - Awareness Training* | Annual | 516 | US, Canada | 1 |
| | Do you operate a soil density/moisture gauge? | Nuclear Density Gauge Operator - Performance Training* | Annual | 516 | US, Canada | 8 |
| | Do you operate any devices containing non-exempt ionizing radiation sources or are you required to wear an AECOM-supplied thermoluminescent radiation dosimeter? | Radiation Worker I - PerformanceTraining* | Annual | 516 | US, Canada | 8 |
| | Are you a Radiation Safety Officer (project site or administrative RSO) for an AECOM radioactive materials (RAM) license? | Radiation Safety Officer - Performance Training * | Initial - Training does not require renewal | 516 | US, Canada | 8 |

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **HEAVY AND MOBILE EQUIPMENT OPERATIONS** | | | | | | |
| | Do you ride in or operate a manlift or other type of aerial lift during the performance of your work? | Aerial Lift (Man-lift) Operation - Performance Training* | 2 | 304, 408 | US, Canada | 4 |
| | | Fall Protection - Performance Training* | 3 | 304 | US, Canada | 4 |
| | Will you perform rescue operations if someone falls from an aerial lift? | Aerial Device Rescue - Performance Training* | 2 | 304, 408 | US, Canada | 4 |
| | | Fall Protection - Performance Training* | 3 | 304 | US, Canada | 4 |
| | Do you operate (drive) a forklift or other powered industrial truck? | Forklift Operator - Performance Training* | 3 | 409 | US, Canada | 6 |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **HEAVY AND MOBILE EQUIPMENT OPERATIONS** | | | | | | |
| | Do you operate other types of heavy equipment or Yellow Iron? | Heavy Equipment Performance Training -Coordinate training with Regional SH&E Manager to receive training specific to the equipment being operated. | Varied | 309 | US, Canada | |

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **RAILROAD SAFETY** | | | | | | |
| | Do you perform work within or adjacent to an active railroad right-of-way? | Client-Specific Railroad Safety Training - Awareness Training | Determined by Client | 201 | US, Canada | 2 |
| | | E-Railsafe - Awareness Training* | 2 | 201 | US | 1 |
| | | Railroad Worker Protection - Awareness Training (or client equivalent)* | Annual | 201 | US | 1.5 |
| | | Railroad Worker Protection - Awareness Training (or client equivalent)* | Annual | 201 | Canada | 1.5 |

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **CLIENT TRAINING** | | | | | | |
| | Do you work for Oil & Gas Sector (i.e. Petroleum) Clients? | Petroleum Safety Training Systems (PSTS) and/or Construction Safety Training System (CSTS) as required by the Client.* | PSTS/ CSTS - Initial | | Canada | |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **CLIENT TRAINING** | | | | | | |
| | Do you work for Chevron EMC? | Chevron HAZ ID Training - Awareness Training | Initial - Training does not require renewal | 201, Chevron | US, Canada | 2 |
| | | Chevron Loss Prevention System (LPS) - Performance Training | 3 | 201, Chevron | US, Canada | 8 |
| | | Smith System Driver - Performance Training | 3 | 201 | US, Canada | 8 |
| | Do you work for BP? | BP Business Unit Training (Coordinate with PM) | Varied | 201, BP | US, Canada | |
| | Do you work for Shell Oil Company? | Shell 12 Life Saving Rules | Initial - Training does not require renewal | 201, Shell | US, Canada | 1 |
| | Do you work for Anadarko? | SafeLand USA Training | Initial - Training does not require renewal | 201, Anadarko | US, Canada | 8 |

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **COMPETENT PERSON TRAINING** | | | | | | |
| | Asbestos | Competent Person (Asbestos) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 501, 514 | US, Canada | |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **COMPETENT PERSON TRAINING** | | | | | | |
| | Blasting & Explosives | Competent Person (Blasting and Explosives) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202 | US, Canada | |
| | Concrete & Masonry Construction | Competent Person (Concrete & Masonry) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202 | US, Canada | |
| | Confined Space Entry | Competent Person (Confined Space Entry) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 301 | US, Canada | |
| | Control of Hazardous Energy, i.e. Lockout/Tagout | Competent Person (Lockout/Tagout) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 302, 410 | US, Canada | |
| | Cranes & Derricks | Competent Person (Cranes & Derricks) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 310 | US, Canada | |
| | Demolition | Competent Person (Demolition) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202 | US, Canada | |
| | Electrical Wiring Design & Protections | Competent Person (Electrical Wiring Design & Protection) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 302, 410 | US, Canada | |
| | Fall Protection | Competent Person (Fall Protection) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 304, 408 | US, Canada | |
| | Hearing Protection | Competent Person (Hearing Protection) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 207 | US, Canada | |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **COMPETENT PERSON TRAINING** | | | | | | |
| | Heavy Equipment | Competent Person (Heavy Equipment) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 309 | US, Canada | |
| | Ionizing Radiation | Competent Person (Ionizing Radiation) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 516 | US, Canada | |
| | Lead | Competent Person (Lead) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 513 | US, Canada | |
| | Material Hoists & Personnel Hoists | Competent Person (Material Hoists & Personnel Hoists) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 310, 409 | US, Canada | |
| | Stairways & Ladders | Competent Person (Stairways & Ladders) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 312 | US, Canada | |
| | Respiratory Protection | Competent Person (Respiratory Protection) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 519 | US, Canada | |
| | Rigging Equipment | Competent Person (Rigging Equipment) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 310 | US, Canada | |
| | Scaffolds | Competent Person (Scaffolds) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 311 | US, Canada | |
| | Steel Erection | Competent Person (Steel Erection) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202 | US, Canada | |

* Indicates training required by legislation/regulation

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **COMPETENT PERSON TRAINING** | | | | | | |
| | Traffic Control Planning | Competent Person (Traffic Control & Planning) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 306 | US | |
| | Trench & Excavations | Competent Person (Trench & Excavations) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 303 | US, Canada | |
| | Underground Construction | Competent Person (Underground Construction) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 414 | US, Canada | |
| | Welding & Cutting | Competent Person (Welding & Cutting) - Designation made by Project Manager in consultation with RSH&EM.* | 2 | 202, 416 | US, Canada | |

| X if yes | Question | Training | Frequency (years until topic expires) | SOP | Applies to | Estimated Hours to Complete |
|---|---|---|---|---|---|---|
| **OTHER –** Other training may be required based on the jurisdiction, client requirements or unique hazards. | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

* Indicates training required by legislation/regulation

| **Acknowledgement**** | | |
|---|---|---|
| Employee Name (Print) | Employee Signature | Date |
| Supervisor Name (Print) | Supervisor Signature | Date |

** When *Acknowledgements* are completed the original goes to the SH&E Administrator (for inclusion in the employee's file and upload to the LMS) and copies are provided to the employee and supervisor.

* Indicates training required by legislation/regulation

# S3NA-003-FM3 Training Needs Assessment – Administrative Employees

## 1.0 Scope and Purpose

1.1 This form applies to all North America AECOM employees solely performing Administrative functions.

1.2 These employee will only work in an AECOM office location and will not travel to project sites, clients sites, or travel for any business purposes.

## 2.0 List of Compliance Training

2.1 Training listed is general in nature and will not address client-specific training requirements or specialized job functions including.

2.2 Although this list of training is provided as a guideline of training an employee needs to complete to do their job, it is the responsibility of the supervisor and/or project manager to confirm that the appropriate level of training is being assigned to the employee with regard to their specific job and task assignments and client needs.

2.3 The list of training below is not to be considered an all inclusive list of training needs.

| Training | Hours to Complete Training | Related SOP | Training Frequency (Years) | Applies to US/Canada Employees |
|---|---|---|---|---|
| HzM(US)/TDG(CAN) Shipping - Awareness Training | 0.5 | 509 | 3 | US, Canada |
| Level 1 Shipper - HzM(US)/TDG(CDN) - Performance Training | 4.0 | 509 | 3 | US, Canada |
| Office Ergonomics - Awareness Training | 0.5 | 102 | 2 | US, Canada |
| OPTIONAL TRAINING - Fire Extinguisher - Awareness Training; AECOM will not require you to operate a fire extinguisher in the office, only evacuate the office safely. | 0.5 | 106 | Annual | US, Canada |
| HazCom(US)/WHMIS(CDN) - Awareness Training* | 0.5 | 508 | Annual | US, Canada |
| SH&E Fundamentals - Awareness Training | 2.0 | 003, 209 | Annual | Canada |
| SH&E Fundamentals - Awareness Training | 2.0 | 003, 209 | 3 | US |
| Workplace Safety & Health Committee - Performance Training* | 16.0 | | Initial - Training does not require renewal | Canada |
| **Total (Initial)** | **26.0** | **Total (Annual renewal)** | | **~5.5** |

| Acknowledgement | | |
|---|---|---|
| Employee Name (Print) | Employee Signature | Date |
| Supervisor Name (Print) | Supervisor Signature | Date |

# S3NA-003-FM4 Training Needs Assessment – Technical Employees

## 1.0 Scope and Purpose

1.1 This form applies to all North America AECOM employees performing Technical functions.

1.2 These employee perform work in AECOM office locations as well as active AECOM project sites.

1.3 Technical employees will not be expected to perform supervisory functions.

## 2.0 List of Compliance Training

2.1 Training listed is general in nature and will not address client-specific training requirements or specialized job functions including.

2.2 Although this list of training is provided as a guideline of training an employee needs to complete to do their job, it is the responsibility of the supervisor and/or project manager to confirm that the appropriate level of training is being assigned to the employee with regard to their specific job and task assignments and client needs.

2.3 The list of training below is not to be considered an all inclusive list of training needs.

| **Training** * Indicates training is required by applicable regulation/legislation. | **Hours to Complete Training** | **Related SOP** | **Training Frequency (Years)** | **Applies to US/Canada Employees** |
|---|---|---|---|---|
| AED - Performance Training | 0.5 | 101, 203, 207 | Annual | US |
| Asbestos - Awareness Training* | 0.8 | 501 | Annual | US, Canada |
| Bear Safety - Awareness Training | 1.0 | 313, 503 | 2 | Canada |
| Biological Hazards - Awareness Training | 1.0 | 503 | 2 | US, Canada |
| Client-Specific Railroad Safety Training - Awareness Training | 2.0 | 201 | Determined by Client | US, Canada |
| Complete AECOM Driver's Acknowledgement Form | 0.0 | 005 | 2 | US, Canada |
| Confined Space - Awareness Training* | 1.0 | 301 | Annual | US |
| Confined Space - Awareness Training* | 1.0 | 301 | 3 | Canada |
| Construction Awareness; consult your RSHE&M and Supervisor to determine specific training topics. | 4.0 | Varied depending on job tasks | Initial - Training does not require renewal | US |
| CPR - Performance Training | 2.5 | 203, 207 | Annual | US |
| Driver & Vehicle Safety - Awareness Training | 0.5 | 005 | 2 | US, Canada |
| E-Railsafe - Awareness Training* | 1.0 | 201 | 2 | US |
| Fall Protection - Awareness Training* | 0.8 | 304 | 3 | US, Canada |
| Field Safety - Awareness Training. Consult your RSH&EM about the need for Medical Surveillance. | 4.0 | 209 | 2 | US, Canada |

| **Training** * Indicates training is required by applicable regulation/legislation. | **Hours to Complete Training** | **Related SOP** | **Training Frequency (Years)** | **Applies to US/Canada Employees** |
|---|---|---|---|---|
| Fire Extinguisher - Awareness Training* | 0.5 | 106, 206 | 1 | US, Canada |
| First Aid - Performance Training* | 2.5 | 101, 207 | 3 | US |
| H2S - Awareness Training* | 0.8 | 508 | Annual | US |
| H2S - Awareness Training* | 8.0 | 508 | 3 | Canada |
| HazCom(US)/WHMIS(CDN) - Awareness Training* | 0.5 | 508 | Annual | US, Canada |
| Hearing Protection - Awareness Training*. Consult your RSH&EM about the need for Medical Surveillance. | 0.8 | 207 | Annual | US, Canada |
| Heavy Equipment Operations & Safety - Awareness Training* | 0.5 | 309 | 3 | US, Canada |
| HzM(US)/TDG(CAN) Shipping - Awareness Training* | 0.5 | 509 | 3 | US, Canada |
| Industrial Ergonomics - Awareness Training | 0.7 | 308 | 3 | US, Canada |
| Lead Safety - Awareness Training* | 0.8 | 513 | Annual | US, Canada |
| Level 1 Shipper - HzM(US)/TDG(CDN) - Performance Training* | 4.0 | 509 | 3 | US, Canada |
| Lockout/Tagout - Awareness Training* | 0.8 | 302, 410 | 3 | US, Canada |
| Office Ergonomics - Awareness Training | 0.5 | 102 | 2 | US |
| Office Ergonomics - Awareness Training* | 0.5 | 102 | 2 | Canada |
| Railroad Worker Protection - Awareness Training* | 1.5 | 201 | Annual | US, Canada |
| Respiratory Protection - Awareness Training*. Consult your RSH&EM about the need for Medical Surveillance. | 0.8 | 519 | Annual | US, Canada |
| SH&E Fundamentals - Awareness Training | 2.0 | 003, 209 | Annual | Canada |
| SH&E Fundamentals - Awareness Training | 2.0 | 003, 209 | 3 | US |
| Standard First Aid, with CPR & AED Performance Training* | 16.0 | 101, 207 | 3 | Canada |
| Traffic Safety - Awareness Training | 0.7 | 306 | 3 | US, Canada |
| Trenching & Excavation Safety - Awareness Training* | 0.8 | 303 | 3 | US, Canada |

| **Training** * Indicates training is required by applicable regulation/legislation. | **Hours to Complete Training** | **Related SOP** | **Training Frequency (Years)** | **Applies to US/Canada Employees** |
|---|---|---|---|---|
| Workplace Safety & Health Committee - Performance Training* | 16.0 | | Initial - Training does not require renewal | Canada |
| **Estimated Initial Total (US/CAN)** | **37.8/68.5** | **Estimated Annual Renewal Total (US/CAN)** | | **19.9/24.5** |

| **Acknowledgement** | | |
|---|---|---|
| Employee Name (Print) | Employee Signature | Date |
| Supervisor Name (Print) | Supervisor Signature | Date |

# S3NA-003-FM5 Training Needs Assessment – Employee Supervisors & Project Managers

## 1.0 Scope and Purpose

1.1 This form applies to all North America AECOM employees performing project and employee supervisory functions.

1.2 These employee perform work in AECOM office locations as well as active AECOM project sites.

## 2.0 List of Compliance Training

2.1 Training listed is general in nature and will not address client-specific training requirements or specialized job functions including.

2.2 Although this list of training is provided as a guideline of training an employee needs to complete to do their job, it is the responsibility of the supervisor and/or project manager to confirm that the appropriate level of training is being assigned to the employee with regard to their specific job and task assignments and client needs.

2.3 The list of training below is not to be considered an all inclusive list of training needs.

| **Training** * Indicates training is required by applicable regulation/legislation. | **Hours to Complete Training** | **Related SOP** | **Training Frequency (Years)** | **Applies to US/Canada Employees** |
|---|---|---|---|---|
| AED - Performance Training | 0.5 | 101, 203, 207 | Annual | US |
| Asbestos - Awareness Training* | 0.8 | 501 | Annual | US, Canada |
| Bear Safety - Awareness Training | 1.0 | 313, 503 | 2 | Canada |
| Biological Hazards - Awareness Training | 1.0 | 503 | 2 | US, Canada |
| Canadian Due Diligence - OH&S Training* | 3.0 | C45 | Initial - Training does not require renewal | Canada |
| Client-Specific Railroad Safety Training - Awareness Training | 2.0 | 201 | Determined by Client | US, Canada |
| Complete AECOM Driver's Acknowledgement Form | 0.0 | 005 | 2 | US, Canada |
| Confined Space - Awareness Training* | 1.0 | 301 | Annual | US |
| Confined Space - Awareness Training* | 1.0 | 301 | 3 | Canada |
| Construction Awareness; consult your RSHE&M and Supervisor to determine specific training topics. | 4.0 | Varied depending on job tasks | Initial - Training does not require renewal | US |
| CPR - Performance Training* | 2.5 | 101, 207 | Annual | US |
| Driver & Vehicle Safety - Awareness Training | 0.5 | 005 | 2 | US, Canada |

| **Training** * Indicates training is required by applicable regulation/legislation. | **Hours to Complete Training** | **Related SOP** | **Training Frequency (Years)** | **Applies to US/Canada Employees** |
|---|---|---|---|---|
| Electrical Safety - Awareness Training* | 0.8 | 302, 410 | 2 | US |
| E-Railsafe - Awareness Training* | 1.0 | 201 | 2 | US |
| Fall Protection - Awareness Training* | 0.8 | 304 | 3 | US, Canada |
| Field Safety - Awareness Training. Consult your RSH&EM about the need for Medical Surveillance. | 4.0 | 209 | 2 | US, Canada |
| Fire Extinguisher - Awareness Training* | 0.5 | 106, 206 | 1 | US, Canada |
| First Aid - Performance Training* | 2.5 | 101, 207 | 3 | US |
| H2S - Awareness Training* | 0.8 | 508 | Annual | US |
| H2S - Awareness Training* | 8.0 | 508 | 3 | Canada |
| HazCom(US)/WHMIS(CDN) - Awareness Training* | 0.5 | 508 | Annual | US, Canada |
| Hearing Protection - Awareness Training*. Consult your RSH&EM about the need for Medical Surveillance. | 0.8 | 207 | Annual | US, Canada |
| Heavy Equipment Operations & Safety - Awareness Training* | 0.5 | 309 | 3 | US, Canada |
| HzM(US)/TDG(CAN) Shipping - Awareness Training* | 0.5 | 509 | 3 | US, Canada |
| Incident Investigation - Awareness Training* | 2.0 | Varied depending upon province | Initial - Training does not require renewal | Canada |
| Industrial Ergonomics - Awareness Training | 0.7 | 308 | 3 | US, Canada |
| Lead Safety - Awareness Training* | 0.8 | 513 | Annual | US, Canada |
| Level 1 Shipper - HzM(US)/TDG(CDN) - Performance Training* | 4.0 | 509 | 3 | US, Canada |
| Lockout/Tagout - Awareness Training* | 0.8 | 302, 410 | 3 | US, Canada |
| Office Ergonomics - Awareness Training | 0.5 | 102 | 2 | US |
| Office Ergonomics - Awareness Training* | 0.5 | 102 | 2 | Canada |
| Railroad Worker Protection - Awareness Training* | 1.5 | 201 | Annual | US, Canada |

| **Training** * Indicates training is required by applicable regulation/legislation. | **Hours to Complete Training** | **Related SOP** | **Training Frequency (Years)** | **Applies to US/Canada Employees** |
|---|---|---|---|---|
| Respiratory Protection - Awareness Training*. Consult your RSH&EM about the need for Medical Surveillance. | 0.8 | 519 | Annual | US, Canada |
| SH&E Fundamentals - Awareness Training | 2.0 | 003, 209 | Annual | Canada |
| SH&E Fundamentals - Awareness Training | 2.0 | 003, 209 | 3 | US |
| Standard First Aid, with CPR & AED Performance Training* | 16.0 | 101, 207 | 3 | Canada |
| Traffic Safety - Awareness Training | 0.7 | 306 | 3 | US, Canada |
| Trenching & Excavation Safety - Awareness Training* | 0.8 | 303 | 3 | US, Canada |
| Workplace Safety & Health Committee - Performance Training* | 16.0 | | Initial - Training does not require renewal | Canada |
| **Estimated Initial Total (US/CAN)** | **37.8/68.5** | **Estimated Annual Renewal Total (US/CAN)** | | **19.9/24.5** |

| **Acknowledgement** | | |
|---|---|---|
| Employee Name (Print) | Employee Signature | Date |
| Supervisor Name (Print) | Supervisor Signature | Date |

# S3NA-003-FM6 Training Needs Assessment – On-site Project Supervisors

## 1.0 Scope and Purpose

1.1 This form applies to all North America AECOM employees performing on-site project supervisory functions.

1.2 These employee perform work in AECOM office locations as well as active AECOM project sites.

## 2.0 List of Compliance Training

2.1 Training listed is general in nature and will not address client-specific training requirements or specialized job functions including.

2.2 Although this list of training is provided as a guideline of training an employee needs to complete to do their job, it is the responsibility of the supervisor and/or project manager to confirm that the appropriate level of training is being assigned to the employee with regard to their specific job and task assignments and client needs.

2.3 The list of training below is not to be considered an all inclusive list of training needs.

| **Training** * Indicates training is required by applicable regulation/legislation. | **Hours to Complete Training** | **Related SOP** | **Training Frequency (Years)** | **Applies to US/Canada Employees** |
|---|---|---|---|---|
| AED - Performance Training | 0.5 | 101, 203, 207 | Annual | US |
| Asbestos - Awareness Training* | 0.8 | 501 | Annual | US, Canada |
| Bear Safety - Awareness Training | 1.0 | 313, 503 | 2 | Canada |
| Biological Hazards - Awareness Training | 1.0 | 503 | 2 | US, Canada |
| Canadian Due Diligence - OH&S Training* | 3.0 | C45 | Initial - Training does not require renewal | Canada |
| Client-Specific Railroad Safety Training - Awareness Training | 2.0 | 201 | Determined by Client | US, Canada |
| Competent Person Function Specific Training - Designation made by Project Manager in consultation with RSH&EM.* | | 202 + Specific Technical SOP | 2 | US, Canada |
| Complete AECOM Driver's Acknowledgement Form | 0.0 | 005 | 2 | US, Canada |
| Confined Space - Performance Training* | 8.0 | 301 | 3 | Canada |
| Confined Space - Performance Training*. Consult your project Safety Plan and Regional SH&E Manager to determine training required per your job role and function. | 8.0 | 301 | Annual | US |

| **Training** * Indicates training is required by applicable regulation/legislation. | **Hours to Complete Training** | **Related SOP** | **Training Frequency (Years)** | **Applies to US/Canada Employees** |
|---|---|---|---|---|
| Construction Awareness; consult your RSHE&M and Supervisor to determine specific training topics. | 4.0 | Varied depending on job tasks | Initial - Training does not require renewal | US |
| CPR - Performance Training* | 2.5 | 101, 207 | Annual | US |
| Driver & Vehicle Safety - Awareness Training | 0.5 | 005 | 2 | US, Canada |
| Electrical Safety - Awareness Training* | 0.8 | 302, 410 | 2 | US |
| E-Railsafe - Awareness Training* | 1.0 | 201 | 2 | US |
| Fall Protection - Performance Training* | 4.0 | 304 | 3 | US, Canada |
| Field Safety - Awareness Training. Consult your RSH&EM about the need for Medical Surveillance. | 4.0 | 209 | 2 | US, Canada |
| Fire Extinguisher - Awareness Training* | 0.5 | 106, 206 | 1 | US, Canada |
| First Aid - Performance Training* | 2.5 | 101, 207 | 3 | US |
| H2S - Awareness Training* | 0.8 | 508 | Annual | US |
| H2S - Awareness Training* | 8.0 | 508 | 3 | Canada |
| HazCom(US)/WHMIS(CDN) - Awareness Training* | 0.5 | 508 | Annual | US, Canada |
| Hearing Protection - Awareness Training*. Consult your RSH&EM about the need for Medical Surveillance. | 0.8 | 207 | Annual | US, Canada |
| Heavy Equipment Operations & Safety - Awareness Training* | 0.5 | 309 | 3 | US, Canada |
| HzM(US)/TDG(CAN) Shipping - Awareness Training* | 0.5 | 509 | 3 | US, Canada |
| Incident Investigation - Awareness Training* | 2.0 | Varied depending upon province | Initial - Training does not require renewal | Canada |
| Industrial Ergonomics - Awareness Training | 0.7 | 308 | 3 | US, Canada |
| Lead Safety - Awareness Training* | 0.8 | 513 | Annual | US, Canada |
| Level 1 Shipper - HzM(US)/TDG(CDN) - Performance Training* | 4.0 | 509 | 3 | US, Canada |

| **Training** * Indicates training is required by applicable regulation/legislation. | **Hours to Complete Training** | **Related SOP** | **Training Frequency (Years)** | **Applies to US/Canada Employees** |
|---|---|---|---|---|
| Lockout/Tagout - Performance Training* | 4.0 | 302, 410 | 2 | US, Canada |
| Office Ergonomics - Awareness Training | 0.5 | 102 | 2 | US |
| Office Ergonomics - Awareness Training* | 0.5 | 102 | 2 | Canada |
| OSHA 10-Hour Construction - Awareness Training* | 10.0 | State/Project Requirement | Initial with varying renewal | US |
| Radiation Safety - Awareness Training* | 1.0 | 516 | Annual | US, Canada |
| Railroad Worker Protection - Awareness Training* | 1.5 | 201 | Annual | US, Canada |
| Respiratory Protection - Awareness Training*. Consult your RSH&EM about the need for Medical Surveillance. | 0.8 | 519 | Annual | US, Canada |
| Scaffolding Safety - Awareness Training* | 0.8 | 311 | 3 | US, Canada |
| SH&E Fundamentals - Awareness Training | 2.0 | 003, 209 | Annual | Canada |
| SH&E Fundamentals - Awareness Training | 2.0 | 003, 209 | 3 | US |
| Standard First Aid, with CPR & AED Performance Training* | 16.0 | 101, 207 | 3 | Canada |
| Traffic Safety - Awareness Training | 0.7 | 306 | 3 | US, Canada |
| Trenching & Excavation Safety - Awareness Training* | 0.8 | 303 | 3 | US, Canada |
| Workplace Safety & Health Committee - Performance Training* | 16.0 | | Initial - Training does not require renewal | Canada |
| **Estimated Initial Total (US/CAN)** | **59.3/86.0** | **Estimated Annual Renewal Total (US/CAN)** | | **29.8/30.0** |

| **Acknowledgement** | | |
|---|---|---|
| Employee Name (Print) | Employee Signature | Date |
| Supervisor Name (Print) | Supervisor Signature | Date |

# S3NA-003-FM7 Training Needs Assessment – Line Managers

## 1.0 Scope and Purpose

1.1 This form applies to all North America AECOM employees performing Line (Department, District, Region, etc.) Management functions.

1.2 These employees primarily perform work in AECOM office locations and may occasionally work on AECOM project sites.

## 2.0 List of Compliance Training

2.1 Training listed is general in nature and will not address client-specific training requirements or specialized job functions including.

2.2 Although this list of training is provided as a guideline of training an employee needs to complete to do their job, it is the responsibility of the supervisor and/or project manager to confirm that the appropriate level of training is being assigned to the employee with regard to their specific job and task assignments and client needs.

2.3 The list of training below is not to be considered an all inclusive list of training needs.

| **Training** * Indicates training is required by applicable regulation/legislation. | **Hours to Complete Training** | **Related SOP** | **Training Frequency (Years)** | **Applies to US/Canada Employees** |
|---|---|---|---|---|
| Canadian Due Diligence - OH&S Training* | 3.0 | C45 | Initial - Training does not require renewal | Canada |
| Complete AECOM Driver's Acknowledgement Form | 0.0 | 005 | 2 | US, Canada |
| Driver & Vehicle Safety - Awareness Training | 0.5 | 005 | 2 | US, Canada |
| Field Safety - Awareness Training. Consult your RSH&EM about the need for Medical Surveillance. | 4.0 | 209 | 2 | US, Canada |
| HazCom(US)/WHMIS(CDN) - Awareness Training* | 0.5 | 508 | Annual | US, Canada |
| HzM(US)/TDG(CAN) Shipping - Awareness Training* | 0.5 | 509 | 3 | US, Canada |
| Incident Investigation - Awareness Training* | 2.0 | Varied depending upon province | Initial - Training does not require renewal | Canada |
| Office Ergonomics - Awareness Training | 0.5 | 102 | 2 | US |
| Office Ergonomics - Awareness Training* | 0.5 | 102 | 2 | Canada |

| **Training** * Indicates training is required by applicable regulation/legislation. | **Hours to Complete Training** | **Related SOP** | **Training Frequency (Years)** | **Applies to US/Canada Employees** |
|---|---|---|---|---|
| SH&E Fundamentals - Awareness Training | 2.0 | 003, 209 | Annual | Canada |
| SH&E Fundamentals - Awareness Training | 2.0 | 003, 209 | 3 | US |
| Workplace Safety & Health Committee - Performance Training* | 16.0 | | Initial - Training does not require renewal | Canada |
| **Estimated Initial Total (US/CAN)** | **8.0/29.0** | **Estimated Annual Renewal Total (US/CAN)** | | **3.8/5.2** |

| **Acknowledgement** | | |
|---|---|---|
| Employee Name (Print) | Employee Signature | Date |
| Supervisor Name (Print) | Supervisor Signature | Date |

# S3NA-003-FM8 SH&E Training Course & Instructor Evaluation

| **Course Name:** | | | | | |
|---|---|---|---|---|---|
| **Date:** | | **Start Time:** | | **Stop Time:** | |

**Type of Training (Check One):** **AECOM Live (Classroom)☐** **AECOM Live (WebEx/Teleconference)☐**
**AECOM eLearning☐** **External Live☐** **External eLearning☐** **OTHER: ☐**

| **Lead Instructor:** | **Instructor 1:** | **Instructor 2:** |
|---|---|---|
| | | |

| | Excellent | Good | Average | Below Average | Poor | Not Applicable |
|---|---|---|---|---|---|---|
| 1. Please rate the quality of the training materials in the following categories: | | | | | | |
| a. The training was technically accurate. | ☐5 | ☐4 | ☐3 | ☐2 | ☐1 | ☐NA |
| b. The training and discussion aligned with the training objectives. | ☐5 | ☐4 | ☐3 | ☐2 | ☐1 | ☐NA |
| c. The training was practical and relevant to my job at AECOM. | ☐5 | ☐4 | ☐3 | ☐2 | ☐1 | ☐NA |
| 2. Please provide your assessment of the Trainer's presentation skills and abilities: | | | | | | ☐NA |
| a. Instructor was knowledgable in the subject matter. | ☐5 | ☐4 | ☐3 | ☐2 | ☐1 | ☐NA |
| b. Instructor was capable of clearly and effectively communicating and teaching. | ☐5 | ☐4 | ☐3 | ☐2 | ☐1 | ☐NA |
| c. Instructor was able to accurately answer my questions. | ☐5 | ☐4 | ☐3 | ☐2 | ☐1 | ☐NA |
| d. Instructor was able to engage the class and maintain my attention. | ☐5 | ☐4 | ☐3 | ☐2 | ☐1 | ☐NA |
| 3. Please provide your assessment of the training event as a whole in the following categories: | | | | | | ☐NA |
| a. How do you rate the quality of audio/visual materials, handouts and other training aids? | ☐5 | ☐4 | ☐3 | ☐2 | ☐1 | ☐NA |
| b. How do you rate the overall quality of the entire training event? | ☐5 | ☐4 | ☐3 | ☐2 | ☐1 | ☐NA |
| c. Was the training location comfortable and large enough to accomodate your class? | ☐5 | ☐4 | ☐3 | ☐2 | ☐1 | ☐NA |

Please list any new skills, techniques, or ideas you learned during this training session that you will apply to your job.

Please provide any additional comments on the training.

# S3NA-003-WI1 Training Needs Assessment Process

## 1.0 Requirements

1.1 This work instruction applies to all AECOM Americas Geography employees and provides options through which an employee can complete a SH&E TNA.

## 2.0 References

2.1 None

## 3.0 Process

3.1 Employees will complete a SH&E TNA upon hire, annually thereafter in conjunction with their annual performance review, and upon any significant changes in their job function.

3.2 Supervisors will verify that their direct reports have complete a TNA through one of the processes defined below. It is the responsibility of hte supervisor and/or project manager to confirm that hte appropriate level of training is being assigned to the employee with regard to their specific job task assignments and client needs.

3.3 Employes will complete a SH&E TNA through one of three processes:

- Through completion of the employee-specific SH&E TNA:
  - Electronic version – America's SH&E Training page
  - Paper version – S3NA-003-FM2 Training Needs Assessment
- Through adoption of the list of compliance training as specified in *S3NA-003-FM3– FM 7Training Needs Assessments*; or
- Through development of process that provides a comparable level of assessment as the SH&E TNA.

3.4 Completed SH&E TNA will be provided to SH&EA for capture within the AECOM LMS.

## 4.0 Records

4.1 None

## 5.0 Attachments

5.1 S3NA-003-FM2 Training Needs Assessment

5.2 S3NA-003-FM3 Training Needs Assessment – Administrative Employees

5.3 S3NA-003-FM4 Training Needs Assessment – Technical Employees

5.4 S3NA-003-FM5 Training Needs Assessment – Employee Supervisors & Project Managers

5.5 S3NA-003-FM6 Training Needs Assessment – On-Site Project Supervisors

5.6 S3NA-003-FM7 Training Needs Assessment – Line Managers

# S3NA-003-WI2 Training Delivery

## 1.0 Training Courses & Content

### 1.1 Course Content

1.1.1 AECOM developed and delivered training will be designed to meet the organizational needs and goals of AECOM.

1.1.2 Training may be provided through external resources and in such cases training content will be evaluated for applicability and acceptability.

1.1.3 The structure of the course content will generally be consistent with the following:

- Introduction to the training topic.
- Standards applicable to the training, i.e. regulatory/legislative, AECOM SOP, etc.
- Training objectives
- Primary course content
  - Significance of topic as it relates to AECOM
  - Expectations to apply the skills and knowledge provided
  - Examples of the training being applied on specific AECOM projects
- Training summary
- Comprehension assessment

1.1.4 The specific content of the course will vary depending on the number of topics covered during the course, the complexity of the course content and the level of certification being offered.

1.1.5 A syllabus will be developed for AECOM developed training consistent with the syllabus template, *S3NA-003-TP1 SH&E Training Syllabus Template*.

1.1.6 The level of certification being offered will determine the level of comprehension assessment being performed.

### 1.2 Course Content Reviews

1.2.1 Course content shall be periodically reviewed, with no greater than three years between reviews.

1.2.2 The **SH&E Training Manager, Region SH&E Manager,** or their designee, shall conduct course content reviews. Reviews will be made to determine if training materials are still relevant to AECOM and the need to modify content accordingly.

1.2.3 Results from training evaluations will also be incorporated into course content reviews and modifications.

1.2.4 For courses where training is provided on an annual basis, course content will be updated annually, or multiple versions of training may be developed for rotating use, to provide participants with new learning materials and avoid stagnation.

1.2.5 All modifications made to SH&E training will be performed to maintain compliance with this SOP, and additional applicable SOP and regulatory/legislative standards.

1.2.6 When modifications to course syllabus and training materials are made, revisions will be approved by the **SH&E Training Manager, Region SH&E Manager,** or their designee and communicated to all Authorized Instructors for use and application.

## 2.0 Authorized Instructors

2.1 The **SH&E Training Manager**, **Region SH&E Managers**, or their designee, will authorize personnel to deliver SH&E training.

2.2 The **SH&E Training Manager** will assess instructor capabilities and provide feedback in order to promote the consistent delivery of training materials in alignment with known adult learning principles.

2.3 Instructor assessments will be performed through live observation of training delivery as well as the use of *S3NA-003-FM8 SH&E Training Course and Instructor Evaluation* or the Training Course & Instructor Evaluation Survey found on the Americas SH&E Training Calendar.

2.4 Results of the training evaluation will be complied and the **SH&E Training Manager** shall review evaluation results, provide feedback to instructors on areas of positive performance, as well as recommendations to improve delivery techniques.

## 3.0 Comprehension Assessment & Certification

3.1 The level of certification being sought will determine the level of comprehension assessment that participants must successfully complete in order to receive credit for completing the training module.

3.2 Comprehension assessments may take the form of structured tests and quizzes, proficiently demonstrating the performance of related skills, discussion of training materials, or other forms that demonstrate to the instructor that the participant has retained and can perform the objectives of the training.

3.3 The different levels of certification are detailed with recommended comprehension assessment techniques. Comprehension assessment techniques for each training course will be specified within the training syllabus.

3.4 The training instructor will validate the attendance form and provide certificates, where appropriate, to participants.

3.5 Results of training and certificates will be uploaded by local **SH&E Administrators** into the AECOM Learning Management System (LMS).

## 4.0 Certification Levels

### 4.1.1 Information Dissemination

- Information is provided to employees through verbal or written communication. This type of training may be used in scenarios where the goal is to provide information to employees with no expectation of implementation or executing a regulatory requirement or AECOM SOP.
- The communication is mostly one way and there is no confirmation or knowledge assessment (i.e. test, interactive discussion, etc.) that the employee must pass to demonstrate understanding and meet a training goal.
- Examples of this type of communication would be newsletters, safety alerts, webinar presentations, video only presentations, etc.

### 4.1.2 Awareness Level Certification

- Awareness-level certifications are applicable to training where the primary goal is to transfer knowledge from the organization to participants.
- Training will typically take the form of instructor-lead discussions, presentation of related video content, and/or self-directed e-learning modules.
- In most cases comprehension assessment will be performed through discussion of the training topic with the participants and/or a simple quiz.
- When quizzes are provided employees will successfully complete at least 75% of the questions.

### 4.1.3 Performance Level Certification

- Performance-level certifications will build upon the Awareness level.
- The goal of Performance Training is to have an employee successfully demonstrate that they can apply the knowledge discussed during training and perform the desired skills necessary to perform their job.
- Training materials are provided and discussed, and will incorporate a demonstration of the skills to be completed.

- The instructor will gauge the level of understanding through interactive discussion with participants and a pass/fail designation of demonstrated skills by the employee.
- A test or quiz of moderate difficulty will be provided, with participants scoring 80% or better, followed by the successful demonstration of the desired skill to receive certification.

4.1.4 **Competent Person Level Certification**

- Competent Person-level certifications may be applicable to, and dictated by, specific regulatory standards.
- When Competent Person-level certifications are offered, comprehension assessments will build upon Performance-level certification.
- Competent Person certifications will incorporate classroom training along with on-the-job mentoring provided by employees previously certified to the Competent Person-level in the area of competency being sought.
- Candidates for Competent Person certification will be required to score 85% or better on administered written exams. Additionally, candidates must be capable of repeatedly demonstrating the desired skills both in a classroom setting as well as in an actual work setting to the Instructor, Project Manager for the project the employee is seeking to gain and apply the certification to, and/or the mentoring Competent Person.
- Competent Person(s) will be designated on a project-by-project basis, in accordance with SH&E SOP S3NA_202_PR_*Competent Person Designation.* Forms to document certification and designation of a Competent Person are provided with the SOP and a record of the designation will be maintained within the project files and LMS.

## 5.0 Expiration of Training

5.1 Training expirations will be defined for each course offered in the course syllabus.

5.2 Employees with expired compliance training will not engage in activities associated with the training until training and certifications have been updated.

5.3 Supervisors will work with employees to determine when training is set to expire and develop individual training plans in order to maintain compliance.

5.4 AECOM will use its LMS to track completion of compliance and conformance training and report back to operations on overall training performance.

# S3NA-003-WI3 Training Documentation

## 1.0 Employee Training File

### 1.1 Minimum Requirements

1.1.1 Supervisor-approved personal training requirements (Training Needs Assessment).

1.1.2 Certificates will be offered for all classes offered and completed, and must indicate:

- Employee name
- Course name, and applicable reference to specific regulatory requirement
- Instructor's printed name and signature
- Date(s) of class
- Company name
- Number of Continuing Education Units (CEU) or Professional Development Hours (PDH) credits, if eligible
- Course attendance or sign-in sheets shall have the signature and ID number of all employees

### 1.2 Data Formats

1.2.1 Electronic Records (Learning Management System) – An electronic database tracking system that maintains employee safety training information (dates, course name, certificates, etc.), including training certificates. Data will be entered by local SH&E Administrators, and each supervisor is responsible to see that the database is current for personnel under their responsibility.

1.2.2 Hardcopy Records (Paper) – Each employee is required to maintain a personal file with hardcopies of their certification(s) from all (internal, external, intranet, Internet) training providers.

## 2.0 Training Courses

### 2.1 Records

2.1.1 An individual training summary will be maintained for each course which must include:

- For each AECOM-delivered training call the sign-in sheet (*S3NA-003-FM1 SH&E Training Sign In Sheet*) will indicate:
  - Course Name
  - Training location information
  - Date(s)
  - Class start and stop time
  - Employee name, signature, location and employee identification number
  - Course outline (list of topics discussed) corresponding to the approved training syllabus
  - Instructors' name(s) and signature(s)
- For external vendor classes equivalent documentation is required.

2.1.2 Expiration of training will be tracked in the AECOM LMS with SH&E Administrators updating training expiration dates when entering/updating training certificates.

# S3NA-003-TP1 Training Syllabus – [COURSE TITLE]

| | |
|---|---|
| **Course Title** | (Insert Course Title) |
| **Duration** | # Hours |
| **Regulatory/policy applicability** | (Insert regulatory and/or SOP reference) |
| **Comprehension assessment method** | (Insert assessment method [Quiz, Test, Skill Performance] and the percentage required to pass) |
| **Certification Level** | (Insert certification level) |
| **Duration of Training Validity** | (Insert expiration, if applicable) |
| **Intended Participants** | (Use Regulatory citation or SHE SOP reference to describe who the training is applicable to, and should be or is required to participate.) |
| **Learning Objectives** | (Briefly describe learning objectives for the training and how they will be assessed.) |

## Training Prerequisites:

- Employee SH&E Orientation including SH&E Fundamentals eLearning

(Discuss any training that may need to be completed prior to attending this course. Examples may include completion of 40-Hour HAZWOPER for 8-Hour HAZWOPER Refresher, or Awareness training required to be completed prior to a Functional/Competency Certification course.)

## Course Outline:

(Detail the contents of the course that will include duration and delivery methods. Provide additional description of who the training is applicable to and how participants will be assessed to ensure adequate knowledge transfer. Complete the table below that will be used in creating the attendance sheet that will serve as the record of training.)

| Module Title | Module Duration* | Module Content (Specify eLearning provider where applicable) |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

* Indicates module is delivered as eLearning by AECOM or authorized provider.

## Expiration of Training:

Training is valid for X years. Re-fresher training may utilize local resources or hands-on training to focus on elements which are unique to the location. Some AECOM Clients may require refresher training on a more frequent basis and it is the responsibility of the project team to ensure all employees meet the training needs of their client. If an employee is unable to produce a valid training certificate where one is needed they may be required to complete a new course.

## Revision History:

| Revision | Date | Change |
|---|---|---|
| Original | (Date) | N/A |
| Revision 1 | | |

AECOM

# CERTIFICATE OF COMPLETION

## [Course Name]

This is to recognize that

# [EMPLOYEE]

Has completed AECOM SH&E Training Course [Title], required by [Regulatory and/or SOP Reference] on [DATE]. Training expires on [DATE].

[Trainer Name]
[Trainer Title]

# S3NA-004 PR Incident Reporting

## 1.0 Purpose and Scope

1.1 To provide direction for timely reporting SH&E incidents.

1.2 This procedure applies to all AECOM Americas based employees and operations.

## 2.0 Terms and Definitions

2.1 **SH&E Incident Reporting and Assistance Line: 1-800-348-5046**

2.1.1 Email: sri@aecom.com (for locations that cannot access IndustrySafe)

2.1.2 **IndustrySafe on-line reporting link:** https://www.industrysafe.com/AECOM

2.2 **SH&E Incidents**: The following events or situations as applied to AECOM employees and/or AECOM-controlled operations are considered SH&E Incidents:

2.2.1 Any injury or illness to an AECOM employee, that could be potentially work related or become aggravated by the work environment. This includes an AECOM subcontractor, temporary employee, or third party contractor that performs work under the control of an AECOM operation.

2.2.2 Any abnormal condition to include pain and soreness shall be reported.

2.2.3 Fire, explosion, or flash that is not an intended result of a remediation process, laboratory procedure, or other planned event.

2.2.4 Any incident involving company-owned, rented, or leased vehicles (including personal vehicles used for company business).

2.2.5 Any breach of a numeric limit attached to a governmental permit or consent.

2.2.6 Any failure to perform the requirements of a non-numeric requirement contained in a government permit or consent.

2.2.7 Any failure to obtain a government permit or consent when required (including failure to obtain revisions before an existing permit or consent expires).

2.2.8 Any notice of violation or notice of non-compliance received from a regulatory authority with enforcement powers.

2.2.9 Property damage resulting from any AECOM or subcontractor activity. This would include Motor Vehicle Accidents (MVA, buildings, equipment, and near miss events as described in 2.2.15).

2.2.10 Unexpected release or imminent release of a hazardous material.

2.2.11 Unexpected chemical exposures to workers or the public.

2.2.12 A safety, health or environmental related injury, damage, incident or complaint associated with the public as it relates to an AECOM activity.

2.2.13 SH&E-related incidents that could result in adverse public media interest concerning AECOM or an AECOM project.

2.2.14 Any inspection by a federal, provincial, or local safety, health, & environmental enforcement agency.

2.2.15 **Near-Miss Incidents:** This is defined as an incident having the potential to cause injury, health effects, environmental impairment, or property damage as described in the above categories – but did not. For example:

2.2.15.1 A crane drops a 454 kilogram (1,000 pound) beam during a lift – and nobody is hurt, no equipment or property is damaged.

2.2.15.2 A work crew is conducting a survey along the highway. A vehicle leaves the roadway and the vehicle enters the survey area at 80 kph (50 mph). The vehicle misses an employee by 1 metre (3 feet); the driver recovers control of the vehicle and leaves the area.

2.2.15.3 Awareness of a verified equipment recall or incident that occurs at another similar worksite.

2.2.15.4 Unsafe conditions should not be reported as Near Misses but should be identified in Inspection and Observation Programs (such as LifeGuard and Office Inspections) and tracked until resolved/closed.

2.2.16 **Security incident:** Any security related incident that could cause harm to or is associated with an AECOM employee in the course of duty

2.2.18 **Major SH&E Incident:** Any SH&E Incident that meets/involves the following criteria:

2.2.18.1 Fatality.

2.2.18.2 Amputation.

2.2.18.3 Hospitalization for treatment for more than 24 hours. (Admission).

2.2.18.4 Absence from work for more than thirty (30) calendar days due to work-related injury/illness.

2.2.18.5 Any single event resulting in more than one employee requiring medical treatment or more than one employee being away from work more than three (3) days.

2.2.18.6 Any SH&E-related Consent Agreement/Order/Lawsuit or enforcement action seeking more than $10,000 or alleging criminal activity.

2.2.18.7 Any spill or release of a hazardous material that is reportable to a regulatory agency.

2.2.18.8 Any Notices of Violation resultant of not operating within a government permit/license or consent.

2.2.18.9 Any incident resulting in property damage expected to exceed $2500 US dollars.

2.2.18.10 Any security related incident that could have caused harm to an AECOM employee or results in property damage expected greater than $2500 US dollars.

2.2.18.10 Near Miss incidents that may have resulted in any of the above but because of "luck" did not happen.

2.3 **Fatality:** Loss of life of any AECOM employee, AECOM subcontractor personnel, client personnel or member of the general public that can be perceived to be related to work performed or controlled by AECOM.

2.4 **General Liability:** Incidents where AECOM could potentially be held liable.

2.5 **AECOM Recordable Injury:** A work related injury or illness that results in the following. **(**See S3NA-601-PR Recordkeeping for definitions).

2.5.1 Fatality

2.5.2 Medical Treatment beyond first aid

2.5.3 Days away from work

2.5.4 Restricted work or transfer to another job

2.5.5 Loss of Consciousness

2.5.6 A Significant injury or illness diagnosed by a medical professional

2.6 Workers Compensation Analyst manages all Americas based injury and illness claims.

2.7 **Lost Time Injury or Illness:** A work-related injury or illness that has caused a worker to be absent from his or her regular work following the day that the injury or illness occurred.

2.8 **Restricted Work (also called "Modified Work"): A work-related** injury or illness that results in the employee being unable to perform one or more of the routine functions of their job. The restricted duties are done within the limitation of the injured person's abilities. (Documentation may be required per regulatory requirements).

2.9 **SH&E Incident Report (IR):** Form used to document incidents which shall be completed when there is no internet access to IndustrySafe. Within 4 hours for a Major Incident and 24 hours for all others. IR's should be submitted to the Supervisor and Regional SH&E Manager.

2.10 **Business Services:** AECOM support functions of Legal, Human Resources, Communications, SH&E Department, etc.

2.11 **WCB:** Workers Compensation Board (Canada; known provincially by variations such as WCB, WSIB, CSST, WSCC, etc.).

2.12 **WC Carrier/Claims:** Workers Compensation Third Party Insurance Partner.

## 3.0 Attachments

3.1 S3NA-004-FM1 SH&E Incident Report (IR)

3.2 S3NA-004-FM2 Near-Miss Incident Report

3.3 S3NA-004-WI1 SH&E Reporting Flowchart

3.4 S3NA-004-WI2 Incident Response and Reporting Instructions

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Employees**. Each employee involved in an SH&E incident will:

- Notify his/her **Supervisor** immediately that an incident (including a Near- Miss) has occurred, the circumstances involved, the nature and extent of the injuries/illness, and whether medical treatment may be required. Except for emergency situations, affected employees are required to discuss their injury/illness status with their supervisor and **Regional SH&E Manager, District SH&E Manager,** and/or project SH&E Professional prior to obtaining medical treatment.
- Contact the SH&E **Incident Line at 1-800-348-5046** for work related non-emergency medical advice by Work Care and/or to obtain AECOM contact information
- Complete Industry Safe on-line reporting **within 4 hours** of incident. If injury/illness prevents input, Supervisor will be responsible for initial input. If employees lack internet access to IndustrySafe, a hardcopy Incident Report form shall be completed and submitted to the **Regional or District SH&E Manager**. If incident is not **Major** as defined above, IndustrySafe input by the end of workday (24 hours maximum) is required.

4.1.2 **Supervisors**.

**Supervisors** will be responsible for the following:

- In an emergency/life-threatening situation, use the appropriate local emergency phone numbers and seek immediate medical care for the **employee**.
- Address any immediate corrective actions required to make the scene safe. Consult with the **Region SH&E Manager** and leadership if guidance is required.
- For **Major Incidents** immediately contact the Regional Executive and SH&E Manager **by phone** once the situation has stabilized.
- Complete an initial incident notification in the IndustrySafe on-line report if employee is not capable/incapacitated and any other applicable documentation .pdf and attach to the on-line report such as:
  a. Police Report
  b. Photographs of incident scene
  c. Witness statements
  d. Federal/State/Province Specific Forms
  e. Timeline

f. Root cause analysis

- As appropriate, initiate an Incident Investigation and Review per the requirements of *S3NA-603-PR Incident Investigation and Review*.
- Completion of any external reporting requirements. For example, the U.S. Coast Guard CG-3865, Recreational Boating Accident Report may be required if the incident involved a boat (contact the **Region SH&E Manager** for clarification). See *S3NA-004-WI2 Incident Response and Reporting* for further instruction.

- Where there is potential for criminal, civil or regulatory action against AECOM or any of its employees or subcontractors, a representative of AECOM Americas legal team (typically regional legal counsel) shall be contacted **prior to any external communication**, correspondence, or meeting concerning any incident, governmental investigation, or environment impact. AECOM's Americas Chief Counsel, or designee, may supplement this policy or require additional measures to protect the best interests of AECOM and its employees. PRO and Risk Management should also be notified if the public is involved or a claim is anticipated.

4.1.3 **Regional SH&E Manager**

- Coordinate with the appropriate District SH&E Manager.
- Monitor phone, messaging, and IndustrySafe for first report of incident and contact those involved for support as necessary.
- Upon receipt of an Incident Notification, contact the **Supervisor** to discuss the incident as well as short term and long term corrective actions.
- Coordinate Case Management with the AECOM Corporate Medical Provider for non urgent medical guidance, if needed.
- Notify and Coordinate with appropriate **Operations Manager** of the incident.
- As appropriate, assist an Incident Investigation and Review.
- Report all fatalities and/or Major SH&E incidents to the **Americas SH&E Director, Business Line Executive** and **Regional Executive** immediately by phone if not already notified by the Supervisor.

4.1.3 **District SH&E Managers**

- **Inform appropriate personnel that have not already been notified of incidents that may affect them.**
- Review electronic entry of incident information in IndustrySafe and coach Supervisors and Employees on completing investigations. Be responsible to manage open incidents until closure.
- Coordinate with **Regional SH&E Manager** for management of medical support.
- Assist with Incident Investigation and Review per the requirements of *S3NA-603-PR Incident Investigation and Review*.
- Forward incident data as needed to **Business Services** for insurance claims.
- Enter Corrective actions as a result of Incident Investigation and Executive Incident Review into the AECOM Americas tracking system to monitor completion.

4.1.4 **Workers' Compensation Analyst**

- If an employee potentially requires support under Worker's Compensation, the employee will be contacted by the AECOM Workers Compensation Analyst. The employee's manager shall also work with the Workers Compensation Analyst as needed in support of the employee. Prior to the employee returning to work after any treatment provided by a medical provider, a medical clearance is to be provided by the employee to the Workers Compensation Analyst and their Manager. The medical clearance will be scanned and added to the IndustrySafe incident by the employee or supervisor.
- Every attempt will be made to accommodate reasonable restricted and modified duties to facilitate a safe return to work of the injured employee. The return to work program is based on the specific needs and circumstances to each case. Each instance will be evaluated on a case-by-case basis. The resulting modified work program will be specific to the injured employee. In

Canada, a third party administrator works with the Workers Compensation Analystor other designated staff (Canada East HR). The third party administrator is familiar with the reporting requirements by province, which vary slightly between jurisdictions across Canada and completes filings and maintains correspondence with the appropriate board on the company's behalf.

## 5.0 Records

5.1 Incident reports and supporting documentation are maintained in the IndustrySafe database.

5.2 If a hardcopy Incident Report is generated it should ultimately be scanned and kept in the IndustrySafe database. All incident information must be retained by AECOM. Records relating to occupational injury and incidents must be kept for up to 30 years (or permanently in the Northwest Territories), depending on the classification of incident.

## 6.0 References

6.1 S3NA-601- PR Recordkeeping

6.2 S3NA-603-PR Incident Investigation and Review

6.3 S3NA-606-PR Modified Duty Program

6.4 S2-001-PR1 Incident Reporting (Global Implementing Procedures)

# S3NA-004-FM1
# SH&E INCIDENT REPORT

AECOM

1. SEEK IMMEDIATE MEDICAL ATTENTION IF NECESSARY
2. EMPLOYEE MUST REPORT ALL INCIDENTS TO THEIR SUPERVISOR IMMEDIATELY.
3. REPORT THE INCIDENT TO THE APPROPRIATE INCIDENT REPORTING LINE.

**(800) 348-5046**

## ORGANIZATION INFORMATION

**REGION:** CANADA NORTH South West

**DISTRICT:**

**PROJECT NUMBER:**

**BUSINESS LINE:** AECOM CORP GROUP SERVICES CONSTRUCTION SERVICES (CSG) ENERGY & POWER ENVIRONMENT PDD TRANSPORTATION WATER

**CLIENT NAME:**

**PROJECT NAME:**

## ADMINISTRATIVE

**EMPLOYEE NAME:**

**EMPLOYEE NUMBER:**

**WORK PHONE:**

**CELL PHONE:**

**EMPLOYEE STATUS** FULL TIME PART TIME SUB TEMP AGENCY THIRD PARTY

**HOME OFFICE ADDRESS:**

**JOB TITLE:**

## DESCRIPTION OF EVENT

**TYPE OF OCCURRENCE:** INJURY/ILLNESS PROPERTY DAMAGE ENV DAMAGE/SPILL REGULATORY INSPECTION MOTOR VEHICLE ACCIDENT BOATING INCIDENT NOV/CITATION OTHER BE SPECIFIC

**DATE OF INCIDENT:**

**TIME OF INCIDENT:**

**DATE REPORTED TO SUPERVISOR:**

**TIME REPORTED TO SUPERVISOR:**

**INCIDENT ADDRESS/LOCATION:**

**CITY:**

**STATE/PROVINCE/TERRITORY:**

**ZIP/POSTAL CODE:**

**WERE THERE ANY SUBCONTRACTORS, WITNESSES OR OTHER PERSONS INVOLVED:** YES NO

**IF YES, PLEASE PROVIDE DETAILS TO INCLUDE NAMES AND CONTACT INFORMATION**

## PERSONAL INJURY

**TYPE OF INJURY:** FIRST AID (TREATED ON-SITE) MEDICAL AID (TREATED BY PROFESSIONAL) FATALITY

**DESCRIBE THE INJURY AND BODY PART AFFECTED:** ***BE SPECIFIC STATEMENTS BELONG ON PAGE 2***

**WAS A DOCTOR OR HOSPITAL VISITED?** YES NO

**IF YES, WHEN:**

**MEDICAL RECEIVED:**

**DOCTOR/HOSPITAL NAME:**

**PROVIDER ADDRESS:**

**PHONE NUMBER:**

**TYPE OF DAMAGE:** AECOM PROPERTY MOTOR VEHICLE (COMPLETE MVA REPORT PAGE 3) SPILL OR RELEASE OF A HAZARDOUS SUBSTANCE MAJOR STRUCTURAL FAILURE CLIENT, SUBCONTRACTOR, OTHER:

**DESCRIBE THE SPECIFIC DAMAGE, STRUCTURAL FAILURE OR HAZARDOUS RELEASE:**

**RANK THE SEVERITY OF THE DAMAGE:** MINOR SERIOUS MAJOR

# S3NA-004-FM1
## SH&E INCIDENT REPORT

WHERE CAN THE PROPERTY BE SEEN?

PROPERTY OWNER NAME: CONTACT INFORMATION:

IS THERE ANY POTENTIAL FOR CIVIL, CRIMINAL OR REGULATORY LIABILITY AGAINST AECOM OR AN EMPLOYEE? YES NO

IF YES, DISCUSS WITH AECOM REGIONAL COUNSEL BEFORE PROCEEDING WITH ANY FURTHER REPORTING.

INDICATE WHO HAS BEEN NOTIFIED OF THE EVENT (E.G., OWNER/OPERATOR, STATE (US) OR GOVERNING BODY OF LABOUR, ETC?

*What, when, where, why, how? Attached notes/diagrams as required and list any machinery or equipment involved.*

**ON-SITE/CORRECTIVE ACTIONS**

INCIDENT IMMEDIATELY REPORTED ON-SITE TO:

WHAT CORRECTIVE ACTIONS WERE IMMEDIATELY IMPLEMENTED ON-SITE?

WHAT LONG-TERM OR PERMANENT CORRECTIVE ACTIONS ARE RECOMMENDED?

**ACKNOWLEDGEMENTS**

EMPLOYEE DESCRIPTION OF INCIDENT:

*What, when, where, why, how? Attached notes/diagrams as required and list any machinery or equipment involved*

| EMPLOYEE PRINTED NAME AND PHONE | SIGNATURE AND DATE |
|---|---|

SUPERVISOR REVIEW OF INCIDENT:

| SUPERVISORS PRINTED NAME AND PHONE | SIGNATURE AND DATE |
|---|---|

MANAGER COMMENTS:

| MANAGER PRINTED NAME AND PHONE | SIGNATURE AND DATE |
|---|---|

FOR REGIONAL SH&E MANAGER USE ONLY:

NAME AND SIGNATURE: DATE:

RECORDABILITY DETERMINATION FIRST AID RECORDABLE RECORDABILITY UNDETERMINED NON WORK

PROPERTY DAMAGE GENERAL LIABILITY VANDALISM

COMMENTS:

**ATTENTION:**

**THIS FORM MUST BE COMPLETED AND EMAILED TO SRI@AECOM.COM OR FORWARDED TO THE REGIONAL SH&E MANAGER WITHIN ONE (1) BUSINESS DAY FOLLOWING THE OCCURRENCE OF THE INCIDENT.**

Submit Form

# MOTOR VEHICLE ACCIDENT (MVA) REPORT

## *ONLY COMPLETE THIS PAGE FOR VEHICLE INCIDENTS*

| | | | |
|---|---|---|---|
| **ADMINISTRATIVE** | | | |
| **AECOM VEHICLE:** FLEET RENTAL PERSONAL | | **JOB ACTIVITY AT TIME OF MVA:** | |
| **DATE OF MVA:** | **TIME OF MVA:** | **LOCATION OF MVA:** | |
| **MANAGER:** | | **NUMBER OF VEHICLES INVOLVED:** | |

***REMEMBER:*** **STAY CALM.**
Do not admit liability, agree to pay for any damage or sign any document except as required by law.

| | | |
|---|---|---|
| **AECOM DRIVER INFORMATION** | | |
| **DRIVER:** | **AECOM PASSENGERS:** | **OTHER PASSENGERS:** |
| **DRIVER'S LICENSE:** | **PROVINCE/STATE ISSUED:** | **EXPIRATION DATE:** |
| **INJURIES TO DRIVER:** | | |
| **INJURIES TO PASSENGERS:** | | |
| **AECOM VEHICLE INFORMATION** | | |
| **YEAR:** | **MAKE:** | **MODEL:** |
| **SERIAL/VIN #:** | **LICENSE PLATE #:** | **REGISTRATION #:** |
| **OWNER:** | **INSURANCE COMPANY:** | **POLICY #:** |
| **COMMERICIAL MOTOR VEHICLE :** | **I F RENTED OR PERSONAL, CONTACT INFORMATION OF OWNER:** | |
| **RANK THE SEVERITY OF THE DAMAGE TO THE VEHICLE:** 0 - $500 | $500 - $1000 $1000 - $4000 | >$4000 |
| **DESCRIPTION OF DAMAGE TO THE BODY OF THE VEHICLE:** | | |
| **OTHER DRIVER/VEHICLE INFORMATION** | | |
| **YEAR:** | **MAKE:** | **MODEL:** |
| **SERIAL/VIN #** | **LICENSE PLATE #:** | **REGISTRATION #:** |
| **DRIVER'S NAME:** | **CONTACT INFO:** | **LICENSE #:** |
| **OWNER:** | **INSURANCE COMPANY:** | **POLICY #:** |
| **IF RENTED OR PERSONAL, CONTACT INFORMATION OF OWNER:** | | |
| **DESCRIPTION OF DAMAGE TO THE BODY OF THE OTHER VEHICLE:** | | |

| | |
|---|---|
| **ACCIDENT DESCRIPTION** | |
| **EXACT LOCATION OF MVA** (HIGHWAY KM, INTERSECTION, EXACT ADDRESS, ETC.)**?** | |
| **OTHER PROPERTY DAMAGED:** | |
| **DESCRIBE THE EVENTS LEADING UP TO AND THE INCIDENT** (REPORT FACTS ONLY: SPEED OF VEHICLES, DIRECTION TRAVELING, WEATHER CONDITIONS, ETC. DO NOT GIVE OPINIONS REGARDING CAUSE OF ACCIDENT OR LOSS.)**:** | |
| **DID THE POLICE ATTEND THE SCENE:** YES NO | **CITATION ISSUED:** YES NO **TO WHO:** |
| **POLICE :** | **CONTACT INFO:** |
| **WITNESS:** | **CONTACT INFO:** |
| **WITNESS:** | **CONTACT INFO:** |
| **SUBMIT THIS MVA REPORT WITH A COMPLETED SUPERVISORS REPORT OF INCIDENT TO THE APPROPRIATE MANAGER** | |
| **HAS AN SUPERVISORS REPORT OF INCIDENT BEEN COMPLETED?** YES NO | |
| **COMPLETED BY:** | **SIGNATURE:** |

# S3NA-004-FM2 Near-Miss Report

## Near-Miss Report

If unable to access IndustrySafe. Please use this form to report any near-misses, you encounter as a part of your work. This may include office or field locations.

**ADMINISTRATIVE**

| | |
|---|---|
| **PROJECT NAME & NUMBER:** ☐ **N/A** | **LOCATION:** |
| **EMPLOYEE NAME:** | **EMPLOYEE NUMBER:** |
| **HOME OFFICE:** | **DEPARTMENT NUMBER:** |
| **MANAGER:** | **JOB TASK/PROJECT DESCRIPTION:** |
| **DATE AND TIME OF NEAR MISS:** | **DATE AND TIME REPORTED:** |

| **Work Activity** | ☐ Office | ☐Driving | ☐Field | ☐Lab | ☐Other: ________________ |
|---|---|---|---|---|---|

*REMEMBER: IDENTIFYING A NEAR MISS DOES NOT IMPLY GUILT BUT ASSISTS IN PREVENTING INCIDENTS OR INJURIES.*

**OBSERVATION, RISK OR NEAR MISS DETAILS**

**NEAR MISS POTENTIAL OUTCOME:** ☐ INJURY/ILLNESS ☐ PROPERTY DAMAGE ☐ ENVIRONMENTAL DAMAGE

**POTENTIAL SEVERITY:** ☐ MINOR ☐ SERIOUS ☐ FATAL

**DESCRIPTION OF NEAR MISS:**

**POTENTIAL IMMEDIATE CAUSES**

- ☐ Procedures not followed
- ☐ Use of tools or equipment
- ☐ Use of protective measures
- ☐ Inattention/Lack of awareness
- ☐ Protective systems
- ☐ Tools, equipment, & vehicles
- ☐ Work exposures to…
- ☐ Work place environmental/layout

**POTENTIAL SYSTEM CAUSES**

- ☐ Physical capacity
- ☒ Physical condition
- ☐ Mental state
- ☐ Behavior
- ☐ Skill level
- ☐ Training/Knowledge transfer
- ☐ Mngmt/Supervision/Employee leadership
- ☐ Contractor selection & design
- ☐ Engineering/Design
- ☐ Work planning
- ☐ Purchasing, material handling/controls
- ☐ Tools & equipment
- ☐ Work rules/policies/stds/procedures
- ☐ Communication
- ☒ Other:_________________________

**CORRECTIVE ACTIONS**

Corrective Action Category Identified to Prevent Future Reoccurrence

(*Identify relevant issues in checkboxes and provide detail below, as applicable*)

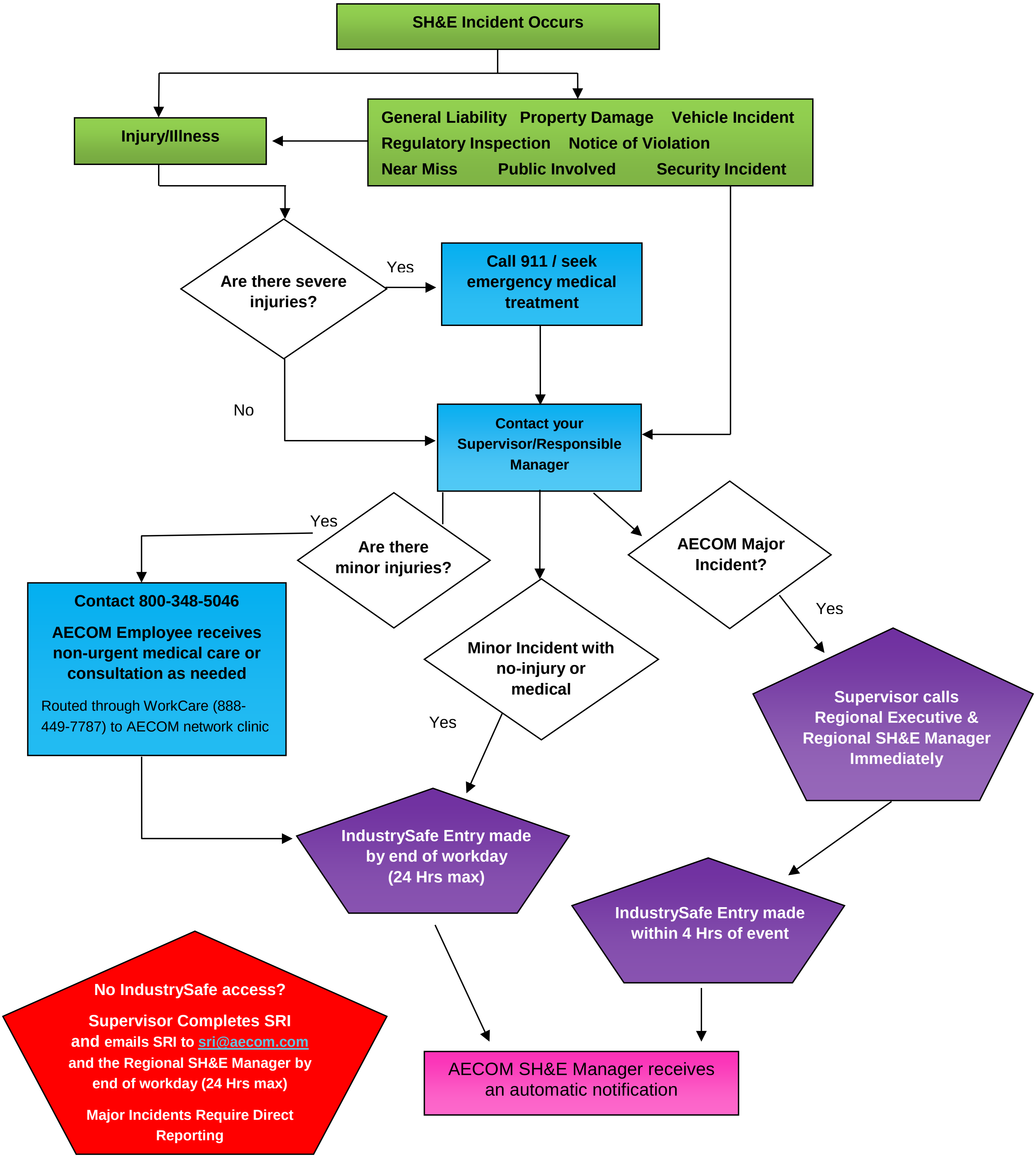
- ☐ Different/New PPE needed
- ☐ New tool(s)/equipment needed
- ☐ Additional/proper personnel needed
- ☐ Change in working procedure
- ☐ New STOP WORK trigger identified
- ☐ Additional training/skills needed
- ☐ Improved housekeeping efforts
- ☐ Modified working behaviors
- ☐ Improved work planning
- ☐ Other:_________________________

# Near-Miss Report

If unable to access IndustrySafe. Please use this form to report any near-misses, you encounter as a part of your work. This may include office or field locations.

| | |
|---|---|
| **WERE IMMEDIATE CORRECTIVE ACTIONS IMPLEMENTED?** ☐ **YES** ☐ **NO** IF YES, PLEASE DESCRIBE:<br>**WHAT LONG-TERM CORRECTIVE ACTIONS ARE RECOMMENDED?** | |
| **FOR SH&E MANAGEMENT USE ONLY:** | |
| **CORRECTIVE ACTIONS REQUIRING IMPLEMENTATION:** | **RATIONALE:** |
| **COMMUNICATED BACK TO EMPLOYEE:** ☐ | **COMMUNICATED BACK TO MANAGER:** ☐ |
| **COMPLETED BY:** | **DATE:** |

# S3NA-004-WI1 Incident Reporting Flowchart



# S3NA-004-WI2 Incident Response and Reporting Instructions

## 1.0 Steps for Initial Response

1.1 Take control of the scene (get everyone's attention and cooperation).

1.2 If necessary call for emergency services and provide first aid/CPR.

1.3 Control secondary incidents (ensure hazards are removed or controlled; issue a stop work order, if required).

1.4 Identify sources of evidence.

1.5 Preserve evidence. In the event of a critical injury, the incident scene must be preserved for the potential site visit of a representative from the applicable government agency (if you are unsure, error on the side of caution and leave the site intact).

1.6 Report the incident to the immediate supervisor for implementing stop work orders or immediate corrective action as required.

1.7 Responsible employee/supervisor is to follow SHE Incident Reporting Procedure to initiate internal reporting and obtain guidance, as necessary. If a manager or supervisor is not available, any AECOM employee can initiate the reporting or make the call.

1.8 The Employee / Supervisor completes the entry into IndustrySafe.

## 2.0 Fatality or Serious SH&E Incident Notification

2.1 **Any fatality or serious SH&E incident** is to be directly reported via a verbal dialog as soon as practical (i.e. as soon as the site is secure and appropriate local emergency response is coordinated), but in no case more than 2 hours after the incident to the appropriate Regional SH&E Manager and Regional Executive.

2.2 Voicemail and/or email alone are not adequate to meet this requirement. The responsibility for this reporting belongs to the responsible manager.

(**i.e. supervisor/office/branch/business line/project manager**).

## 3.0 Internal Reporting Procedures

3.1 The call (from the scene of the incident, if possible) or entry into IndustrySafe initiates the reporting procedures.

3.2 **For Emergency Injuries and Incidents**

*Call 911*

Managers call their appropriate supervision and their Regional SH&E Manager immediately once the situation is safe and stabilized.

The responsible manager, or delegate, must make initial notification into IndustrySafe within 4 hours of the event.

3.3 **Non-emergency injuries or medical conditions**

Notify your responsible manager, supervisor/project manager.

Call the Incident Reporting and Assistance Line at 1.800.348.5046 for connection with Work Care physician support

The employee or responsible manager must make initial notification into IndustrySafe within 4 hours of the event.

3.4 **Property damage, environmental releases, and non-medical incidents**

3.4.1 Immediate assistance circumstances

Contact your responsible manager, supervisor/project manager.

Call the Incident Reporting and Assistance Line at 1.800.348.5046 for situations that require immediate assistance (property damage estimated above $2,500, utility strikes, incidents involving the public, security-related incidents, etc.). The Assistance Line will connect you to the proper authorities within AECOM.

The employee or responsible manager must make initial notification into IndustrySafe within four hours of the event.

3.4.2 Non-critical and no-injury incidents

Examples include: Property damage less than $2,500, all near misses, etc.

Contact your responsible manager, supervisor/project manager.

The employee or responsible manager must make case entry into IndustrySafe within 24 hours of the event.

3.5 The employee involved in an incident shall complete incident reporting in IndustrySafe, or delegate to their responsible manager, within the required timeline for the category of event from 3.3 through 3.4 above.

- If the employee is unable to complete the report because of the severity of the injuries, the responsible manager, should start the IndustrySafe entry and notification process.

3.6 The Responsible Manager will contact the RSHEM to:

- Confirm that on-site corrective actions were implemented,
- Determine the need for HR involvement (for medical aid incidents, WCB/WSIB/H&W/ WC reporting, and modified work cases),
- Determine the need for review by the District Manager,
- Identify and complete any other external reporting requirements (client, ministry responsible for labour, ministry responsible for environment), and
- Work with Regional Counsel or Media Communications as needed

3.7 The Regional SH&E Manager must:

- Initiate an internal or external investigation of the incident, as necessary (Regional Counsel may request/oversee an external investigation).
- Review the information and provide it to SH&E support staff within 24 hours. If no investigation is required, identify any corrective actions that can be implemented at the program level (safe work practices, equipment, training, safety bulletins, policies or procedures) to safeguard against a recurrence of the incident.
- Work with the manager, Human Resources, and Regional Counsel or Media Communications, as required.

## 4.0 External Reporting Procedures

4.1 Notification to external regulatory agencies (i.e. OSHA, ministry of labour/environment, WCB, WSIB, WC, H&W, etc) is to be done in accordance with S3NA_601_PR_Recordkeeping

4.2 The Responsible Managerin conjunction with the Regional SH&E Manager will determine what (if any) external reporting obligations must be met. For example:

4.2.1 **Client.** To a Client whom the employee was conducting work for at the time of the incident or accident. Health and safety requirements will vary for different clients, and therefore client reporting will be handled on an individual basis by the manager(s) involved.

4.2.2 **State and OH&S Governing** Agency. Reporting to the State, governing body of labour or OH&S (Canadian provincial/territorial ministry responsible for labour) by the employer (AECOM management/representative) will be done in accordance with regulatory requirements. Since reporting requirements vary slightly between jurisdictions throughout North America, the following can only be used as rough guidelines for determining whether or not a call should be made to the governing body:

- If a fatality or permanent injury is incurred;
- If the accident/incident involved a major structural failure or collapse of a building, bridge, tower, crane, hoist, temporary construction support system or excavation; or

- If the accident/incident involved the major release of a hazardous substance
- If required by OSHA (such as 3 or more hospitalized, etc.)

4.2.3 Environmental Governing Agency. To the governing body for the environment and spill reporting (provincial/territorial ministry responsible for environment) by the employer (AECOM management/representative). Reporting requirements vary slightly between jurisdictions:

- Spills, releases or other damage to the environment. (For minimum quantities for reporting based on the type of product spilled or released, refer to the applicable legislation.).

**: R PNYA RNa R a b f NgN b : NaR NY Y RYRN R R a0 a aSPNa**

4.3.1 Any SH&E incident involving medical treatment for an AECOM employee, release of a hazardous material/substance and/or breach of a numeric or non-numeric permit/consent limit is to be reported as soon as possible, but not later than the end of the work-shift, to the Regional SH&E Manager, Regional/Business Line Manager and Group SH&E Director by using a direct communication method (face-to-face or phone call). Responsibility for this reporting belongs to the responsible project/location/department manager.

### 4.4 Worker's Compensation.

4.4.1 AECOM's Workers Compensation Analyst will be responsible for working with the appropriate manager if the employee is off work for any length of time, if a modified work program will be created for the individual, or if there are any long-term implications from the accident.

4.4.2 **Canada.** Reporting to the WCB must be completed by both the employee(s) injured in the mishap and the employer (AECOM management/representative). Reporting requirements vary slightly between jurisdictions across Canada, therefore, the following can only be used as rough guidelines for determining whether or not a call should be made to the appropriate agency:

- If the employee requires medical treatment (by a medical practitioner, not just first aid);
- If the employee is off of work beyond the day of the accident;
- If the employee has to perform different or fewer work duties;
- If a fatality or permanent injury is incurred.

4.4.3 **United States.** Injured U.S. based employees will be referred to the Workers Compensation Analyst for potential claims processing. Workers Compensation regulations vary by State. The Workers Compensation Analyst and the RSH&E Manager will ensure that appropriate State reporting has been completed, as applicable. For property damage incidents with any potential resulting liability to the company will be referred to the Insurance group and liability carrier for claims processing. Any fatality or hospitalization of three or more employees must be called into OSHA within 8 hours.

# S3NA-005-PR Vehicle and Driver Safety Program

## 1.0 Purpose and Scope

1.1 Establish an AECOM program for safe operation of vehicles in order to reduce the risks to which AECOM employees are exposed while operating a motor vehicle.

1.2 This procedure applies to all AECOM North America based employees and operations.

## 2.0 Terms and Definitions

2.1 **Authorized Driver:** AECOM employees who possess and provide proof of a current driver's license with full privileges and has completed, at a minimum the AECOM Driver & Vehicle Safety Awareness Training. Proof of insurance is also required when using personal vehicles on AECOM business.

2.2 **Distracted Driving:** Any activity that takes the driver's attention away from the primary task of driving.

2.3 **Incident:** An incident, for the purposes of this procedure, is a vehicle collision or other event where personal injury or property damage occurs, or where a citation is issued while on AECOM business under certain circumstances. This may also include acts of theft, vandalism, and criminal mischief. Circumstances for citations to be considered as incidents include, but are not limited to, an instance where the citation results in the restriction or suspension of the employee's ability to legally operate a motor vehicle, a governmental motor vehicle agency assigning points to the employee's license, or the employee receives a citation where AECOM insurance is provided as proof of insurance at the time of issuance.

2.4 **Local Laws:** All signs, postings, laws, regulations, ordinances and codes applicable for the jurisdiction in which the motor vehicle is being operated.

2.5 **Mobile Device:** Any mobile electronic device that is used to receive or communicate voice, email, internet, and/or public media. The device requires user interaction (typing, dialing, reading, keying, etc.) that distracts the motor vehicle operator. Example devices include, but are not limited to:

- Mobile/Cellular phones
- Personal Data Assistant (PDA)
- iPads or other tablet models
- Computers
- Global Positioning System receivers

2.6 **Operating Under the Influence (OUI):** OUI is the operation of any vehicle on company business under the influence of alcohol, drugs, medications, or other substances capable of inducing an altered mental state and/or impairing physical and mental judgments such that the influence of said substances produces impairment in violation of governmental laws for the location of the impairment.

2.7 **Spotters:** Extra personnel that may provide guidance when maneuvering in close and/or complex situations in order to avoid the occurrence of an incident.

## 3.0 Attachments

3.1 S3NA-005-FM Driver's Acknowledgement Form

3.2 S3NA-005-WI Driver Safe Work Practices

# 4.0 Procedure

## 4.1 Roles and Responsibilities

4.1.1 **District Managers** will be responsible for the following:

- Verifying that any company vehicle under their operational control is in a preventative maintenance program
- Verifying that all company vehicles are properly insured per AECOM policy
- Verifying that a local pre-operational vehicle inspection program was established

4.1.2 **Supervisors** will be responsible for the following:

- Confirming employees are informed of the provisions of this procedure.
- Providing a copy of this procedure to any employee who will be driving an AECOM owned, leased or personal vehicle for company business.
- Verifying that each employee has completed the S3NA-005-FM Driver's Acknowledgement Form and submitted the completed form to:
  - For Canadian Employees, the Driver's Acknowledgement Form will be submitted to Canadahrssc@aecom.com, or by mail to: AECOM, Markham West, 105 Commerce Valley Dr. West, Markham, ON L3T 7W3
  - For U.S. Employees, the Driver's Acknowledgement Form will be submitted to HRRecords@aecom.com, or by fax to: 84-515-8304, or by US Mail to: HR Records, AECOM, 4840 Cox Road, Glen Allen, VA 23060.

4.1.3 **SH&E Department** will be responsible for the following:

- Maintaining and updating an eLearning course detailing AECOM's *Vehicle and Driver Safety Awareness* materials.
- Maintaining this procedure and updating it when regulatory or company policies dictate.
- Assisting operational leaders with determining the risk incurred by the use of motor vehicles.
- Making available supplementary driving safety training beyond AECOM's *Vehicle and Driver Safety Awareness*

4.1.4 **Employees** will be responsible for the following:

- Following this procedure and all applicable laws while operating a vehicle.
- Immediately reporting all vehicle incidents per our incident reporting policy.
- Notifying their Supervisor, Region SH&E Manager, and Region Counsel upon receipt of a legal summons associated with any moving violation related to the use of a company vehicle.
- Immediately reporting any change or limitation(s) to his or her Driver's License to his or her **Supervisor** and making the required modifications to their Driver's Acknowledgement Form.
- Conducting a pre-operational inspection of the vehicle for any damage or deficiencies; reporting any discovered deficiencies affecting the safe operation of the motor vehicle to the local office authority.

4.1.5 **Region Human Resources Manager** will be responsible for the following:

- Obtaining a copy of an employee's Motor Vehicle Record (MVR), as required.
- Supporting disciplinary action, as necessary.

4.1.6 **Region Counsel** will be responsible for the following:

- Providing direction to the employee and Supervisor relative to the receipt of any legal summons relative to a moving violation incurred in a company vehicle.
- Obtaining an official copy of the police/accident report associated with any company vehicle, as requested.

### 4.2 General Procedures and Practices

4.2.1 Only Authorized Drivers shall operate a motor vehicle (rental, personal, or AECOM owned/leased) while on AECOM business.

4.2.2 Drivers must comply with AECOM's Global Travel Policy and the applicable state laws on the use of cell phones and other mobile devices while operating a motor vehicle. [NOTE: *Individual state, provincial, and local laws vary*.]

4.2.3 Texting while driving is strictly prohibited.

4.2.4 Seat belts shall be worn by all occupants whenever the vehicle is in motion.

4.2.5 The number of passengers shall not exceed the manufacturer's specifications for the vehicle.

4.2.6 Loads shall be secured and shall not exceed the manufacturer's specifications and legal weight limits for the vehicle, or regulatory requirements (i.e., threshold for DOT)

4.2.7 Motorcycles may not be operated on company business unless:

- Specific approval is provided by the Supervisor.
- A hazard analysis is completed.
- Required training and license is in place.

4.2.8 Staff inexperienced in two-way radio communication protocols and/or driving on gravel roads shall get on-site training from experienced personnel.

4.2.9 Headlights or daytime running lights will be used at all times the vehicle is operating.

### 4.3 AECOM Owned or Leased Vehicles (additional requirements)

4.3.1 The granting of driving privileges for AECOM owned or leased vehicles shall include the following:

- Possession of the appropriate qualifications.
- Having a good driving record.
- Complying with the procedures set out in this section and with applicable Safe Work Practices adopted and issued through the AECOM SH&E program.

4.3.2 An **employee's** driving privileges for company business may be removed at any time at the sole discretion of AECOM.

### 4.4 Authorized drivers shall:

4.4.1 Perform pre-operation vehicle inspections.

4.4.2 Arrange for preventive maintenance services for the vehicle and maintain it in sound mechanical condition.

4.4.3 Not operate the vehicle if unsafe or if conditions exist that would likely result in vehicle damage or personal injury.

4.4.4 Not use the vehicle for any unofficial use including personal business unless specific permission is given by the Supervisor.

4.4.5 Transport only persons on AECOM related business or those persons receiving transportation as a prescribed service.

4.4.6 Not pick up hitchhikers.

4.4.7 Not use the vehicle for transportation to or from work or park at a residence overnight unless approved by the employee's Supervisor.

4.4.8 Not smoke or allow anyone else to smoke in the vehicle.

4.4.9 Be responsible for any damage caused by abuse of the vehicle.

4.4.10 Secure the vehicle when left unattended.

4.4.11 Upon request the HR Representative will provide a copy of the **employee's** driving report to AECOM's insurance carrier.

4.4.12 An **employee** will be deemed to have an unsatisfactory driving record if, during the immediately preceding three (3) years, the employee has had their Driver's License suspended or revoked, or has had more than two (2) minor convictions, or a major conviction, or more than one (1) at fault claim, or more than six (6) demerits points for driving violations.

4.4.13 To maintain driving privileges, AECOM may require the **employee** to take a defensive driver course at AECOM's expense.

4.4.14 If the **employee's** driving privileges are revoked and their position requires the use of a vehicle for AECOM business, AECOM may, at its discretion, attempt to identify a suitable alternative position with AECOM for which use of a vehicle is not required and which is consistent with the **employee's** skills and AECOM's operating needs.

4.4.15 AECOM reserves the right to require **employees** to take in-car driver training should driving conditions, performance or their driving record warrant it.

### 4.5 Vehicle Maintenance

4.5.1 Vehicles shall be fit for purpose and shall be maintained in a safe working order, with seat belts fully functional. This applies to all vehicles owned or leased by AECOM and to personally-owned vehicles used for company business.

### 4.6 Safety Equipment

4.6.1 The following suggested items should be kept in all vehicles used for company business in remote project locations:

- First Aid kit, appropriate to the work and crew size, or per regulations.
- Emergency equipment (e.g., flares, flashlight, blanket, etc.) based on conditions.
- Supervisors Report of Incident

**4.6.2 Driver Fitness**

4.6.3 Drivers are responsible for being appropriately licensed, trained and medically fit to operate the vehicle.

4.6.4 AECOM **employees** operating vehicles on AECOM business shall be alert and not operate a vehicle when fatigued.

### 4.7 Driver Impairment

4.7.1 Drivers shall not operate a motor vehicle while under the influence of alcohol or drugs, or any other substance or medication that impairs their ability to drive safely.

### 4.8 Vehicle Incident

4.8.1 In the event of a traffic accident while on AECOM business, an employee MUST follow *S3NA-004-PR Incident Reporting*, including seeking assistance, reporting the incident to the appropriate authority, completing and submitting the required forms. The AECOM Fleet Management Company will also be contacted when vehicle is a company leased vehicle.

4.8.2 Testing for Alcohol and/or Drugs – See the AECOM Employee Handbook; refer any questions to the HR Department. In the event that a police/regulatory officer responding to a vehicle incident administers field and/or laboratory impairment testing AECOM reserves the right to obtain copies of such testing results for inclusion in the incident report and consideration in a subsequent incident investigation.

4.8.3 Investigation Process – refer to *S3NA-603-PR Incident Investigation and Review*.

4.8.4 Consequences if determined to be at "fault" – taking a Defensive Driving Training course shall be among the considerations as a corrective action. The **Region SH&E Manager** can advise as to the availability of such training.

4.8.5 In addition, the employee will:

- If requested, provide police and other driver(s) with their liability insurance information.
- Not operate a damaged vehicle if its safety is questionable, its operating condition is illegal by applicable laws or its condition is such that further damage would likely result from its operation.
- If requested, provide and discuss the completed draft Supervisor's Report of Incident form with **Region Counsel**. The employee should then forward the completed form to the **Region Counsel** with copies to others as required.
- If the employee receives a Summons, Complaint or other legal documents relating to a traffic incident, note the date, time, place and method of delivery and immediately forward the original documents to **Region Counsel**.
  - **THE EMPLOYEE SHOULD NOT ADMIT LIABILITY, AGREE TO PAY FOR ANY DAMAGE OR SIGN ANY DOCUMENT EXCEPT AS REQUIRED BY LAW**. Statements made in haste or anger may be legally damaging.

4.8.6 In the event of an accident, the supervisor must follow the procedures set out in *S3NA-004-PR Incident Reporting* for reporting the accident.

### 4.9 Traffic Citations

4.9.1 The employee is personally responsible for payment of any fines for moving violations and parking citations incurred while driving any vehicle on AECOM business and for reporting such Incidents to his/her Supervisor, Region SH&E Manager, and Region Counsel.

### 4.10 Vehicle Insurance

4.10.1 For information about insurance carried by AECOM for AECOM owned or leased vehicles and any questions about insurance the employee may have as to business use of employee-owned vehicles, questions should be directed to the AECOM Insurance Department.

## 5.0 Records

5.1 Driver's Acknowledgement forms (and associated Motor Vehicle Driving Records) shall be filed in HR employee personnel files.

## 6.0 References

6.1 AECOM Employee Handbook (HR Department)

6.2 S3NA-004-PR Incident Reporting

6.3 S3NA-603-PR Incident Investigation and Review

# S3NA-005-FM Driver's Acknowledgement Form

**IF YOU DRIVE ON AECOM BUSINESS, YOU MUST READ THIS PROCEDURE AND FILL OUT AND RETURN THIS PAGE TO THE HUMAN RESOURCES SHARED SERVICE CENTER HRRecords@aecom.com (US) or Canadahrssc@aecom.com (Canada) FOR SECURE FILING.**

**Employee Name (Print):** ______________________________

**Driver's License Number:** ______________________________

**Expiry Date:** ______________________________

I acknowledge that I have read the attached Procedure and understand that it contains important information about AECOM's procedures regarding employee use of AECOM fleet or personal vehicles. I agree to adhere to the requirements set forth in the Procedure.

As a condition of driving a personal vehicle on AECOM business I will present my Driver's License and proof of insurance for validation purposes to my Supervisor as witnessed below.

In addition to completing this form, I understand that as a condition to operating an AECOM fleet vehicle, AECOM may run a Motor Vehicle Driving Record report and provide this report to my Supervisor.

I understand that I must notify AECOM immediately if there is any change in the status of my Driver's License and AECOM reserves the right to terminate my driving privileges and any associated benefits at any time, for any reason, in its sole discretion.

I understand that AECOM may require me to participate in a defensive driving course at AECOM's expense in order to continue my driving privileges for AECOM fleet vehicles.

This Procedure and my signed Acknowledgement are intended to and shall supplement the terms of my employment relationship with AECOM.

**Date:** ____________________ **Signature:** ____________________

(Employee)

I confirm that the Driver's License number and expiry date set forth above are consistent with the employee's Driver's License.

**Date:** ____________________ **Name of Witness (print):** ____________________

**Supervisor Signature:** ____________________

# S3NA-005-WI Driver Safe Work Practices

## 1.0 General

1.1 When accessing any pickup truck box, staff will: step up into the box to avoid excess reaching and strain and; use three point contact getting in and out of the truck box (avoid jumping off the tailgate).

1.2 Drivers must comply with AECOM's Global Travel Policy and the applicable state laws on the use of cell phones and other mobile devices while operating a motor vehicle. [NOTE: *Individual state, provincial, and local laws vary*.]

1.3 Be familiar with all client health and safety rules and regulations when on their sites. The employee may be required to leave their keys in the ignition or to display a vehicle pass. When parking, it is recommended that employees back into the parking spot.

## 2.0 Before Vehicle Operation

2.1 Confirm that you have your driver's license and that the vehicle registration and proof of insurance is in the vehicle.

2.2 Prior to driving the vehicle, adjust rear view mirror, side mirrors, driver's seat and head restraint as needed.

2.3 Fasten the seat belt and have all passengers fasten their seat belts before starting the engine. Keep belts fastened while the vehicle is moving or the engine is running.

2.4 Check for the correct functioning of:

2.4.1 Parking Brake--holds against slight acceleration

2.4.2 Foot Brake--holds, stops vehicle smoothly

2.4.3 Clutch and Gearshift--shifts smoothly without jumping or jerking

2.4.4 Steering--moves smoothly

2.4.5 Lights--headlights, warning lights, and turn signals operational

2.4.6 Dash Control Panel--all lights and gauges operational

2.4.7 Moving Parts--no strange noises

2.4.8 Horn--operational

2.4.9 Hydraulic systems--no evidence of leaks and systems operate smoothly

## 3.0 During Vehicle Operation

3.1 Maintain a safe distance when travelling behind other vehicles.

3.2 Confirm the area behind your vehicle is clear prior to and while reversing a vehicle.

3.3 When parking the vehicle on the edge of a roadway, turn on the four-way indicators (hazard lights) prior to leaving the vehicle.

3.4 Check carefully for oncoming traffic before opening the door and exiting the vehicle.

3.5 If requested, provide police and other driver(s) with their liability insurance information.

3.6 Monitor weather reports for the travel route.

3.7 Observe extra caution in and around emergency and construction zones.

3.8 Avoid unattended rest areas, when possible, and especially at night.

3.9 If the vehicle breaks down and another person stops to assist, do not leave the vehicle. Ask the person to call the police for assistance.

3.10 Contact the police to help those with car trouble instead of stopping to assist.

3.11 When possible, staff should have a car mechanic change or repair a flat tire. If staff must change a tire, they must adhere to the manufacturer's specifications and observe all proper lifting technique and safety procedures. The tire should then promptly be checked by a qualified car mechanic to ensure proper alignment and properly tightened lug nuts. The flat tire should be promptly repaired or replaced.

## 4.0 If Vehicle is to be Left Unattended

4.1 Turn the ignition off, remove the key and set the emergency brake.

4.2 Lock and secure the vehicle.

4.3 Secure equipment and property in a locked trunk or tool chest.

4.4 Do not leave keys in an unattended vehicle.

## 5.0 Staff shall Drive Defensively

5.1 The driver should use another person to guide them in backing up if they do not have a clear view of where they are going or the movements of other vehicles and people in the vicinity.

5.2 Tools and other items shall not be left loose in the passenger compartment of a vehicle.

**5.3 Road Rage**

5.3.1 Road rage is a dangerous driving situation that can occur and should be avoided whenever possible, but NEVER instigated. Do not get drawn into a confrontation. Avoid any confrontational eye contact.

5.3.2 The driver should be aware of all vehicles around them, paying frequent attention to the vehicle's mirrors.

5.3.3 Get out of the way. Even if the other motorist is speeding, it is safest not to make a point by staying in your lane. The other driver may be dealing with an emergency situation.

5.3.4 Unless it is necessary to use the horn as an alert, do so sparingly.

5.3.5 If someone is following you after an on-the-road encounter, drive to a public place or to the nearest police station and seek assistance.

5.3.6 Attempt to note the offender's license plate number and write it down as soon as possible.

5.3.7 Report any aggressive driving to the police immediately. This action may aid in preventing further occurrences by the same driver.

## 6.0 Winter Driving

6.1 Clear snow from all exterior vehicle surfaces.

6.2 Avoid using cruise control on icy roads.

6.3 Accelerate and brake gently to reduce skids or spinouts.

6.4 Wear winter clothing that does not restrict movement, vision or hearing.

6.5 Where required, have snow chains for the vehicle and be familiar with their installation.

6.6 Use extra caution while driving during hazardous winter conditions.

6.7 Avoid sudden changes of speed or direction to reduce possibility of skidding.

6.8 Drivers should always leave extra distance between their vehicle and the vehicle ahead of them. Stopping on ice takes about eight times the distance that it takes on dry pavement.

6.9 Carry suitable warm clothing and emergency equipment during the winter months. Temperatures can plunge rapidly.

6.10 Be aware of icy patches and black ice on the road bridges and intersections that are especially prone to ice patches.

6.11 Be familiar with the skid control procedures for the type of vehicle being driven (i.e., front, rear or four-wheel drive).

## 7.0 Gravel Roads and Remote Locations

7.1 Prior to getting in the vehicle, inspect the vehicle and have any required maintenance performed before leaving for the job site.

7.2 Prior to driving on a road with an assigned radio frequency, the passenger will test the two-way radio to confirm that the proper radio frequency is set and that the transmission is being received clearly by other traffic. The passenger will operate the two-way radio.

7.3 Drivers will maintain appropriate speed for the road conditions.

7.4 Headlights will be used at all times that the vehicle is in operation.

7.5 Drivers will respect the understood road protocol, drive defensively, and respect intersections.

7.6 4WD options will be utilized at the discretion and comfort level of the driver. If road conditions are questionable even for 4WD use, the road will not be traveled and either another route found or the job postponed until road conditions improve.

## 8.0 Off-road

8.1 If inexperienced, seek supervisory advice and training.

8.2 Vehicles should only be driven off roads after all other options (ATV's, etc.) have been considered.

8.3 Prior to driving off-road check to see that the vehicle is in good operating condition and your tires are properly inflated. Realize the limitations of your vehicle and do not become over confident.

8.4 Seat belts should be kept fastened at all times and all loose objects in the vehicle securely fastened to prevent them from becoming projectiles.

8.5 Drive according to the ground conditions. Speed and power are not required in rough off-road driving. In many cases with manual transmissions, letting the clutch out slowly and allowing the vehicle to crawl over obstacles in the lowest gear is the best scenario.

8.6 Learn to read the surrounding terrain. Monitor the ground conditions ahead of the vehicle -- it is essential to know what to expect from the ground being driven on.

8.7 When slowly traversing difficult areas of soft ground, try to keep the vehicle in motion. Once stopped it will be far more difficult to get it going again. If the vehicle becomes stuck, do not spin the wheels, as it will only dig in further or deeper until the vehicle chassis rests on the ground. Try to go slowly backwards in the vehicle's own tracks, as these have been previously compressed by the vehicle. In most cases this will be successful. If not, place appropriate material (wooden planks, mats, branches, etc.) under the wheel to improve traction.

8.8 Before driving over rough terrain, the terrain should be inspected on foot first.

8.9 When climbing hills ALWAYS go straight up or down. It is also smart to know what is on the other side of the hill before going up. At the base of the hill the driver should apply more power. Ease up on the power while approaching the top and before going over the crest. If the vehicle stalls on the ascent, back straight down the hill in reverse. For downhill travel in a vehicle with manual transmission, always use the lowest gear, and do not disengage the clutch to allow the vehicle to coast. If the vehicle is equipped with an automatic transmission, use low range and the lowest drive setting. NEVER drive a hill at an angle.

8.10 If the hill is very steep and you do not feel confident that your vehicle can make it up, then do not attempt it.

8.11 If you come to an area that is covered with water, you will not know the depth of the water or the condition of the ground under the water. This is especially true at night, when your vision is more limited. As such, driving through water covered areas or driving around barricades setup by public safety officials to prevent access into areas impacted by flooding is strictly prohibited. Turn Around, Don't Drown®

8.12 Prior to returning to the road, do a vehicle inspection to confirm the vehicle is road worthy.

# S3NA-201-PR Client Site Requirements

## 1.0 Purpose and Scope

1.1 Describes the manner in which AECOM employees (including Project Managers) interface with the operational, safety, and other management systems at client-owned industrial sites and addresses the resources available to meet our client's requirements.

1.2 This procedure applies to all AECOM Americas based employees and operations.

## 2.0 Terms and Definitions

2.1 **Owner/Operator:** The owner or operator of a facility at which contractors work. The Owner/Operator might or might not be AECOM's client.

2.2 **Process Safety Management (PSM):** .The US OSHA regulation that prescribes management systems for facilities handling large amounts of hazardous chemicals. The PSM regulations are primarily applicable to chemical manufacturing, petroleum refining and explosives processing facilities.

## 3.0 Attachments

3.1 S3NA-201-GL Process Safety Management Requirements

## 4.0 Procedure

### 4.1 AECOM Project Managers

- Advise the **Owner/Operator** of any unique hazards associated with the work to be performed by AECOM and its subcontractors and of any hazards found during the project.
- Obtain the site-specific SH&E requirements and information from the **Owner/Operator/Client** and communicate that information to AECOM employees and subcontractors to be assigned to work at that facility.
- Verify that AECOM project personnel and subcontractors have met applicable client SH&E requirements for working at the industrial site. Also verify compliance with legislative occupational health and safety and AECOM SH&E requirements.
- Verify onsite training and proof of worker qualification for AECOM and subcontractor staff prior to working at any client facility subject to the US OSHA PSM regulations.

### 4.2 Region SH&E Manager

- Provide assistance to the project team with interpreting and complying with **Owner/Operator** or client health and safety requirements.
- Assist **Account Managers**, **Project Managers**, and **Marketing** with the preparation of SH&E information to be presented to the clients.

### 4.3 Director of Safety, Health & Environment

- Provide consistent and accurate data to be reported to clients and data base collection consortiums.
- Provide assistance to **Region SH&E Managers** and Marketing in the preparation of data to be submitted with proposals and marketing information.

### 4.4 Employees

- Comply with all AECOM and **Owner/Operator** SH&E requirements and report all injuries, incidents and new hazards encountered.
- Maintain paper copies of their medical surveillance clearance, training, respirator fit tests and other applicable certifications with them at project sites for presentation to the client or **owner/operator** as proof of qualification to be on site.

- Be informed of the Emergency Response procedures.
- Sign in to ensure they will be accounted for in the event of an emergency and to confirm that they are aware of what they are required to do in an emergency.
- Wear and openly display any special visitor identification.
- Obtain approval from the site owner, prior to entering a restricted work site.
- Review, understand, and adhere to any governing health and safety requirements.
- Be supervised on a work site at all times by an employee familiar with the SH&E Program and the applicable Task Hazard Analysis and other safety plans

### 4.5 Onsite Requirements (All AECOM and Subcontractor staff)

- Prior to starting any work, confirm with the client representative the location of the work, the scope of work and how the work will be performed as well as the expected completion date.
- Upon arrival at the site, check in with the client representative. All appointments shall be arranged with the client representative prior to visits to plants. Do not enter a plant without the knowledge of the client representative.
- Request that the client representative point out any safety risk areas and specific procedures to be followed at or around the work area.

### 4.6 Training

4.6.1 All AECOM and AECOM subcontract **employees** must be trained in the work practices necessary to perform assigned tasks at the work site. This training includes the skills needed to safely perform assigned tasks and to work safely in the industrial environment at the facility.

4.6.2 Each AECOM and AECOM contract **employee** shall be instructed in the known fire, explosion or toxic release hazards related to his/her job, the process at the work site, and the applicable provisions of the emergency action plan.

4.6.3 The **Project Manager** shall document that each AECOM **employee** and subcontractor has received and understood the required training and prepared a record which contains the identity of the **employee**, date of the training, and means used to verify that the employee understood the training. This documentation shall be available at the project site for submission to the owner/operator of the facility upon request.

### 4.7 Incident Response and Investigation

4.7.1 All incidents which have the potential to cause injuries or property damage will be reported immediately (as soon as the incident is stabilized, but no later than the end of the shift following the incident) to the **Project Manager** and to the **Owner/Operator** and/or client.

4.7.2 An incident investigation must be initiated in accordance with S3NA-603-PR *Incident Investigation and Review*. Resolutions and corrective actions must be documented, offered to the **Owner/Operator**, and handled in accordance with the Procedure.

## 5.0 Records

5.1 None

## 6.0 References

6.1 US OSHA Regulations: 29 CFR 1910.119 - Process safety management of highly hazardous chemicals.

6.2 S3NA-209-PR *Project Hazard Assessment and Planning*

6.3 S3NA-603-PR *Incident Investigation and Review*

# S3NA-201-GL Working at Process Safety Management Sites

## 1.0 Purpose and Scope

1.1 Provides guidance to AECOM employees managing and/or working in client facilities covered by regulations equivalent to OSHA 29 CFR 1910.119 or Process Safety Management (PSM) regulations. Provinces in Canada and States in the US may have regulations that are equivalent or more comprehensive than the OSHA regulations.

1.2 This procedure applies to all AECOM Americas based employees and operations.

1.3 The primary purpose of the PSM Standard is to prevent or minimize the unwanted release of hazardous chemicals, especially into locations that would expose personnel to serious hazards. The regulations apply directly to the owner/operator of a facility that stores, uses, or manufactures certain hazardous chemicals in quantities above a threshold listed in the regulations. The regulations require the owner/operator to pass the requirements on to contractors and subcontractors working at the facility and to include contractors and subcontractors in certain safety programs at the facility.

## 2.0 Terms and Definitions

2.1 **Process:** Any activity involving a highly hazardous chemical; including any use, storage, manufacturing, handling, or the on-site movement of such chemicals or combination of these activities.

2.1.1 A process consists of one or more unit operations such as mixing, filtering, distillation, etc. A process also involves input(s) and delivers output(s). A process can involve a chemical reaction, heat transfer or mass transfer, a phase change, and other transformations or exchanges.

2.1.2 An overall process can incorporate mini processes; these could be either continuous or batch, with closed or open systems to the atmosphere. A complicated process may require a separate control room(s) for different portions of the process. A process may involve all or one of the following either in the pure state or as a mixture, with or without heat addition or removal:

- Gases
- Liquids
- Solids

2.1.3 Some processes involve direct contact among streams (such as in fluidized beds) or provide an indirect contact such as through standard heat exchangers.

2.2 **Catastrophic Release:** A major uncontrolled emission, fire, or explosion, involving one or more highly hazardous chemicals, that leads to serious danger to persons both within and outside the workplace and results from uncontrolled developments.

2.3 **Dangerous Substance:** A material possessing flammable or explosive properties.

2.4 **Process Hazard Analysis (PHA):** The application of one or more analytical techniques that aid in identifying and evaluating process hazards.

2.5 **Uncontrolled Developments:** Occurrences that are likely to develop quickly, to be outside the normally expected range of operating problems, to present only limited opportunity for preventive action, and to require any such action to be in the nature of an emergency response.

2.6 **Hot Work:** Work involving electric or gas welding, cutting, brazing, or similar flame or spark producing operations.

## 3.0 References

3.1 OSHA Regulations: 29 CFR 1910.119 - Process safety management of highly hazardous chemicals.

# 4.0 Procedure

## 4.1 Roles and Responsibilities

### 4.1.1 Project Manager

- Responsible for administering this guideline and development of the project Health and Safety Plan (HASP).
- Responsible for communicating with the client and/or owner/operator of the facility to determine site specific hazards, safety procedures, security, and emergency response requirements.
- Responsible to ensure that all AECOM employees and subcontractors are fully aware of, understand, and adhere to the appropriate safety procedures.

### 4.1.2 Field Task Manager/Supervisor

- Responsible for managing onsite activities in compliance with the HASP and site specific requirements.
- Responsible for ensuring that all AECOM employees and subcontractors on site can show documentation of required training, medical surveillance, fit testing, and certifications.
- Responsible for communicating with the **Project Manager**, client, and owner/operator about all changes in project hazards and conditions that could affect safety or security at the project site.

### 4.1.3 Region SH&E Manger

- Assists AECOM site management as needed by providing guidance and clarification as to issues that may arise.
- Review and approve the site specific HASP, Task Hazard Analysis (THA) and other hazard assessments.

### 4.1.4 Employees

- **Employees** shall comply with established procedures and safe work practices, be on the alert for changing conditions and quickly report any accidental release or potential release of hazardous chemicals to a supervisor. The company will promptly investigate every incident that results in, or could have resulted in, a dangerous release of a hazardous chemical.
- All **employees** will attend the Owner’s (refinery/chemical plant/facility) process overview and any site-specific training during the refinery/chemical plant/facility orientation, including the process overview and Emergency Action Plan. Attached is a summary of applicable information taken from the PSM standard.

## 4.2 Owner/Operator SH&E Requirements

4.2.1 Clients or **Owner/Operators** may have established specific procedural requirements for the health and safety of all contractors working on their facility. The employer (refinery/chemical plant/facility) shall develop and implement written procedures that provide clear instructions for safely conducting activities involved in each process. Some of these requirements might address confined spaces, chemical hazard communication, hazardous energy control (lockout/tagout) and blood borne pathogens.

4.2.2 Client facilities subject to the US OSHA PSM regulations will require onsite training and proof of worker qualification prior to contractors being giving access to the facility.

### 4.2.3 Onsite Requirements

- Prepare and submit to the owner/operator for approval any hot work, hazardous work, road closure, permits required by the facility or regulations.
- Avoid interfering with daily plant processes by causing interruptions or distractions to plant employees.
- Maintain a watch for moving plant equipment such as fork lift trucks, conveyors, material bins, and overhead equipment and stay clear of process equipment which may move unexpectedly.
- Be constantly aware of the environment as the work is performed and stay clear of hot process pipes, equipment, or live electrical conductors.

- Respect all safety guards, fencing, line markings, and other safety boundary markers.
- Do not touch or change any process controls. Do not open panels without a plant representative present or without specific client authorization.
- Do not discuss the project with plant employees. Refer questions to the client representative.
- Do not enter enclosures or areas that might be “confined spaces”.
- Do not enter areas where fall arrest equipment will be needed, unless authorized, properly trained and equipped for this purpose.
- No staff shall enter a restricted area without proper authorization.
- AECOM employees and subcontractors shall not allow other personnel into a restricted area without first orienting them to the hazards and appropriate controls, and obtaining the necessary approvals.

## 4.3 Training

4.3.1 **Employees** will receive initial and refresher training in the following:

- An overview of the refinery/chemical plant/facility process and operating procedures for the process that employees will be working with or near, including the hazards of the chemicals used in the process. This will include a complete review of the company Hazard Communications (HAZCOM) Program and all Material Safety Data Sheet (MSDS)s that are provided for each unit where the employees will be working;
- Specific safety and health hazards;
- Procedures and safe work practices applicable to the employee's job tasks, including personal protective equipment, permits (confined space, hot work and general safe permits, job hazard analysis and auditing;
- The site-specific Emergency Response Plan.

# S3NA-202-PR Competent Person Designation

## 1.0 Purpose and Scope

1.1 Outlines the process and minimum requirements necessary for classifying an AECOM employee as a "Competent Person" in one or more activity areas.

1.2 This procedure applies to all AECOM North America based employees and operations where AECOM is self-performing the identified activities and where AECOM controls projects performing the activities requiring a Competent Person. Client-mandated requirements may apply on a project-specific basis and shall be addressed in supplemental documents [e.g., Task Hazard Analysis (THA) or Health and Safety Plan (HASP).

1.3 It is recognized that regulations and legislation may contain alternate definitions for Competent Person and it will be the responsibility of the Project Manager to determine if conflicts exist between AECOM and applicable regulatory/legislative definitions and resolve the conflict.

1.4 When a qualified employee within AECOM is not available to be designated as the AECOM Competent Person, the Project Manager in coordination with their Region SH&E Manager may designate an appropriately qualified and trained Contractor employee as the Competent Person for the project.

## 2.0 Terms and Definitions

2.1 **Competent Person**: One who is capable of identifying existing and predictable hazards in surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization and resources to take prompt corrective measures to eliminate them.

2.2 **HASP**: Project Health and Safety Plan.

## 3.0 Attachments

3.1 S3NA-202-FM Competent Person Designation

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 A Competent Person in AECOM is an employee who functions in a technical role when either AECOM self-performs associated field work (above) or oversees and directs the work of subcontractors. For operations where AECOM is providing oversight of subcontractors (ex. drilling services), it is the subcontractors employee who is the Competent Person on-site for that phase of operation.

- Any AECOM employee considered for designation as a "Competent Person" shall:
  - Complete a Training Needs Assessment (TNA) with their Supervisor under the guidance of the **Region SH&E Manager**, regarding competent person's requirements;
  - Obtain approval from their supervisor prior to enrolling in any AECOM-sponsored safety competent person training program.
  - Track his or her own training anniversary dates and arrange for appropriate refresher training at least 30 days prior to expiration of certification.
- Contractor Competent Persons
  - Unless AECOM is self-performing, the Contractor is responsible for determining the safe means and methods of its work activities.
  - The Contractor is responsible for designating its Competent Person(s) for each category of work it undertakes as required above.
  - The Contractor's Competent Person is responsible for technically supporting the Contractor's site operations for the safe execution of its activities.

   - The Contractor's Competent Person should be knowledgeable about the work activities, compliance with the associated safety and health regulations, identifying and removing any attendant field hazards and the Contractor's work practices and procedures.
   - For work on AECOM controlled sites, the Project Manager confirms that the Contractor designates a Competent Person(s) for its activities. *S3NA-202-FM Competent Person Designation* or the equivalent may be use for this purpose.

4.1.2 **Project Manager**/**Field Task Manager/Supervisor** are responsible for ensuring that all assigned personnel, including personnel utilized from other offices to support their operations, comply with the requirements of this procedure. The **Project Manager** shall:

- Designate the Competent Person based on the work activity using *S3NA-202-FM Competent Person Designation*;
- Implement corrective actions when employees fail to meet training requirements;
- Identify supplemental employee training needs based on local/client requirements;
- Verify competent person training requirements are reviewed with each employee, based upon current and anticipated job functions and past performance on a routine basis;
- Identify additional employees requiring competent person training based on this procedure;
- For projects controlled by AECOM, when these activities are contracted to another party, secure the identity of the Contractor's Competent Person(s), provide them with a copy of this SOP to verify the Contractor's capability to comply with the requirements within, and obtain documentation to support the designation of the Contractor employee as a Competent Person for AECOM;
- Verify the designation of the Competent Person for a specific activity is effectively communicated to field personnel on site during daily tailgate safety meetings.

4.1.3 **The Region SH&E Manager** or designee will work with operations to assess the competency of all designated persons based on specific requirements outlined in this procedure. With the **Project Manager** or designee determining the work-specific Competent Person, the **Region SH&E Manager** provides guidance as needed. The SH&E Department (i.e., **Region SH&E Manager**) with operations is responsible for:

- Establishing competent person training/experience requirements and communicating these requirements to line management.
- Monitoring the overall implementation of this SOP.
- Monitoring field compliance of this procedure.
- Providing technical assistance/support as requested by **Region and District Managers**.
- Performing internal safety training classes as requested by **Region and District Managers**.
- Supporting the **Project Manager** in establishing minimum competent person requirements for regulated job activities based on individual job descriptions, applicable regulatory requirements, operational considerations, and management directives.
- Reviewing and approving as requested by designated operations representatives the Competent Person's qualifications for AECOM employees.
- Develop and maintain a process to track employee training compliance and anniversary dates.

4.2 **The following activities require an individual to be designated as a competent person:**

4.2.1 Asbestos

4.2.2 Blasting & Explosives

4.2.3 Concrete & Masonry Construction

4.2.4 Confined Spaces

4.2.5 Control of Hazardous Energy (Lockout-Tagout)

4.2.6 Cranes & Derricks

4.2.7 Demolition

4.2.8 Electrical Wiring Design & Protections

4.2.9 Fall Protection

4.2.10 Hearing Protection

4.2.11 Heavy Equipment

4.2.12 Ionizing Radiation

4.2.13 Lead

4.2.14 Material Hoists & Personnel Hoists

4.2.15 Stairways & Ladders

4.2.16 Respiratory Protection

4.2.17 Rigging Equipment

4.2.18 Scaffolds

4.2.19 Steel Erection

4.2.20 Trench & Excavations

4.2.21 Underground Construction

4.2.22 Welding & Cutting

4.3 The AECOM competent person field functions are dependent on the project activities and AECOM's field function. Refer to each SH&E Standard Operating Procedure (SOP) for the activities listed above and the associated legislative (e.g., OSHA) standard to determine the details of responsibility. Generally, it is the Competent Person's responsibility to be onsite at all times when AECOM staff are performing work governed by this SOP, make daily inspections of the conditions and work activities, and take actions to control any hazards associated with those activities.

4.4 The *S3NA-202-FM Competent Person Designation* shall be used on all projects for documenting Competent Person designations. It must be filled out completely and updated as necessary by the contractor.

## 5.0 Records

5.1 AECOM Competent Person Designation forms shall be maintained in the project file.

5.2 Documentation as to daily inspections and corrective measures by the AECOM Competent Person shall be maintained in the project file.

## 6.0 References

6.1 None

# S3NA-202-FM Competent Person Designation

| | | | |
|---|---|---|---|
| **Company:** | | | |
| **Project Location:** | | **Job Number:** | |
| **Designated Competent Person:** | | **ID Number:** | |

**Check the technical activity for which the Designation will apply:**

| | |
|---|---|
| ☐ Asbestos | ☐ Ionizing Radiation |
| ☐ Blasting & Explosives | ☐ Lead |
| ☐ Concrete & Masonry Construction | ☐ Material Hoists & Personnel Hoists |
| ☐ Confined Space Entry | ☐ Stairways & Ladders |
| ☐ Control of Hazardous Energy (Lockout/Tagout) | ☐ Respiratory Protection |
| ☐ Cranes & Derricks | ☐ Rigging Equipment |
| ☐ Demolition | ☐ Scaffolds |
| ☐ Electrical Wiring Design & Protections | ☐ Steel Erection |
| ☐ Fall Protection | ☐ Trench & Excavations |
| ☐ Hearing Protection | ☐ Underground Construction |
| ☐ Heavy Equipment | ☐ Welding & Cutting |

**Other (Explain):**

The AECOM employee identified has been designated as the Competent Person in the technical area specified, and by the Project Manager identified. This designation is based on the following:

1. The Project Manager is authorizing the competent person to allocate whatever resources that are necessary to perform tasks associated with the area of competency to provide a safe work environment and comply with applicable regulatory and legislative requirements, and AECOM SH&E procedures and policies.
2. The Project Manager has confirmed that the individual is competent to perform the required tasks by way of:
    a. Documented training
    b. Practical experience (hands-on)
    c. Documented professional experience

**Print name and sign below**

**Designated by:** ______________________________ **Date:** ____________________
(AECOM Project Manager)

**Designated by:** ______________________________ **Date:** ____________________
(AECOM Office Manager)

**Designated by:** ______________________________ **Date:** ____________________
(AECOM Regional SH&E Manager or Designee)

**Comments:**

*Attach any related documentation of training, certifications, insurance coverages, or other related information that supports the designation of the person as Competent.*

# S3NA-203-PR Emergency Response Planning, Field

## 1.0 Purpose and Scope

1.1 Addresses the requirements for preparation and planning for potential emergencies that may occur at while AECOM staff are working in the field.

1.2 Applies to all AECOM North America staff working outside of an AECOM office in a field environment.

1.3 The intent of this plan is to:

1.3.1 Promote the safety of workers, visitors, and responders.

1.3.2 Reduce the potential for destruction of goods and other property.

1.3.3 Reduce the magnitude of environmental and other impacts.

1.3.4 Help responders quickly determine and initiate proper remedial actions.

1.3.5 Reduce recovery times and costs.

1.3.6 Make workers, visitors, and responders more confident that emergencies will be properly managed.

## 2.0 Terms and Definitions

2.1 **Emergency:** An unplanned situation or event (including natural disasters) resulting in involvement of the public emergency services, police, fire, paramedic, or the environmental regulatory authorities.

2.2 **First Aid Provider:** Occupationally required to be trained in first aid, although may not be required by law to render first aid. A first aid provider responds as a "Good Samaritan." Uses a limited amount of equipment to perform initial assessment and provide immediate life support and care while awaiting arrival of emergency medical services.

2.3 **First Responder:** A designated individual who uses a limited amount of equipment to perform initial assessment and intervention and is trained to assist other emergency medical services.

2.4 **Emergency Medical Technician (EMT) Basic:** The second level of professional emergency medical care provider. An EMT is qualified to function as the minimum staff for an ambulance.

2.5 **EMT Intermediate:** The third level of professional emergency medical care provider. Can perform essential advanced techniques and administer a limited number of medications.

2.6 **Paramedic:** The fourth level of professional emergency medical care provider. Can administer additional interventions and medications.

## 3.0 Attachments

3.1 S3NA-203-WI Incident Response to Specific Hazards

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Project Managers and Supervisors** are responsible for developing and implementing emergency response plans for their field staff and projects.

### 4.2 Emergency Response Plan (ERP)

4.2.1 Project Managers and supervisors will establish and implement of an ERP, including communicating the plan to all employees.

4.2.2 Emergency contact lists and procedures that includes fire, police, ambulance, poison control, first aiders onsite, security, Site Safety Officer or Coordinator, SH&E Reporting number for reporting all AECOM incidents, and other required emergency contacts will be available.

4.2.3 The site specific Emergency Response Plan (ERP) will comply with all governing regulations.

4.2.4 Where an established ERP is not already in place or outlined in a Health and Safety Plan (or Safe Work Plan), a Task Hazard Analysis that includes emergency response plans appropriate to the site and circumstances will be developed.

4.2.5 If the hazard assessment for the project indicates a need for planned evacuation or rescue, appropriate written procedures will be developed and implemented and a worker will be assigned to coordinate their implementation.

4.2.6 Staff will be trained to their limited involvement in an emergency evacuation or rescue; however, all evacuations in the following circumstances will be carried out by professionals trained and properly equipped for the type of evacuation or rescue required:

- work at high angles,
- work in confined spaces or where there is a risk of entrapment,
- work with hazardous substances,
- underground work,
- work on or over water,
- work in remote isolation, and
- workplaces where there are persons who require physical assistance to be moved.

4.2.7 The ERP will address a clear path of travel to and from a working area, as applicable:

- The access will be made obvious and most direct with adequate illumination.
- The access will remain clear and unobstructed at all times.
- No material or equipment may be stored or temporarily left in path of egress.
- A traffic barrier will be used for facilitating vehicle and pedestrian traffic.
- The access route will have a clear line of vision into oncoming traffic lanes.

4.2.8 During project safety meetings, all staff will be advised of the location of first aid services, equipment, and supplies. As well, emergency contact information will be posted by all entrances on a worksite or left on the dash of the vehicle (mobile site office).

4.2.9 IT IS EXPECTED THAT MODIFICATIONS TO EMERGENCY PLANS MAY BE NECESSARY ONCE THE ACTUAL SITE HAS BEEN SET UP AND SITE CONDITIONS HAVE BEEN REVIEWED.

### 4.3 First Aid

4.3.1 An assessment shall be made for each project or site visit to determine the response time and availability of EMS.

- If the assessment identifies reasonable risks that are life threatening and EMS response is greater than 4 minutes, at least two people on site shall be trained in first aid and CPR.
- If no life threatening risks exist on site and EMS response is greater than 30 minutes, at least one person shall be trained in first aid and CPR.

4.3.2 All AECOM site offices or trucks (mobile worksites) will maintain adequate first aid kits in convenient and accessible locations as appropriate for the specific location. Contact the SH&E department for specific guidance.

4.3.3 In addition, training of employees in basic first aid and adult CPR is required to meet legislative requirements. Acceptable training shall be conducted by the Red Cross or equivalent service provider approved by the regulatory agency. First aid certification shall be renewed every third year (or as dictated by legislation). Additional training may be required for personnel who have access to automated external defibrillators (AED).

4.3.4 First aid attendants, floor safety wardens, and all other persons authorized to call for transportation for injured workers will be made aware of the emergency evacuation procedures specific to their project site.

4.3.5 First aid supplies and facilities that meet the applicable OSHA, provincial, or territorial OHS legislation will be made available on site. Where required, every first aid room will

- Be located in an area that is easily accessible to workers at all times, and be near both the work area it is to serve and toilet facilities;
- Have adequate lighting, ventilation, and heating, and be covered by a floor made of non-porous material;
- Be of an adequate size to accommodate a stretcher;
- Be equipped with:
    - Instructions on how and where to access a first aider,
    - A communication system capable of communicating with the medical facility to which an injured worker would be transported,
    - A permanently installed sink with hot and cold potable running water,
    - A cot or bed with a moisture-protected mattress and two pillows;
- Be clearly identified as a first aid room;
- Be used exclusively for the purposes of administering first aid and medical examinations and to provide rest for persons who are ill or injured;
- During working hours, be supervised by a first aider, as needed, who is readily available to provide first aid; and
- Be kept clean and sanitary.

4.3.6 All first aid equipment and supplies will be:

- Located at or near the work site they are intended to serve.
- Available and accessible during all working hours.
- Maintained in a clean, dry and serviceable condition.
- Contained in a material that protects the contents from the environment and be clearly identified as first aid equipment and supplies.

## 4.4 Other Emergency Response Equipment

4.4.1 Provide portable fire extinguishers of appropriate class, size, and number of extinguishers in accordance with *S3NA-206-PR Fire Protection, Field*.

4.4.2 Provide eye wash stations (where appropriate to hazards).

4.4.3 Maintain an emergency response plan and emergency kit appropriate to the hazards associated with the location (e.g., earthquakes, tornadoes, hurricanes, etc.).

## 4.5 Parking

4.5.1 Signs will be posted to indicate permissible parking areas.

4.5.2 Parking areas shall not restrict access by emergency personnel and vehicles.

## 4.6 Communications

4.6.1 Supervisors are responsible for confirming that crews have access to communication devices that are in good working order, have reception in the area in which the crews will be working, and meet the needs of the planned check-in and emergency response procedures. This may include

- 2-way radios,
- Cellular phones (or combination cell phone/2-way radio),
- Satellite phones,
- Car phones, or
- Personal Locator Beacons.

4.6.2 The project manager will be responsible for confirming that field crews have the appropriate means of communication before leaving for the field. The type of communication device will depend on the location and circumstances of the job task.

4.6.3 All staff are responsible for maintaining the communication devices in good working order before leaving for the field and for ensuring that battery-operated electronic devices have been recharged or have fresh batteries.

4.6.4 All staff are responsible for keeping communication devices clean and dry to facilitate their effective operation.

4.6.5 In the field, the communication device should be kept in a central location or with the crew if remote travel is necessary.

4.6.6 If a staff member is working outside of hearing or sight range of other crew members, they will have an understood check-in procedure and will carry the appropriate means of communication.

### 4.7 Visitors

4.7.1 All visitors to the site will review and acknowledge the safety plan or Task Hazard Analysis and associated Emergency Response Procedures.

### 4.8 Emergency Response

4.8.1 Employees responding to emergency situation should take no unnecessary risk. In the case of an emergency, the first aid attendant will promptly provide injured workers with a level of care within the scope of the attendant's training, objectively record observed or reported signs and symptoms of injuries and exposures to contaminants, and refer for medical treatment workers with injuries considered by the first aid attendant as being serious or beyond the scope of the attendant's training.

4.8.2 All incidents will be reported in accordance with *S3NA-004-PR Incident Reporting*.

4.8.3 If emergency action is required to correct a condition that constitutes an immediate threat to workers, only those qualified and properly instructed workers necessary to correct the unsafe condition may be exposed to the hazard and every possible effort will be made to control the hazard while this is being done.

4.8.4 Emergency procedures are outlined in *S3NA-203-WI Incident Response to Specific Hazards*; however, in situations where no specific procedures have been established, common sense and sound judgment should be followed to determine the safest course of action**.**

4.8.5 Upon evacuation or dismissal, no unauthorized or nonessential personnel are allowed access to the facility or project area during an emergency.

4.8.6 All accident and emergency sites will be immediately secured to prevent unauthorized access or the possibility of further risk to workers, property, or the public at large.

4.8.7 All emergencies will be handled by the highest-ranking AECOM representative at the site.

4.8.8 Employees should assist, as able to do so, and follow directions from a lead manager in any emergency operation.

4.8.9 Employees should render assistance in the safest possible manner, using appropriate personal protective equipment and precautions.

4.8.10 In the event of an emergency, the supervisor shall designate one area for all employees to gather for a roll call.

4.8.11 During an emergency, AECOM staff shall take direction from outside professional responders, as appropriate, who are in control of the situation.

### 4.9 Post-Emergency Follow Up

4.9.1 Prior to resuming operations, the work area will be inspected to confirm that conditions are under control and no longer pose a hazard to employees.

## 5.0 Records

5.1.1 The site specific Emergency Response Plan is included in the Task Hazard Analysis (HASP or Safe Work Plan, as appropriate) and will be filed in the project file once the work is completed.

5.1.2 Emergency Response Plans shall be part of site SH&E audits.

## 6.0 References

6.1 S3NA-206-PR Fire Protection, Field

# S3NA-203-WI Emergency Response to Specific Hazards

## 1.0 Injury or Health-Related Emergencies

### 1.1 In the event of serious illness or injury:

1.1.1 Do not move the victim or leave them alone unless absolutely necessary.

1.1.2 Call for emergency medical assistance.

1.1.3 Provide first aid to the level of qualification. Record the first aid given in the First Aid Treatment Record.

1.1.4 Request assistance from other first aiders as necessary.

1.1.5 Notify the immediate supervisor or manager.

1.1.6 If you are the injured or ill party, call for help and do not drive yourself to the hospital.

1.1.7 Arrange for hospital emergency service, medical practitioner's office emergency service, or medical practitioner's appointment, as needed.

### 1.2 In the event of minor injuries:

1.2.1 If required, summon assistance.

1.2.2 Initiate first aid immediately as necessary.

1.2.3 Follow up as needed.

## 2.0 Fire

### 2.1 If you discover a fire:

2.1.1 If the fire is small and containable, use the appropriate fire extinguisher and/or fire fighting tools to extinguish the flames and cool the ashes.

2.1.2 Call 911 to advise the operator of your location and provide as much detail as possible about the fire, its potential source, surrounding buildings or flammable materials, and number of people in the area.

2.1.3 If the fire is of moderate or large size, evacuate the area and do not return until emergency fire crews give the all-clear.

### 2.2 If you hear an alarm:

2.2.1 Go to designated muster point, if there is one, or evacuate the area to a safe distance.

2.2.2 Do not return to the area until officials provide the all-clear.

## 3.0 Electrical Storms

### 3.1 Guidelines

3.1.1 Lightning can strike several miles/kilometres from its source, so early precautions are crucial. If thunderstorms are in the forecast, reassess your plans for outdoor activities.

3.1.2 If you can hear thunder, then you are close enough to the storm to be at risk.

3.1.3 You are considered to be in the high danger zone if you are less than 6 miles/10 kilometres away. Use the 30/30 Rule to help you. If you can count 30 seconds or less between seeing lightning and hearing thunder, you should seek shelter immediately.

3.1.4 Do not resume any outdoor activities until you have waited at least 30 minutes after hearing the last clap of thunder. It is crucial to ensure that the risk of a lightning strike has passed completely.

### 3.2 Do:

3.2.1 Stay clear of high ground and open spaces.

3.2.2 Seek shelter in a house, large building or motor vehicle (if there is no other shelter). Keep windows and doors shut.

3.2.3 If you are riding a bicycle, motorcycle, or ATV, get off and seek shelter immediately. The rubber tires will not protect you.

3.2.4 If you are boating, head for shore. If caught on the water, crouch low in the boat.

3.2.5 If you are in a flat, open field, bend down and put your hand on your knees. Maintain minimum contact with the ground.

3.2.6 Avoid contact with metal. Stay at least 30 metres away from metal fences and take off shoes that have metal cleats.

3.2.7 Stay away from water, including lakes and puddles.

3.2.8 Stay sheltered until the storm is over.

### 3.3 Don’t:

3.3.1 Don’t seek shelter under a tree, in a shed, or in a small, open building.

3.3.2 Don’t lie down on the ground.

3.3.3 Don’t take a shower or bath. If lightning strikes the plumbing system it can be conducted into the tub or shower.

3.3.4 Don’t use the phone or electrical appliances unless absolutely necessary. Electricity travels through wires.

3.3.5 Don’t use a mobile phone outdoors.

3.3.6 Don’t hold a golf club, umbrella, or fishing rod.

3.3.7 Don't travel in a severe storm. If you are caught in your car, keep windows closed and park off the road away from power lines.

3.3.8 Don’t try to finish your activity; find shelter and wait out the storm.

3.3.9 Staff will not travel in areas where there is a severe thunderstorm warning.

## 4.0 Tornadoes

### 4.1 Guidelines

4.1.1 When a tornado approaches, anyone in its path should take shelter indoors—preferably in a basement or an interior first-floor room or hallway. Avoid basement or first floor shelter areas with heavy equipment located on the floor directly above.

4.1.2 Make yourself as small as possible by crouching into a ball-like position, covering your head and neck.

4.1.3 Avoid windows and seek additional protection by getting underneath large, solid pieces of furniture.

4.1.4 Avoid automobiles and mobile homes, which provide almost no protection from tornadoes.

4.1.5 Those caught outside should lie flat in a depression or on other low ground and wait for the storm to pass.

## 5.0 Hurricanes

### 5.1 Guidelines

5.1.1 Coastal residents should form evacuation plans before a warning is issued to identify a safe shelter and a route to get there.

5.1.2 Stock up on emergency supplies including food, water, protective clothing, medications, batteries, flashlights, important documents, road maps, and a full tank of gasoline.

5.1.3 As a storm unfolds, evacuees should listen to local authorities on radio or television. Evacuation routes often close as a storm develops.

5.1.4 Dedicated professionals and improved technology have made hurricane forecasting more accurate than ever before, but it is far from precise.

5.1.5 If forced to weather a storm, get inside the most secure building possible and stay away from windows.

5.1.6 Remember that a lull often signifies the storm's eye—not its end. Anyone riding out a hurricane should wait for authorities to announce that the danger has passed.

## 6.0 Earthquakes

6.1.1 Drop down; take cover under a strong desk or table and hold on.

6.1.2 Stay indoors until the shaking stops and you are sure that it is safe to exit.

6.1.3 Stay away from bookcases or furniture that can fall on you.

6.1.4 Stay away from windows. In a high-rise building, expect the fire alarms and sprinklers to go off during a quake.

6.1.5 If you are in bed, hold on and stay there, protecting your head with a pillow.

6.1.6 If you are outdoors, find a clear spot away from buildings, trees, and power lines. Drop to the ground.

6.1.7 If you are in a car, slow down and drive to a clear place. Stay in the car until the shaking stops.

## 7.0 Gas Leak

### 7.1 Gas Odor

7.1.1 Leave the area immediately.

7.1.2 Notify the appropriate authorities and owner of the site.

7.1.3 Refrain from using ignition sources (cigarettes, electrical devices, etc including cell phones).

7.1.4 Do not turn on vehicles or other electrical switches.

7.1.5 Warn others in the area.

7.1.6 Meet with responding personnel to identify the location of the odor.

### 7.2 Major Leak

7.2.1 Leave the area immediately.

7.2.2 Notify the appropriate authorities and owner of the site.

7.2.3 Secure area and warn others.

7.2.4 Meet with responding personnel to provide additional information.

7.2.5 Refrain from using ignition sources (cigarettes, electrical devices, etc including cell phones).

7.2.6 Do not turn on vehicles or other electrical switches.

## 8.0 Violence or Potential for Violence

8.1.1 Remain calm

8.1.2 Do not put yourself at increased risk.

8.1.3 Speak in a soft, non-threatening manner.

8.1.4 Do not touch the person or try to disarm them.

8.1.5 Avoid hostile actions or interactions, except to maintain personal safety.

8.1.6 Try to leave the area.

8.1.7 Report the incident as soon as possible.

# S3NA-204-PR Environmental Compliance

## 1.0 Purpose and Scope

1.1 This procedure is intended to describe how region business lines and project managers will manage/minimize environmental risks associated with the execution of individual projects and office operations.

1.2 This procedure applies to all AECOM North America-based employees and operations.

## 2.0 Terms and Definitions

2.1 Applicable or Relevant and Appropriate Requirements (ARAR) – numerical concentration limit, an emission or effluent discharge limit, or as a methodology for establishing such limits. ARARs may be chemical-specific, location-specific, or action-specific in nature.

2.2 Compliance Map – a document defining and detailing a regulatory statute and its associated actions, limits, records retention requirements, and/or other applicable metrics.

2.3 Subject Matter Expert – a person who is an expert in a particular topic or area due to experience, technical/regulatory knowledge, and/or training.

2.4 Reportable Quantity (RQ) - quantities of hazardous substances, which when released to the environment, require notification to the National Response Center and the appropriate state agency. Multiple agencies and regulations have established RQs; RQ's may differ by agency.

2.5 Resource Conservation and Recovery Act (RCRA) – enacted in 1976, is the principal federal law in the United States governing the disposal of solid waste and hazardous waste.

2.6 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) – enacted in 1980, is a United States federal law (also known as Superfund) designed to clean up sites contaminated with hazardous substances.

## 3.0 Attachments

3.1 S3NA-204-FM Office/Project Environmental Compliance Assessment Checklist

3.2 S3NA-204-GL Environmental Compliance

## 4.0 Procedure

4.1 AECOM activities will adhere to all applicable federal, provincial, state, local, and client environmental compliance, permitting, and licensure requirements.

4.2 Develop a Compliance Map, for those projects where AECOM is a permit holder or where AECOM is operating under a client's permit, to indicate the applicable actions, limits, records retention requirements, and applicable submittals to verify compliance with each cited regulation. See S3NA-204-GL for examples of a Compliance Map.

**4.3** Where the possibility of an environmental release exists, due to AECOM's activities, identify the applicable Reportable Quantity prior to the start of work.

4.4 When necessary, project teams will consult with Subject Matter Experts to identify the necessary permitting/licensing and/or applicable regulations governing the planned scope of work. Example guiding questions that project teams may use to initially assess their project's environmental compliance needs include, but are not limited to:

- Will AECOM's activities have the potential to discharge any hazardous or other regulated chemicals/materials to the air?

- Is there any equipment on site that has an air permit or similar regulatory requirement governing air discharges to the environment? Note: This should include client-owned equipment that AECOM will operate and have contractual regulatory liability for during the planned scope of work.
- Will AECOM manage characteristic- or listed-hazardous waste for the client?
- Will your activities generate any solid, universal or characteristic/listed hazardous waste subject to requirements?
- Is this a site or facility where AECOM will perform activities under a RCRA or CERCLA permit, or a Consent Order?
- Is the site or facility a hazardous waste large generator (i.e.., large quantity, small quantity, or conditionally-exempt small quantity?
- What oil storage capacity does the site or facility have (count containers/equipment with capacities of 55 gal drum or greater)?
- Will AECOM's activities create a discharge into a waterway or other conveyance that feeds into a defined US waterway?
- Will AECOM's activities disturb ≥ 1 acre of land surface area?
- Will AECOM's activities physically disturb or impact a wetland?

## 4.5 Environmental Compliance Assessments

4.5.1 AECOM will periodically assess its operations (offices and project sites) and activities to verify ongoing activities adhere to the defined ARARs. Frequency should be based on complexity of the project/size of the office and the associated environmental compliance risks to AECOM; offices and projects requiring a Compliance Map will be assessed no less than annually.

4.5.2 The Office Facilitator or Project Manager will conduct the assessment or designate an appropriate individual to conduct the assessment.

4.5.3 Provide information to AECOM senior management on the environmental compliance performance of specific operations.

## 4.6 Environmental Compliance Assessments Documentation

4.6.1 Assessments will document compliance and non-compliance issues associated with the facility or AECOM's activities at the project site.

4.6.2 The assessments will be documented and tracked using an appropriate system (e.g., S3NA-704-TP, Corrective Action Plan or equivalent) that identifies and tracks all issues from recognition to closure. Documentation for each finding must include a designation of corrective action(s) to be taken, identifying the individual(s) responsible for implementing the corrective actions, the scheduled date of completion, and the actual completion date.

## 4.7 Roles and Responsibilities

4.7.1 The **Region Executive** will be responsible for the following:

- Identifying regionally-based environmental compliance resources, including but not limited to Subject Matter Experts.

4.7.2 **Region Business Line Manager** will be responsible for the following:

- Putting into practice a policy that all operations will comply with applicable federal, state, provincial, local, or client environmental compliance regulations during the performance of AECOM activities.

4.7.3 **District Managers** will be responsible for the following:

- Making available resources to implement the applicable environmental regulatory requirements during the execution of all AECOM activities.

4.7.4 **Project Managers** will be responsible for the following:

- Implementing all applicable requirements to facilitate compliance with the project's ARAR and documenting them in a project-specific Compliance Map, including but not limited to:
  - Identifying and understand the applicable environmental compliance regulations that apply to the project's activities.
  - Verifying that staff have the appropriate environmental training prior to performing the assigned activities.
  - Budgeting the necessary resources into each project to achieve compliance with the defined regulations.
  - As applicable, verifying that the Region Counsel and Office of Risk Management (ORM) has reviewed and approved the signed client's Agency Agreement authorizing AECOM to sign a waste manifest or sign shipping papers "as an agent of that client." NOTE: It is AECOM's policy that we do not sign client waste manifests or shipping papers unless authorized to do so by Region Counsel and ORM.
  - Obtaining all applicable environmental permits prior to the start of any regulatory permitted activity, including those permits held by the client which may impact AECOM's activities.
  - Assessing the compliance status of AECOM's activities.
  - Implementing any identified corrective actions relative to noted environmental compliance deficiencies.
  - Closing out any regulatory permit(s) at the end of the project.

4.7.5 Employees will be responsible for the following:

- Reporting all environmental releases or permit exceedances per *S3NA-003-PR*.
- Operating all equipment and performing all tasks within the ARAR as defined in the associated regulatory permit or Compliance Map.
- Signing waste manifests only if authorized by the Project Manager and Region Counsel.

4.7.6 The Region SH&E Manager will be responsible for the following:

- Assisting operations personnel to coordinate environmental compliance for activities undertaken by the Business Lines, including but not limited to:
  - Assisting operations in defining applicable regulatory requirements.
  - Supporting environmental compliance assessments of operation's activities as needed.
  - Reporting on the status of identified corrective actions.
  - Reporting those regulatory non-compliance events that result in a Notice of Violation, notice of non-compliance, or other state of noncompliance to both region management and region counsel.

4.7.7 Region Counsel will be responsible for the following:

- Reviewing, commenting on, and approving a client's signed Agency Agreement letter authorizing AECOM to sign a waste manifest or shipping papers "as an agent of the client."
- Taking appropriate action upon notification that AECOM received a Notice of Violation or any other written notice of non-compliance, or became aware of the existence that AECOM is operating in a state of noncompliance.
- Supporting operation's response to Notices of Violation or any other written notice of non-compliance issued to AECOM from a regulatory agency.

4.7.8 America's Office of Risk Management will be responsible for the following:

- Reviewing, commenting on, and approving a client's signed Agency Agreement letter authorizing AECOM to sign a waste manifest or shipping papers "as an agent of the client."

## 5.0 Records

5.1 S3NA-204-FM1, Office/Project Environmental Compliance Assessment Checklist

5.2 S3NA-704-TP, Corrective Action Plan

## 6.0 References

6.1 Although this listing appears comprehensive, it is not feasible to include every applicable environmental regulatory citation within this procedure; therefore, project teams are encouraged to use this listing as a starting point with the understanding that there may be other state, local, or client guidance which must also be implemented.

6.2 40 CFR (US only)

6.3 Canadian Environmental Protection Act, R.S.C. 1992, c. 37 (Canada Federal)

6.4 Environmental Protection and Enhancement Act (EPEC), R.S.A. 2000, c. E-12 (Alberta only)

6.5 Environmental Management Act, S.B.C. 2002, c. 53 (British Columbia only)

6.6 Environment Act, C.C.S.M. c. E125 (Manitoba only)

6.7 Clean Environment Act, R.S.N.B. 1973, c. C-6 (New Brunswick only)

6.8 Environmental Protection Act, S.N.L. 2002, c. E-14.2 (Newfoundland and Labrador only)

6.9 Environmental Protection Act, R.S.N.W.T. 1988, c. E-7 (Northwest Territories only)

6.10 Environment Act, S.N.S. 1994-95, c. 1 (Nova Scotia only)

6.11 Environmental Protection Act, R.S.O. 1990, c. E.19 (Ontario only)

6.12 Environmental Protection Act, R.S.P.E.I. 1988, c. E-9 (Prince Edward Island only)

6.13 The Environmental Management and Protection Act, 2002 S.S. 2002, c. E-10.21 (Saskatchewan only)

6.14 Environment Act, R.S.Y. 2002, c. 76 (Yukon Territory only)

# S3NA-204-FM Office/Project Environmental Compliance Assessment Checklist

## 1.0 Scope and Purpose

1.1 This form applies to all North America AECOM employees solely performing Administrative functions.

1.2 Please use this checklist to assess the environmental compliance status of an office or project location. Assess all printing rooms, laboratories, maintenance areas, garages, or any other area where equipment or activities generate, store, treat, or dispose of wastewater, raw chemicals, air emissions, or solid waste.

1.3 After completion of the assessment, discuss findings with the Office Facilitator/Project Manager and document the findings/deficiencies in the applicable tracking system. Upon completion, submit this assessment to your Region or District SH&E Manager.

Office Location/Project Name: ______________________________

Office Facilitator/Project Manager: ______________________________

Subject Matter Expert (as applicable): ______________________________

Compliance Map Completed: Yes ☐ No ☐ NA ☐ Date Last Reviewed? ______________________________

Region /District SH&E Manager: ______________________________

Self-Assessment Completed By: ______________________________

Date Completed: ______________________________

i. Are hazardous materials (e.g., lab chemicals, petroleum products, radioactive materials, gas cylinders, etc.) stored at this office or project location? Yes ☐ No ☐ *If yes, complete the table below*

| Hazardous Material | Volume | How Stored | Where & is MSDS available |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |

ii. Are any liquid or solid waste products (e.g., waste oil, waste solvents, toner cartridges, paints, used batteries, degreasing sludge, etc.) generated, stored, treated, recycled, or disposed of at this office or project location? Yes ☐ No ☐ *If yes, complete the table below*

| Waste | Volume/yr | How Stored | Disposed (Y/N) | Recycled (Y/N) |
|---|---|---|---|---|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |

| | | | | |
|---|---|---|---|---|
| 4. | | | | |

iii. For recycled or disposed waste products defined above, identify the recycling/disposal company or facility. For material sent to a recycler, have you required and/or received a statement from the recycler that the material will be properly managed? Yes ☐ No ☐ *If yes, complete the table below*

| Recycling/Disposal Company | Company Location | Recycling/Disposal Statement (Y/N) |
|---|---|---|
| 1. | | |
| 2. | | |
| 3. | | |

iv. Do site-generated wastewaters (other than domestic wastewater) enter a sewer line, an NPDES outfall, or a drainage ditch/retention pond? This includes vehicle wash water, oil and grease, antifreeze, lab chemicals, etc. Yes ☐ No ☐ *If yes, complete the table below*

| Waste Type | Discharge Point | Volume/yr | Permit Req'd (Y/N) |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |

v. Is this office or project involved with hazardous material (HzM) shipping via ground and/or air? Yes ☐ No ☐ *If yes, complete the table below*

| Typical HzM | Typical Frequency/Volume | Typical Destination |
|---|---|---|
| 1. | | |
| 2. | | |
| 3. | | |

vi. If the answer to Item v. is yes, has DOT Level 1 Shipper, DOT Level 1 NDMG Shipper, IATA, or DOT Level 2 shipper training been conducted for applicable employees?
Yes ☐ No ☐ *If yes, complete the table below (no need to list every person with this training)*

| Employee Name | Training Date |
|---|---|
| 1. | |
| 2. | |
| 3. | |

vii. If the answer to Item v. is yes, are records of HzM shipments for the past three (3) years available on-site for review by regulatory auditors?
Yes ☐ No ☐ *If yes, complete the table below (no need to list every person with this training)*

| Shipment Date | HzM Shipped | HzM Shipper |
|---|---|---|
| 1. | | |
| 2. | | |

| | | |
|---|---|---|
| 3. | | |

| viii. Does this office or project site store potentially contaminated samples (e.g., soil and groundwater samples from RCRA or CERCLA sites)? Yes ☐ No ☐ *If yes, complete the table below* | | |
|---|---|---|
| **Where Stored** | **How Stored** | **How Disposed** |
| 1. | | |
| 2. | | |
| 3. | | |

| ix. Does this office or project operate equipment which generates air emissions through a vented hood or other point source? Yes ☐ No ☐ *If yes, complete the table below* | | |
|---|---|---|
| **Process** | **Air Emission Characteristics** | **Operation Frequency** |
| 1. | | |
| 2. | | |
| 3. | | |

| x. Are grounds maintenance activities self-performed by this office or project location? Yes ☐ No ☐ *If yes, complete the table below* | |
|---|---|
| **Products Used** | **Approximate Quantities/yr** |
| 1. | |
| 2. | |
| 3. | |

| xi. Are underground storage tanks owned or operated at this office or project site? Yes ☐ No ☐ *If yes, complete the table below* | | | | | |
|---|---|---|---|---|---|
| **Number & Volume** | **Material Stored** | **Waste (Y/N)** | **Leak Detection (Y/N)** | **Registered (Y/N)** | **Released (Y/N)** |
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |

| xii. Are aboveground storage tanks owned or operated at this office or project site? Yes ☐ No ☐ *If yes, complete the table below* | | | | |
|---|---|---|---|---|
| **Number & Volume** | **Mat'l Stored** | **Waste? (Y/N)** | **Secondary Containment (Y/N)** | **Release? (Y/N)** |
| 1. | | | | |

| | | | | |
|---|---|---|---|---|
| 2. | | | | |
| 3. | | | | |

xiii. Does this office or project site own or operate a potable water well, septic system, stormwater discharge, or water softening process? Yes ☐ No ☐ *If yes, complete the table below*

| **Type** | **Description** | **Permitted? (Y/N)** |
|---|---|---|
| 1. | | |
| 2. | | |
| 3. | | |

xiv. Does this office or project site operate under any EPA or State permit conditions?
Yes ☐ No ☐ *If yes, complete the table below*

| **Type** | **Purpose** | **Permit No.** | **Expiration** | **Noncompliance Issues** |
|---|---|---|---|---|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |

xv. Does this office or project site generate hazardous wastes requiring an EPA or state ID Number?
Yes ☐ No ☐ *If yes, complete the table below*

| ID Number | Company Name associated with ID | Process Covered by the ID Number | Agency who Issued the ID Number |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |

# S3NA-204-GL Environmental Compliance

## 1.0 Recommendation

1.1 Project teams supporting complex projects requiring environmental/regulatory permitting, Operation & Maintenance (O&M) of client- or AECOM-permitted systems, or other licensing of processes or equipment should develop a *Compliance Map* to identify the associated permit, license, or Applicable or Relevant and Appropriate Requirement's (ARARs) defined actions, limits, and records retention requirements.

1.2 The project team should confirm the accuracy of a Compliance Map with an appropriate Subject Matter Expert.

1.3 The project team should review the Compliance Map at least annually or when a change in regulations, permit, equipment, or process occurs to verify continuing compliance with the associated permit, license, or ARARs.

1.4 The project team should authorize an individual to take prompt corrective measures when a deviation from the Compliance Map is reported. A deviation resulting in a known or possible state of regulatory non-compliance involving AECOM will be immediately reported per *S3NA-003-PR Incident Reporting*. The project team will ascertain the need to further report the known or possible non-compliance event to the client and/or applicable regulatory agency. If AECOM is not the designated permittee or licensed organization, AECOM should not report a known or possible state of regulatory non-compliance without first notifying the client and receiving verbal or written communication directing AECOM to report the event to the applicable regulatory agency.

## 2.0 Examples of Typical Compliance Maps

### 2.1 Environmental Sampling for an National Permit Discharge Elimination System (NPDES) Outfall

| Topic | Task | Task Description | Frequency | Regulatory Citation |
|---|---|---|---|---|
| Storm Water | Sample Outfall 001 for benzene and pH | Quarterly sample Outfall 001 for benzene and pH. Limit is 5 ug/L and 6.5 - 9 s.u. Record inspector, location, date and time of sampling using Form 3.<br><br>Maintain records for at least 3 years. | Quarterly by December 31, March 31, June 30 and October 31. | Part A.3 in NPDES Permit |
| Storm Water | Collect weekly flow measurements from Outfall 001 | Record inspector, location, date and time of sampling using Form 4. Maintain records for at least 3 years. | Weekly. | Part A.4 in NPDES Permit |
| Storm Water | Submit the Discharge Monitoring Report (DMR) Form | Complete the agency DMR form and have client or responsible party sign and certify DMR. If outfall did not have a discharge, fill out form stating as such. If additional monitoring is performed, submit those results also. Submit by the 28th of the month following the end of the quarter.<br><br>Maintain records for at least 3 years. | Quarterly by January 28, April 28, July 28 and October 28. | Part B.2 in NPDES Permit |

## 2.2 Nuclear Density/Moisture Gauge Radioactive Materials License

| Requirement | Due Date | Submit To | Requiring Document (State of Florida, Radioactive Materials License No.: xxxx-1, Amendment No.: 7) | Comments |
|---|---|---|---|---|
| Authorized storage location is [insert address] | As required | State of Florida DOH | Conditions 10.B. | If the office relocates, the RSO must submit the change to the State of Florida and request Amendment No.: 8. |
| Maintenance of training for NDMG users | Quarterly | File | Conditions 12.A. | NDMG operator and DOT shipping training must be maintained for the duration of employment of the individual or 5 years, whichever is greater. Training certificates should be uploaded into LMS. |
| Leak test on moisture/density gauges | At least every 12 months | File | Conditions 16. | Leak test should be scheduled no later than the 10th month following the most recent leak test |
| Physical inventory and inspection of all sealed sources received/possessed under License No.: xxxx-1 | At least every 6 months | File | Conditions 17. | |
| Maintenance of inventory records | Quarterly | File | Conditions 17. | Inventory records will be filed for 3 years from the date of the inventory inspection. The inventory records must include the following:<br>1. Manufacturer's name<br>2. Model and Serial Nos. of each sealed source<br>3. Identify of each sealed source's radionuclide and it's estimated activity<br>4. The location of each sealed source<br>5. The date the inventory was completed<br>6. RSO's signature |

# S3NA-205-PR Equipment Inspections and Maintenance

## 1.0 Purpose and Scope

1.1 This procedure establishes the AECOM requirements for the maintenance, inspection, and repair of AECOM-owned equipment used by AECOM staff to prevent unsafe conditions from developing.

1.2 This procedure applies to all AECOM North America-based staff and operations.

1.3 This procedure does not apply to Personal Protective Equipment.

## 2.0 Terms and Definitions

2.1 **Equipment**: Any machinery, tools, or other devices that serve a function and are used during work for AECOM business.

2.2 **Inspection**: A formal (planned, documented) or informal (ongoing observations/physical checks, not documented) review of the condition and function of the equipment, the purpose of which is to identify any damage or condition that might pose a hazard or impair the proper functioning of the equipment.

2.3 **Maintenance**: Regular care and upkeep of equipment in accordance with manufacturers' instructions, at a minimum, and with AECOM specified schedules and requirements where applicable.

## 3.0 Attachments

3.1 S3NA-205-FM1 Equipment Maintenance Inventory

3.2 S3NA-205-FM2 Equipment Inspection Report

## 4.0 Procedure

4.1 Inspections and maintenance of AECOM-owned or -leased equipment shall be completed by qualified/competent persons.

4.2 Supervisors and managers will confirm that staff assigned to use equipment are familiar with the specific inspection and maintenance requirements of that equipment.

### 4.3 Maintenance

4.3.1 All AECOM-owned or -leased equipment shall be maintained in good working order, free of defects or conditions that may pose a risk to employees, the public, or the environment.

4.3.2 Large mobile equipment or equipment that has associated high risk exposures (e.g., electrical or radiation) shall have an established, documented, preventative maintenance program. Examples of equipment that will have documented maintenance inspections include

- Nuclear densometers
- AECOM leased or owned vehicles
- AECOM leased or owned boats, ATVs, or snowmobiles
- Electrofishers
- Lab equipment

4.3.3 The maintenance program shall:

- Adhere to applicable regulations, standards, and manufacturers' specifications;
- Provide for service by appropriately qualified maintenance personnel; and,
- Require maintenance schedules and records of maintenance.

4.3.4 **District Business Line Managers** and **Office Managers** shall determine and inventory the equipment within their operation requiring scheduled maintenance. Using applicable regulations, industry standards, best practices, and manufacturer's recommendations, the office must develop a maintenance schedule with defined responsibility, required actions, and frequency (*S3NA-205-FM1 Equipment Maintenance Inventory*).

4.3.5 Employees who are assigned equipment or tools that require maintenance under this program will review maintenance schedules for that equipment and will confirm that required maintenance has occurred or see that it is undertaken.

### 4.4 Inspections

4.4.1 Employees will inspect all tools and equipment before using them to identify:

- Damage
- Unsafe conditions
- Need for recertification
- Suitability of the tool or equipment for the intended work process

### 4.5 Repairs and Out of Service

4.5.1 All tools or equipment that an employee deems defective will immediately be repaired, or, if repair is not practicable, tagged "Out of Service" and sent for repairs or discarded.

4.5.2 Defects or other unsafe conditions observed during an AECOM inspection shall be recorded and tracked until the equipment is repaired and ready to return to service (*S3NA-205-FM2 Equipment Inspection Report*).

### 4.6 Rented or Personal Equipment

4.6.1 Any equipment that is not owned by AECOM (e.g., rental or personal equipment used for AECOM business) will be inspected by employees prior to use.

4.6.2 Any defects or unsafe conditions will be reported to the supervisor, rental agency, or owner of the equipment, and the equipment will not be used until the equipment is repaired, the condition is corrected, or alternate equipment is found.

## 5.0 Records

5.1 Completed maintenance inventories (*S3NA-205-FM1 Equipment Maintenance Inventory*) and associated maintenance records will be stored in local office files.

5.2 Completed inspection reports (*S3NA-205-FM2 Equipment Inspection Report*) and associated repair records will be stored in local office files.

## 6.0 References

6.1 None

# S3NA-205-FM1 Equipment Maintenance Inventory

| EQUIPMENT | FREQUENCY OF SERVICE | MANUFACTURER'S STANDARDS | INDUSTRY STANDARDS | LEGISLATED REQUIREMENTS | LOCATION OF EQUIPMENT |
|---|---|---|---|---|---|
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# S3NA-205-FM2 Equipment Inspection Report

| EQUIPMENT | DATE | RESULTS | ACTION REQUIRED | COMPLETED (DATE) |
|---|---|---|---|---|
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# S3NA-206-PR Fire Protection, Field

## 1.0 Purpose and Scope

1.1 This procedure establishes the AECOM requirements for the selection, placement, use, and inspection of fire extinguishing and fire detection equipment.

1.2 This procedure applies to all AECOM North America-based field work.

## 2.0 Terms and Definitions

2.1 **Combustible liquid:** Liquid that must be heated to a temperature of 100° F or 37.8° C to emit sufficient vapors to form an ignitable mixture with the air.

2.2 **Flammable liquid:** Liquid that gives off enough vapor to form an ignitable mixture with air at ambient temperatures (less than 100° F or 37.8°C).

## 3.0 Attachments

3.1 S3NA-106-WI Portable Fire Extinguishers

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 The **Project Manager** shall confirm that fire protection equipment is available at all field sites or in vehicles as required.

4.1.2 The **Project Manager** shall confirm that any fire extinguishing and detection equipment established at AECOM temporary worksites (and vehicles) are appropriately maintained and inspected in accordance with local fire codes.

4.1.3 The **Project Manager** shall confirm that all field staff who may have to use a portable fire extinguisher or other fire protection equipment are adequately trained in their use.

4.1.4 **Employees** shall familiarize themselves with the fire response and protection procedures that apply to the site on which they are working.

### 4.2 Planning

4.2.1 All field sites (including vehicles) will be equipped with a fire extinguisher and/or fire protection equipment appropriate to the number of staff, location of the work, and job task, as dictated by legislation or client requirements.

4.2.2 Fire protection equipment may include:

- Fire extinguishers, of the appropriate size, class, and type for the hazard
- Round-nosed shovel, as required
- Pulaski tool or mattock, as required
- Hand-tank pump containing at least 18 liters of water, as required to meet regulations

4.2.3 All **employees** shall be constantly on the alert for conditions that might contribute to a fire and shall remove or report the hazard.

4.2.4 Do not use gasoline or other flammable liquids as degreasing or cleaning agents. Use only approved solvents or other combustible liquids.

4.2.5 All work sites housing large volumes of chemicals shall ensure that placards identifying the chemicals are in place.

### 4.3 Planning

4.3.1 All field sites (including vehicles) will be equipped with a fire extinguisher and/or fire protection equipment appropriate to the number of staff, location of the work, and job task, as dictated by legislation or client requirements.

4.3.2 Fire protection equipment may include:

- Fire extinguishers, of the appropriate size, class, and type for the hazard
- Round-nosed shovel, as required
- Pulaski tool or mattock, as required
- Hand-tank pump containing at least 18 liters of water, as required to meet regulations

4.3.3 All **employees** shall be constantly on the alert for conditions that might contribute to a fire and shall remove or report the hazard.

4.3.4 Do not use gasoline or other flammable liquids as degreasing or cleaning agents. Use only approved solvents or other combustible liquids.

4.3.5 All work sites housing large volumes of chemicals shall ensure that placards identifying the chemicals are in place.

4.3.6 All **employees** shall know the location of fire fighting equipment in their work area.

4.3.7 Access to fire fighting equipment must never be blocked by material, equipment, or vehicles.

4.3.8 A schedule for inspecting fire fighting equipment shall be developed to confirm that it is in place, accessible, and fully charged. Inspection and maintenance shall be conducted in accordance with the manufacturer's instructions.

## 4.4 In the Event of a Fire

4.4.1 Activate the nearest fire alarm or call for help, if available, before attempting to extinguish a fire. If the fire is too big to control with the equipment at hand, retreat.

4.4.2 Never turn your back on a fire. Always back away until you are at a safe distance.

4.4.3 Never use water on an electrical fire.

4.4.4 All fire extinguisher contents shall be applied from upwind and shall be directed at the base or outer edge of the fire with a sweeping motion.

4.4.5 Never return a discharged fire extinguisher to its normal location. Take it out of service for recharging and replace it with a fully charged unit.

## 4.5 Fire Extinguishers

4.5.1 Vehicles used for field work may be required to carry fire extinguishers as well, depending on client and/or industry standards. These fire extinguishers must be secured to the vehicle and never carried in the cab. It is the responsibility of all field staff to confirm that these fire extinguishers are kept charged, secured, and available in good working condition.

4.5.2 Fire extinguishers are to be readily available wherever the potential for fire exists (e.g., during welding, grinding, or open flame operations).

4.5.3 Fire extinguishers must be available in locations where flammable or combustible materials are stored, handled, or used.

4.5.4 Fire extinguishers will be readily accessible, properly maintained, regularly inspected, and promptly refilled immediately after use.

4.5.5 Fire extinguishers will be secured to all mobile equipment.

4.5.6 Only trained personnel should use a fire extinguisher. In the event of a fire, follow the site or project-specific emergency procedures for contacting the local fire department.

## 4.6 Location and Identification of Fire Extinguishers

4.6.1 Fire extinguishers will be located and installed as follows:

- Located where they are readily seen. If an obstruction is unavoidable, then a sign indicating the location of the extinguisher and/or color symbol (e.g., red markings) will be used.
- Fire extinguishers will always be positioned with the label visible.
- If extinguishers of different classes (e.g., one Class A and one Class B) are stored together, then they will be marked using stencils or signs clearly indicating the type of fire for which each should be used.

- If an extinguisher contains an electrically conductive agent (e.g., water), it will be clearly labeled with a sign that states “Not for Electrical Fires” with letters visible from at least 3 feet away.
- Extinguishers will not be left on the floor, but will be hung on a wall, column, or other appropriate support or shall be of the wheeled or cart type. Extinguishers of not more than 40 pounds will be hung so that the top is not more than 5 feet above the floor. Extinguishers greater than 40 pounds will be hung so that the top is not more than 3-½ feet from the floor. The bottom of the extinguisher will not be less than 4 inches from the floor.
- Extinguishers will be suitable for use at temperatures of 40°F to 120°F. The mounting locations will allow the fire extinguishers to be kept within this temperature range.

### 4.7 Inspection of Fire Equipment

4.7.1 Inspection, Maintenance, and Testing of Portable Extinguishers

- The use or discharge of any fire extinguisher by an AECOM employee shall be immediately reported to the Supervisor. A Supervisor's Incident Report shall be developed and submitted in accordance with S3NA-004-PR Incident Reporting.
- Extinguishers are to be inspected monthly to ensure they are still in the proper location, have not been used or tampered with, are still properly charged, and that they have no obvious external damage. The initials of the inspector and the date of inspection will be noted on the tag attached to the extinguisher.
- Any extinguisher showing damage will be replaced.
- A thorough inspection will be performed annually by personnel specifically trained in the inspection (e.g., extinguisher supplier).
- Extinguishers will be tested and recharged by qualified contractors as required by the applicable regulations and standards.

### 4.8 Forest Fires

4.8.1 If a crew discovers an uncontrolled, unattended forest fire, they will:

- Notify the appropriate authorities;
- If possible, use the fire fighting equipment at their disposal to suppress the fire; or
- If the fire is out of control or the crew determines the area to be unsafe, evacuate the area; and
- Immediately notify their project manager and other AECOM personnel in the area.

4.8.2 If a crew is to be working in an area where a known wildfire is burning or a wildfire starts, they will:

- Monitor the current status of the fire using radios and contact with the local authorities;
- Evacuate the area if an evacuation alert is given; and
- Immediately notify their project manager and other personnel in the area if the hazard or circumstances change.

4.8.3 If crews must start or monitor a fire for any reason, they will:

- Obtain the appropriate permits;
- Monitor any fire bans in the area; and
- Take every precaution to keep the fire in control and in a designed containment area.

## 5.0 Records

5.1 Fire extinguisher inspections shall be maintained in the appropriate office safety files.

## 6.0 References

6.1 S3NA-004-PR Incident Reporting

# S3NA-206-WI Portable Fire Extinguishers

## 1.0 Portable Fire Extinguishers

### 1.1 Selection Requirements

Portable extinguishers will be selected based on the following classifications:

| Classification | Type of Fire |
|---|---|
| Class A | Combustible materials |
| Class B | Flammable liquid, gas, or grease |
| Class C | Electrical equipment |
| Class D | Combustible metal |

In addition, portable fire extinguisher selection, placement, and fire protection systems designed for use on a project or in an AECOM office will be made in conjunction with an AECOM SH&E representative, the local fire department, or a professional fire protection systems contractor. Unless otherwise approved by an AECOM SH&E representative, fire extinguishers selected for use will be of the Type A, B, and/or C variety, typically charged with water, carbon dioxide, nitrogen, a dry chemical, or other approved extinguishing agent.

### 1.2 Class A Extinguishers

The number of Class A extinguishers will be based on the following:

| | **Light (low) Hazard Occupancy** | **Ordinary (moderate) Hazard Occupancy** | **Extra (high) Hazard Occupancy** |
|---|---|---|---|
| **Minimum rated single extinguisher** | 2-A | 2-A | 2-A |
| **Maximum floor area per unit of A** | 3,000 sq. ft. | 1500 sq. ft. | 1000 sq. ft. |
| **Maximum floor area for extinguisher** | 11,250 sq. ft. | 11,250 sq. ft. | 11,250 sq. ft. |
| **Maximum travel distance to extinguisher** | 75 ft. | 75 ft. | 75 ft. |

The availability of Class A extinguishers can be satisfied with the use of extinguishers with multiple ratings (e.g., Class A, B, and C). In addition, where automatic sprinkler systems are present, the maximum floor area for each extinguisher does not apply; however, the 75-foot travel distance does.

### 1.3 Class B Extinguishers

Class B extinguishers will be provided according to the severity of the hazard as listed below:

| **Fire extinguishers labeled prior to June 1, 1969** | |
|---|---|
| **Type of hazard** | **Basic minimum extinguisher rating** |
| Light | 4B |
| Ordinary | 8B |
| Extra | 12B |
| **Fire extinguishers labeled after June 1, 1969** | |

| Type of hazard | Basic minimum extinguisher rating |
|---|---|
| Light | 5B, 10B |
| Ordinary | 10B, 20B |
| Extra | 20B, 40B |

An open tank in a building having flammable liquids in depth exceeding ¼ inch will be provided with sufficient extinguishers to provide 1 numerical unit of Class B or each square foot of tank surface area, the minimum extinguisher being a 5B (using labels after June 1, 1969). So, for example, a tank with a surface area of 50 square feet would require two Class 20B (or one 40B) and one Class 10B extinguisher. For tanks exceeding 100 square feet in surface area, a fixed extinguisher will be provided in addition to sufficient portable extinguishers for the numerical unit of Class to equal 100 (e.g., two Class 40B and one Class 20 B).

All Class B extinguishers will be located on the same floor as the hazard, with a travel distance of no more than 50 feet. For widely separated hazards (e.g., boiler rooms, paint storage areas, kitchens), a separate extinguisher for each class of hazard will be provided if the travel distance is more than 25 feet.

### 1.4 Class C Extinguishers

Class C extinguishers (one 15-pound carbon dioxide or equivalent) will be provided within 25 feet of a high hazard area containing an electrical distribution source such as a generator, transformer, or main switchgear. Also, the extinguisher size and locations will be determined based on the expected type of fire (combustible-Class A, or flammable-Class B) as noted above.

### 1.5 Class D Extinguishers

A Class D extinguisher for the specific type of combustible metal will be kept within 25 feet of the area where the metal is machined or processed.

# S3NA-207-PR Medical Services and First Aid

## 1.0 Purpose and Scope

**1.1** The purpose of AECOM's Medical Services and First Aid Program is to define the types of first aid providers within AECOM, to explain duties and responsibilities of first aid providers, and to maintain sufficient quantities of basic first aid kit supplies at each field office or project location.

**1.2** This procedure applies to all Americas AECOM operations. .

## 2.0 Terms and Definitions

**2.1** **AED**: Automated external defibrillator or AED is a portable electronic device that automatically diagnoses the potentially life threatening cardiac arrhythmias of ventricular fibrillation and ventricular tachycardia in a patient, and is able to treat them through defibrillation, the application of electrical therapy which stops the arrhythmia, allowing the heart to re-establish an effective rhythm, are used in the resuscitation of a patient in full cardiac arrest.

**2.2** **First Aid Provider:** A first aid provider responds as a "Good Samaritan." They use a limited amount of equipment to perform initial assessment and provide immediate life support and care while awaiting arrival of emergency medical services.

**2.3** **First Responder:** A designated individual who uses a limited amount of equipment to perform initial assessment and intervention, and is trained to assist other emergency medical services.

**2.4** **Emergency Medical Technician (EMT) Basic:** The second level of professional emergency medical care provider. An EMT is qualified to function as the minimum staff for an ambulance.

**2.5** **EMT Intermediate:** The third level of professional emergency medical care provider. Can perform essential advanced techniques and administer a limited number of medications.

**2.6** **Paramedic:** The fourth level of professional emergency medical care provider. Can administer additional interventions and medications.

**2.7** **Reasonable Risks:** For the purpose of this Standard Operating Procedure, a traumatic injury with the potential for immediate life threatening consequences. Injuries may include, but are not limited to:

- Falls from heights in excess of six (6) feet/1.8 meters.
- Electrical Shock
- Loss of Consciousness
- Severe bleeding.
- Concentrated chemical exposure above a short-term exposure limit (STEL) or immediately dangerous to life and health (IDLH) value.
- Crushing and/or severing injuries.

## 3.0 Attachments

**3.1** S3NA_207_GL_Recommended First Aid Kit Contents

## 4.0 Procedure

**4.1** An injured employee's survival and recovery from incidents in the field are dependent upon the availability of appropriate first aid supplies and equipment, as well as the availability of a first aid-trained attendant.

**4.2** The level of first aid attendant, the type of first aid kit and additional requirements such as blankets and qualified first aid attendants vary depending upon the number of workers, location of job site and associated job hazards. Prior to conducting field work, the employee must discuss these requirements, in addition to other required Personal Protective Equipment, with their **Project Manager**.

**4.3** An assessment shall be made for each project site to determine the response time and availability of Emergency Medical Services (EMS). In the absence of an infirmary, clinic, hospital, or physician, that is reasonably accessible in terms of time and distance to the worksite, which is available for the treatment of injured employees, a person who has a valid certificate in first-aid training from the U.S. Bureau of Mines, the American Red Cross, or equivalent training that can be verified by documentary evidence, shall be available at the worksite to render first aid.

### 4.4 First Aid Kits

4.4.1 It is required that all AECOM project or field sites maintain adequate first aid kits in convenient and accessible locations as appropriate for the specific location. Where the eyes or body of any person may be exposed to injurious materials, suitable facilities shall be provided within the work area for rinsing the material from eyes and off skin. Contact the SH&E Department for specific guidance.

4.4.2 All field sites (including vehicles) must be equipped with a complete first aid kit appropriate to the number of staff, location of the work, and job task, as dictated by the applicable legislation and regulation.

4.4.3 A log to track usage and a monthly inspection form should be included with the first aid kit.

4.4.4 The **Safety Local representative** (or **Site Safety Officer**, site supervisor, etc.) identified on each individual project site will be responsible for the inspection of field based kits for their assigned projects, including all vehicles.

4.4.5 Entries into the log are to be made by each employee that takes something from the kit. Employees are to indicate if the items were taken as a result of a work related incident and whether a Supervisor Report of Incident Form (SRI) was completed. During the monthly inspection, the **Safety Local representative** is to initial next to each entry which indicates there was a workplace exposure to verify the status of the affected employee.

4.4.6 Staff working away from the vicinity of a first aid kit shall carry a personal first aid kit.

4.4.7 The first aid equipment and supplies must be maintained in a clean, dry and serviceable condition, contained in a material that protects the contents from the environment, and clearly identified as first aid equipment and supplies.

4.4.8 AED's were required, must be maintained in optimal working condition. AED's will be inspected monthly by a properly trained and qualified employee. At a minimum, the AED manufacturer's recommended service schedule is to be followed; records of all servicing and testing is to be maintained. Only staff who have a valid first aid training certificate (which includes instruction on the use of an AED), and who have reviewed all manuals and DVD training resources which accompany the machine, may use an AED.

### 4.5 Postings

4.5.1 The location of first aid kits will be conspicuously posted at all AECOM field project sites. At field project sites, and other locations where 911 may not be readily available, the first aid kit should be posted along with applicable emergency contact, and hospital route information for the location.

### 4.6 Training

4.6.1 Required training shall be conducted by the Red Cross or equivalent. First Aid and CPR training will be renewed every 2 years. Additionally, annual training may be required for personnel who have access to AED. Employees will receive AED training for the device(s) which they may use and training certification will be renewed annually. Specific training may also be considered for such topics including wilderness survival and rescue for employees performing work in remote locations where access by EMT is limited by extreme terrain.

4.6.2 First Aid/CPR Training is required for the following AECOM employees:

- As required in accordance with applicable regulatory and project requirements;
- Employees conducting field work with reasonable risk for life threatening injuries where EMS are not accessible within four (4) minutes; and
- Employees conducting field work in remote areas that are not accessible by EMS within the regulatory or legislative requirement.

4.6.3 As there is potential for exposure to blood borne diseases, it is necessary for anyone who may render first aid and CPR to be aware of the hazards associated with contact with human blood and certain body fluids. AECOM's Blood Borne Pathogen (BBP) program (*S3NA-503-PR Blood Borne Pathogen Program*) is designed to protect all AECOM personnel from exposure to potentially infectious organisms found in human blood and other body fluids. (**29 CFR 1910.1030(g)(2))**

### 4.7 Providing Assistance to Injured Employees

4.7.1 In the case of an emergency, the first aid attendant may provide injured workers with a level of care within the scope of the attendant's training, objectively record observed or reported signs and symptoms of injuries and exposures to contaminants, and refer for medical treatment workers with injuries considered by the first aid attendant as being serious or beyond the scope of the attendant's training.

4.7.2 The location of the first aid kit must be obvious and made clear to all staff members. All on-site personnel should be made aware of the location and contents of the first aid kit at a worksite.

4.7.3 All on-site personnel must be aware of the first aid attendant location and contact information, as required.

### 4.8 Roles and Responsibilities

4.8.1 **Regional SH&E Manager** is responsible for the following:

- Coordinate assessments of each office for response time and availability of Emergency Medical Services (EMS).
- Coordinate first aid/adult cardiopulmonary resuscitation (CPR) and automated external defibrillator (AED) training with the local Operations Manager(s) for applicable personnel.

4.8.2 **Safety Local representative** is responsible for the following:

- Conduct monthly inspections of first aid kits and follow-up with employees which used for a Work Related purpose.
- Inform office/location manager of any discrepancies between usage log and actual contents of kit.
- Order replacement supplies and re-stock first aid kits.

4.8.3 **Site Safety Officers** (field based project sites) are responsible for the following:

- Conduct monthly inspections of first aid kits and follow-up with employees which used for a Work Related purpose.
- Inform office/location manager of any discrepancies between usage log and actual contents of kit.
- Order replacement supplies and re-stock first aid kits.

4.8.4 **Employees** are responsible for the following:

- Complete entry into first aid kit log for items used.
- Contact supervisor and assist with the completion of the SRI.

4.8.5 **Operations (Regional, District, Department) Manager** is responsible for supporting the assessment of office and field employees in the need for first aid, CPR and/or AED training and making training available to employees who require the training.

## 5.0 Records

None.

## 6.0 References

**6.1** Title 29, Code of Federal Regulations, Sections 1910.151, 1910.266(i)(7), 1910.1030(g)(2) and 1926.50

**6.2** S3NA_003_PR Training

**6.3** S3NA_208_PR_Personal Protective Equipment Program

**6.4** S3NA-503-PR Blood Borne Pathogen Program

**6.5** CANADA OCCUPATIONAL HEALTH AND SAFETY REGULATIONS SOR/86-304

**6.6** WORKPLACE SAFETY AND HEALTH ACT 217/2006

6.7 OCCUPATIONAL HEALTH AND SAFETY ACT O.C. 91-1035

# S3NA-207-GL Recommended First Aid Guidelines

## 1.0 Recommendations

1.1 The following recommendations are from the contracted AECOM Third Party Medical Provider

1.2 First aid kits should be periodically restocked according to a schedule and contain appropriate items that would be useful to deal with specific events that relate to a specialized occupation.

## 2.0 Regulations

2.1 All guidelines must comply with

2.1.1 29 CFR 1910.151;

2.1.2 29 CFR 1926.50;

2.1.3 Canada Labour Code, Part II, R.S.C. 1985, c.L-2;

2.1.4 Canada Occupational Safety and Health Regulations, SOR/ 86-304; and

2.1.5 Any local State, Provincial or Territorial regulations.

## 3.0 General Guidelines for a Workplace First Aid Kit

3.1 The type of business and the number of employees can alter this list. The list below is for approximately 25 employees in an office environment:

3.1.1 Gauze pads - sterile – 4” x 4” (10)

3.1.2 Large wound dressing – 5x9” or 8x10” (2)

3.1.3 Eye patch (3)

3.1.4 Band-aids (25)

3.1.5 Elastic bandage – 3” (2)

3.1.6 Roller gauze – 3” (2)

3.1.7 Triangular bandage (2)

3.1.8 Cold pack (2)

3.1.9 Gloves – non-latex (6 pair minimum)

3.1.10 Antiseptic wipes for wound care (6)

3.1.11 Packets of burn cream, antibiotic ointment, sting relief wipes (6 each)

3.1.12 Scissors (1 pair)

3.1.13 Tweezers (1 set)

3.1.14 Analgesic packets of 2 (acetaminophen, ibuprofen) (12) depending on policy

3.1.15 Eye flush – 4 oz (1)

3.1.16 Adhesive tape – (1 roll)

3.1.17 Waterless hand sanitizer (Purell) (1 bottle)

3.1.18 CPR pocket mask or Microshield (1)

3.1.19 First aid guidelines and emergency contact instructions

# S3NA-208-PR Personal Protective Equipment Program

## 1.0 Purpose and Scope

1.1 Provide an effective Personal Protective Equipment (PPE) Program to protect AECOM employees from potential workplace safety and health hazards.

1.2 This procedure applies to all AECOM North America-based employees and operations.

1.3 The proper use of appropriate PPE, in combination with effective engineering and administrative controls, can provide AECOM employees with protection against potential workplace hazards and can reduce the potential for workplace injury and illness.

## 2.0 Terms and Definitions

2.1 **PPE**: Personal Protective Equipment

2.2 **ANSI:** American National Standards Institute

## 3.0 Attachments

3.1 S3NA-208-FM PPE Hazard Analysis

3.2 S3NA-208-WI1 PPE Selection

3.3 S3NA-208-WI2 Eye and Face Protection Fact Sheet

3.4 S3NA-208-WI3 Head Protection Fact Sheet

3.5 S3NA-208-WI4 Foot Protection Fact Sheet

3.6 S3NA-208-WI5 Hand Protection Fact Sheet

3.7 S3NA-208-WI6 Protective Clothing Fact Sheet

## 4.0 Procedure

### 4.1 Roles and Responsibilities

#### 4.1.1 Region SH&E Manager

- Provide guidance to **Project Managers, Field Task Managers, Supervisors**, and field staff on the assessment of hazards and the selection of PPE.
- Provide training materials to **Project Managers, Field Task Managers** and **Supervisors** for **employee** training.

#### 4.1.2 Project Managers (Field Task Managers, Supervisors)

- Conduct Hazard Assessments to identify hazards present and to specify PPE appropriate for those hazards.
- Determine which of your staff members will require **employee**-issued PPE.
- Approve the purchase of company-issued PPE.
- Verify that appropriate PPE is utilized by your **employees** when required or necessary.

#### 4.1.3 Employee

- In accordance with your training and instructions, utilize appropriate PPE that has been issued to them when required or necessary.
- Inspect your PPE prior to use to confirm that it is functional, and maintain your PPE in a clean and functional condition.
- Follow instructions and manufacturers' guidance on the care, use, and storage of your PPE.
- Prior to using any type of PPE, confirm that it is in good shape, free of dirt and debris, and that you are familiar with its correct use. Always make sure PPE fits adequately to perform the use intended.

- Refrain from wearing PPE outside of the work area for which it is required if doing so would constitute a hazard.

## 4.2 Hazard Assessment for Office Locations

S3NA-209-FM PPE Hazard Analysis will serve as the certificate of hazard assessment, as defined in 29 CFR 1910.132 (d) (2), for office activities that require PPE. This checklist will also be used to determine the PPE requirements for nonroutine maintenance tasks that may not be evaluated during the initial hazard assessments.

## 4.3 Hazard Assessment for Off-Site Locations

4.3.1 HAZWOPER Locations

- Each Health and Safety Plan (HASP) that is prepared for waste site investigations/remediation includes a hazard assessment for each proposed field activity. Task-specific PPE requirements are listed in the HASP. Therefore, the HASP will serve as the certificate of hazard assessment for each project that involves off-site work activities that require the use of PPE.

4.3.2 All Other Off-Site Locations

- The Task Hazard Analysis will serve as the certificate of hazard assessment for projects that involves offsite work activities that require the use of PPE. The checklist will be reviewed with the entire field team prior to arriving at the site.

## 4.4 Training

4.4.1 Staff will receive adequate instruction on the correct use, limitations, and assigned maintenance duties for the equipment to be used. The following information, at a minimum, will be covered during PPE training:

- What PPE is required.
- When it is required.
- Why it is required.
- How to properly don, doff, adjust, and wear the PPE described.
- The limitations of the PPE, including its expected useful life.
- How to properly care for, maintain, and dispose of the PPE.

4.4.2 Field staff are responsible for confirming that they have reviewed the operation manual for the PPE before work commences.

4.4.3 All staff will receive an orientation to the hazards on the job site as well as initial Field Safety orientation that outlines appropriate PPE requirements.

4.4.4 AECOM **employees** who have participated in the 40-hour HAZWOPER training course are considered to have met the **employee** training requirements of the PPE standard. The training certificates that are issued as documentation of successful completion of the 40-hour HAZWOPER course will also serve as documentation of training as required by the PPE standard. **Employees** who have not participated in the HAZWOPER training will be provided PPE training specific to your assignment and/or location. The PPE Facts Sheets (attached) can serve as the basis for training.

## 4.5 Determining the Need for PPE

4.5.1 Using the Task Hazard Assessment or HASP, the need for the following types of PPE will be evaluated.

4.5.2 PPE will:

- Be selected and used in accordance with recognized standards and provide effective protection.
- Not in itself create a hazard to the wearer.
- Be compatible, so that one item of PPE does not make another item ineffective.
- Be maintained in good working order and in a sanitary condition.

4.5.3 Prior to entering any regulated work area, confirm that you have access to or are equipped with the following CSA-approved PPE, appropriate to the site hazards:

- Head Protection
- Eye & Face Protection
- Foot Protection
- Hi-Visibility Vests
- Hearing Protection

4.5.4 After the hazard assessments have been completed, the **Project Manager** will select the appropriate PPE for each job category or task, as necessary. The selected equipment will be indicated on the hazard assessment. PPE will be provided to each **employee** appropriate for the hazards present. All PPE selected and purchased by AECOM will meet or exceed the American National Standards Institute (ANSI) standards, Canadian Standards Association (CSA) standards, or other standards as dictated by provincial, territorial, or state legislation.

### 4.6 Eye and Face Protection

4.6.1 The OSHA standard requires that AECOM **employees** use appropriate eye and face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acid and caustic liquids, chemical gases or vapors, and injurious light radiation. The standard further requires that eye protection provide side protection when there is a hazard from flying objects.

### 4.7 Head Protection

4.7.1 Protective helmets (hard hats) are required when **employees** are working in areas where there is a potential for falling objects to cause injury to the head. When working near exposed electrical conductors that could contact the head, helmets designed to reduce electrical shock will be worn.

### 4.8 Foot Protection

4.8.1 Protective footwear is required when **employees** are working in areas where there is a danger of foot injuries from falling and rolling objects or from objects piercing the sole and where an **employee's** feet are exposed to electrical hazards.

### 4.9 Hand Protection

4.9.1 Appropriate hand protection is required when **employee's** hands are exposed to hazards such as those from skin absorption of harmful substances, severe cuts and lacerations, severe abrasions, punctures, chemical burns, thermal burns, or harmful temperature extremes.

### 4.10 Chemically Resistant Clothing

4.10.1 Chemically resistant clothing is required when there is significant potential for the **employee** to come in direct contact with the chemicals he/she is handling. Tasks that involve chemical handling will be evaluated for the potential of splashing or spilling.

### 4.11 High-Visibility Apparel

4.11.1 High-visibility apparel with reflective banding (ANSI Class II and III garment) is required for all field activities in close proximity to moving traffic and other modes of transportation (transit, airlines, marine, etc.), in proximity to heavy equipment operations, or whenever otherwise specified in a project HASP. Color of apparel (orange or lime) may be client/project-specific.

### 4.12 Personal Clothing

4.12.1 For personal safety on the job site, do not wear

- Loose or unsecured clothing or loose fitting cuffs.
- Greasy or oily clothing, gloves, or boots.
- Torn or ragged clothing.

4.12.2 Neck chains are hazardous and will be worn under clothing so that they do not hang out. Long hair will be tied back or otherwise confined.

4.12.3 Clothing made of synthetic fibres can be readily ignited and melted by electric flash or extreme heat sources. Cotton or wool fabrics are recommended for general use.

### 4.13 Specialized PPE

4.13.1 In addition to basic PPE, additional specialized PPE may be required to provide appropriate protection to the **employee**. Refer to applicable OH&S legislation and related Standard Operating Procedures for additional information on PPE requirements.

- Fall Protection: Only full body harnesses with shock-absorbing lanyards will be used for personal fall arrest.
- Respiratory Protection: Respiratory protection shall be selected based on the contaminant and concentration to which the **employee** will be exposed. Refer to*S3NA-519-PR-Repiratory Protection Program* and the task- or project-specific Baseline Hazard Assessments for specific requirements.
- Fire Resistant Clothing: Approved fire resistant outer clothing may be required at work locations with flammable or explosive materials or environments.
- Other Head Protection: Operators and passengers (if permitted) of all terrain vehicles and snowmobiles will wear approved helmets.
- Chemical Protective Clothing: Approved chemical protection appropriate to the hazard will be worn. Review applicable Material Safety Data Sheets (MSDSs) for appropriate PPE.
- Protection from Drowning: **Employees** being transported by boat are required to wear life jackets. **Employees** exposed to any other drowning hazards are required to wear personal flotation devices. Life jackets and personal flotation devices will have the proper regulatory approval.

### 4.14 PPE Supplies

4.14.1 Each AECOM office will maintain a supply of safety equipment including safety glasses, gloves, and chemically resistant clothing based on the nature of their field activities. The **Office Manager** or designee will be responsible for maintaining this inventory. PPE that is required for large field efforts will be ordered by the **Project Manager** or their designee.

4.14.2 At a minimum, the office will review its PPE program annually.

### 4.15 Obtaining Personalized Safety Gear

4.15.1 The OSHA standard in 29 CFR 1910 - Subpart I / 29 CFR 1926 requires that protective equipment, including PPE for eyes, face, head, and extremities, protective clothing, and respiratory devices, be provided to **employees** wherever necessary by reason of hazards.

4.15.2 **Employees** are not expected to provide their own general PPE. Although each AECOM office stocks and issues various general issue safety gear such as hard hats, plan safety glasses, disposable gloves and coveralls, fall protection, and hearing protection, certain personalized safety gear such as prescription safety glasses, safety-toed (capped) boots, and cotton coveralls will be ordered and sized specifically for the user.

4.15.3 Most PPE will be provided to the **employee** at no charge, with the exception of the above personalized safety equipment (safety glasses, safety toed boots, washable coveralls). A partial cost reimbursement to the **employee** may be made based on legacy company practice or project stipulations.

4.15.4 Prescription Safety Glasses

- As with all hazards, staff will be notified of their potential for injury and will be provided with the appropriate PPE. If wearing contact lenses poses a hazard to the worker's eyes during work, the worker will be advised of the hazards and the alternatives to wearing contact lenses.
- Eligibility
    - **Employees** will wear safety glasses during activities that involve exposure to eye hazards such as flying particles, chemical splash, or certain types of radiation such as ultraviolet

light from welding operations. Typically, the following types of field activities will require the use of safety glasses:

- Site investigation or remediation and construction activities.
- Stack monitoring and other types of air emissions monitoring.
- Audits and assessments in industrial or manufacturing facilities.
- Activities conducted within laboratories.
- Activities at client facilities where safety glasses are required.
  - Eligibility to obtain prescription safety glasses will be determined by the **employee's supervisor** based upon the guidance above.
- Procurement of Prescription Safety Glasses
  - **Employees** who have been authorized to purchase prescription safety glasses by their **supervisor** should consult the AECOM SH&E Department's Intranet for obtaining detailed instructions on how and where to purchase the equipment. **Employees** will be able to choose from several styles of approved frames, all equipped with permanently attached sideshields. Various lens materials are also available, although polycarbonate is recommended.
  - Except for eye examinations, associated prescription eyewear costs will be paid by AECOM. The **employee** may be asked to pay an optician's dispensing fee, which may be submitted on an expense report for reimbursement. Because eye examinations are not covered, **employees** who have had recent eye examinations should contact the eye care professional in advance to determine their procedure for handling a current prescription.
  - **Employees** who are eligible will be allowed to order one pair of prescription safety glasses every other year from the selection of glasses offered by the program.
  - Contact the **Region SH&E Manager** for guidance on the procurement of prescription safety glasses.

4.15.5 Safety Toed Boots/Shoes

- Eligibility
  - **Employees** will wear safety boots/shoes during activities that pose the potential for foot injury from dropped objects or penetrations through the sole. Typically, safety toed boots/shoes will be required for the same type of activities, with the exception of laboratory activities, for which safety glasses are required. In addition, work around all types of heavy equipment will typically require the use of safety shoes.
  - Eligibility to obtain safety shoes will be determined by the **employee's supervisor** based upon the guidance above.
- Procurement of Safety Shoes
  - Eligible **employees** will be allowed to purchase one pair of safety shoes every other year.
  - **Employees** who have been authorized to purchase safety shoes by their **supervisor** should consult the **Region SH&E Manager** for obtaining for detailed instructions on how and where to purchase the equipment. The style chosen (i.e., boot or shoe) should be determined based upon the application. For example, low cut shoes may be appropriate for audits and assessments in light industry applications, while safety boots will be more appropriate for environmental remediation, construction, and heavy industry work with significant foot hazards. Before purchasing, the **employee** is required to verify that the safety boots or shoes meet the specifications above.
  - After the purchase, an **employee** expense report, including a dated receipt for the shoes, should be submitted for approval and reimbursement. AECOM will reimburse the **employee** up to a amount that is specified by the **SH&E Department** or **Region Operations** management.

4.15.6 Reusable Coveralls

- Eligibility

  - Reusable cotton (or some other washable fabric) coveralls may be made available to **employees** who regularly perform field work based on conditions. Coveralls can be worn over personal clothing to help protect and keep them clean.
  - Eligibility to obtain washable coveralls will be determined by the **employee's supervisor** based upon the guidance above.
- Procurement of Reusable Coveralls
  - AECOM has established a master services agreement with a work clothing vendor that supplies us with long- sleeved, blue coveralls bearing the AECOM logo. These coveralls can be ordered through a standard purchase requisition authorized by the **employee's supervisor**. The cost of the coveralls will be covered entirely by your region.
  - **Employees** who are eligible will be allowed one pair of coveralls per year.

## 5.0 Records

5.1 Completed *S3NA-209-FM PPE Hazard Analysis* forms will be maintained in local office safety files.

## 6.0 References

6.1 Occupational Safety and Health Administration (OSHA) PPE standard (29 CFR 1910.132) requires AECOM to assess workplace(s) to determine if hazards that necessitate the use of PPE exist in the workplace, and, if such hazards are present, to

6.1.1 Select the appropriate types of PPE and

6.1.2 Provide employees with training about the use and care of the selected PPE.

# S3NA-208-FM PPE Hazard Analysis

*This form will be used for office activities that require PPE. It will also be used to determine the PPE requirements for nonroutine maintenance tasks that may not be evaluated during the initial hazard assessments.*

**1. Job Title(s):** This hazard analysis describes the tasks and required personal protective equipment for the following job titles:

**2. Description of Tasks:** The tasks performed by personnel in the above job titles include:

**3. Potential Hazards and PPE Selection** (see *S3NA-208-GL1 PPE Selection Guidelines* for assistance).

| TASK | POTENTIAL HAZARDS (1) | PPE SELECTION |
|---|---|---|
| | | |
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| | | |
| | | |

The signature of the certifying manager below verifies that the tasks are accurately described:

Signature Date

Print Name Date

# S3NA-208-FM PPE Hazard Analysis

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| TASK | POTENTIAL HAZARDS (1) | PPE SELECTION |
|---|---|---|
| | | |
| | | |
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| | | |
| | | |
| | | |
| | | |

The signature of the certifying manager below verifies that the tasks are accurately described:

Signature Date

Print Name Date

# S3NA-208-WI1 PPE Selection

## 1.0 Lists of Potential Hazards

| | POTENTIAL HAZARDS |
|---|---|
| HEAD | Falling overhead objects |
| | Spark contact |
| | Chemical contamination |
| | Cold/heat |
| | Electrical (>600 volts) |
| | |
| HANDS | Cuts, punctures, abrasions |
| | Burns |
| | Dermatitis |
| | Chemical absorption |
| | Cold |
| | |
| FEET | Falling or rolling objects |
| | Chemical absorption |
| | Dermatitis |
| | Burns |
| | Cold |
| | Slips, trips |
| | |
| FACE | Burns (chemical, spark, UV radiation) |
| | Chemical splashing |
| | Flying particulates |
| | Abrasions, cuts |
| | |
| EYES | Burns (gas, liquid, spark) |
| | Abrasions-flying particulates |
| | Absorption |
| | Retinal/corneal damage (UV/IR radiation) |
| | |
| EARS | Noise |
| | Cold |

| | |
|---|---|
| **BODY PROTECTION** | **Chemical splashing** |
| | **Burns (chemical, UV radiation)** |
| | **Absorption** |
| | **Spark contact** |
| | **Cuts/abrasions/punctures** |
| | **Heat/cold stress** |
| | **Moving vehicles/heavy equipment** |
| | |
| **MISCELLANEOUS** | **Insects (ticks, spiders, mosquitoes, bees/wasps)** |
| | **Animals (dogs, bears, wild boars, raccoons)** |
| | **Reptiles (snakes)** |
| | **Poison plants (poison ivy, poison sumac, poison oak)** |
| | **Biological (fungus, bacteria, fungus, viral)** |

## 2.0 Eye & Face Protection Selection Chart

| | | ASSESSMENT | PROTECTOR TYPE (see Table 2) | PROTECTOR | LIMITATIONS | NOT RECOMMENDED |
|---|---|---|---|---|---|---|
| IMPACT | Chipping, grinding, machining, masonry work, riveting, and sanding. | Flying fragments, objects, large chips, particles, sand, dirt, etc. | B, C, D, E, F, G, H, I, J, K, L, N | Spectacles, goggles, faceshields<br><br>SEE NOTES (1) (3) (5) (6) (10)<br>For severe exposure Add N | Protective devices do not provide unlimited protection.<br><br>SEE NOTE (7) | Protectors that do not provide protection from side exposure.<br>SEE NOTE (10)<br><br>Filter or tinted lenses that restrict light transmittance, unless it is determined that a glare hazard exists. Refer to OPTICAL RADIATION. |
| HEAT | Furnace operation, pouring, casting, hot dipping, gas cutting, and welding. | Hot sparks | B, C, D, E, F, G, H, I, J, K, L, *N<br><br>*N<br><br>N | Faceshields, goggles, spectacles.<br>*For severe exposure, add N<br><br>SEE NOTE (2) (3)<br><br>*Faceshields worn over goggles H, K<br><br>SEE NOTE (2) (3)<br><br>Screen faceshields. Reflective faceshields.<br><br>SEE NOTE (2) (3) | Spectacles, cup and cover type goggles do not provide unlimited facial protection.<br><br>SEE NOTE (2)<br><br>SEE NOTE (3) | Protectors that do not provide protection from side exposure. |
| | | Splash from molten metals | | | | |
| | | High temperature exposure | | | | |
| CHEMICAL | Acid and chemicals handling, degreasing, plating | Splash | G, H, K<br><br>*N | Goggle, eyecup and cover types.<br><br>*For severe exposure, add N | Ventilation should be adequate but well protected from splash entry | Spectacles, welding helmets, handshields |
| | | Irritating mists | G | Special purpose goggles | SEE NOTE (3) | |
| DUST | Woodworking, buffing, general dusty conditions. | Nuisance dust | G, H, K | Goggles, eyecup and cover types | Atmospheric conditions and the restricted ventilation of the protector can cause lenses to fog. Frequent cleaning may be required. | |

| | | ASSESSMENT | PROTECTOR TYPE | PROTECTOR | LIMITATIONS | NOT RECOMMENDED |
|---|---|---|---|---|---|---|
| OPTICAL RADIATION | WELDING: Electric Arc | | O, P, Q | **TECTORS FILTER LENS PRO- SHADE TECTORS** SEE NOTE (9) 10-14 Welding Helmets or Welding Shields | Protection from optical radiation is directly related to filter lens density. SEE NOTE (4). Select the darkest shade that allows adequate task performance. | Protectors that do not provide protection from optical radiation. SEE NOTE (4) |
| | WELDING: Gas<br>CUTTING<br>TORCH BRAZING | | J, K, L, M, N, O, P, Q | SEE NOTE (9) 4-8 Welding Goggles or Welding Faceshield<br>3-6<br>3-4 | SEE NOTE (3) | |
| | TORCH SOLDERING | | B, C, D, E, F, N | 1.5-3 Spectacles o Welding Faceshiel | | |
| | GLARE | | A, B | Spectacle SEE NOTE (9) (10) | Shaded or Special Purpose lenses, as suitable. SEE NOTE (8) | |

NOTES

(1) Care shall be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards. Adequate protection against the highest level of each of the hazards must be provided.
(2) Operations involving heat may also involve optical radiation. Protection from both hazards shall be provided.
(3) Faceshields shall only be worn over primary eye protection.
(4) Filter lenses shall meet the requirements for shade designations in Table 9-2.
(5) Persons whose vision requires the use of prescription (Rx) lenses shall wear either protective devices fitted with prescription (Rx) lenses or protective devices designated to be worn over regular prescription (Rx) eyewear.
(6) Wearers of contact lenses shall also be required to wear appropriate covering eye and face protection devices in a hazardous environment. It should be recognized that dusty and/or chemical environments may represent an additional hazard to contact lens wearers.
(7) Caution should be exercised in the use of metal frame protection devices in electrical hazard areas.
(8) Refer to Section 6.5, Special Purpose Lenses. (ANSI A87.1-1989)
(9) Welding helmets or handshields shall be used only over primary eye protection.
(10) Non-sideshield spectacles are available for frontal protection only.

## 3.0 Eye and Face Protector Selection Guide

A. SPECTACLE, No sideshield
B. CUP GOGGLE, Direct ventilation
C. CUP GOGGLE, Indirect ventilation
D. SPECTACLE, Headband temple
E. COVER WELDING-BURNING
F. GOGGLES, Indirect Ventilation
G. FACESHIELD
H. WELDING HELMET, Hand held
I. WELDING HELMET, Stationary window
J. WELDING HELMET, Lift front
K. COVER GOGGLE, Direct ventilation
L. SPECTACLE, Half sideshield
M. SPECTACLE, Full sideshield
N. SPECTACLE, Detachable sideshield
O. SPECTACLE, Non-removable lens
P. SPECTACLE, Lift front
Q. COVER GOGGLE, No ventilation
R. COVER GOGGLE, Indirect ventilation

## 4.0 Filter Lenses for Protection Against Radiant Energy

| OPERATIONS | ELECTRODE SIZE 1/32 INCH | ARC CURRENT | MINIMUM PROTECTIVE SHADE |
|---|---|---|---|
| | | | |
| Shielded metal-arc welding | Less than 3 | Less than 60 | 7 |
| | More than 3-5 | 60-160 | 8 |
| | More than 5-8 | 161-250 | 10 |
| | More than 8 | 251-550 | 11 |
| Gas metal arc welding and flux cored arc welding | | Less than 60 | 7 |
| | | 60-160 | 10 |
| | | 161-250 | 10 |
| | | 251-500 | 10 |
| Gas tungsten arc welding | | Less than 50 | 8 |
| | | 50-150 | 8 |
| | | 151-500 | 10 |
| Air carbon | (Light) | Less than 500 | 10 |
| Air cutting | (Heavy) | 500-1000 | 11 |
| Plasma arc welding | | Less than 20 | 6 |
| | | 20-100 | 8 |
| | | 101-400 | 10 |
| | | 401-800 | 11 |
| Torch brazing | | | 3 |
| Torch soldering | | | 2 |
| Carbon arc welding | | | 14 |

| 4.1.1.1 OPERATIONS | PLATE THICKNESS (INCHES) | (MM) | 4.1.1.2 MINIMUM* PROTECTIVE SHADE |
|---|---|---|---|
| | | | |
| Gas welding: | | | |
| Light | Under 1/8 | Under 3.2 | 4 |
| Medium | 1/8 to ½ | 3.2 to 12.7 | 5 |
| Heavy | Over 1/2 | Over 12.7 | 6 |
| Oxygen cutting: | | | |
| Light | Under 1 | Under 25 | 3 |
| Medium | 1 to 6 | 25 to 150 | 4 |
| Heavy | Over 6 | Over 151 | 5 |

# S3NA-208-WI2 Eye and Face Protection Fact Sheet

## 1.0 Introduction

1.1 Personal protective equipment (PPE) is designed to protect you from health and safety hazards that cannot be removed from your work environment. PPE is designed to protect many parts of your body including eyes, face, head, hands, and feet. AECOM has evaluated each of the job tasks performed in AECOM offices. The purpose of these evaluations was to assess the hazards associated with a specific task and to determine what type or types of PPE will adequately protect you from those hazards. It has been determined that your job will require the use of eye and/or face protection. This fact sheet has been developed to inform you about why eye and face protection is needed, when it should be worn, how to wear and adjust it properly, the limits of this type of PPE, and how to properly maintain and clean the eye and face protection you are issued.

## 2.0 Types of Eye and Face Protection

There are three major types of eye and face protection, including:

### 2.1 Primary Protectors

2.1.1 Safety glasses

The most widely used form of eye protection is safety glasses. To prevent lateral exposure to impact fragments, safety glasses are often equipped with side shields. Depending on the hazard, side shields can be either a cup-type or flat-folded. The cup-type provides more complete protection.

2.1.2 Safety goggles

- Vented goggles—impact only
- Indirectly vented—chemical splash and impact
- Non-vented—chemical fumes

2.1.3 Glasses offer excellent protection against impact; however, goggles form a tight-fitting seal to the skin around the entire eye and are more appropriate for chemical concerns.

### 2.2 Secondary Protectors

2.2.1 Faceshield

- Wear faceshields when there is a severe danger from impact or chemical splash. Faceshields are secondary protectors and must be worn over safety glasses or goggles.

2.2.2 Welding Helmet or Faceshield

- When welding, employees must use equipment with filter lenses that have a shade number appropriate for protection against injurious light radiation.

## 3.0 Cleaning and Maintaining Safety Eyewear

3.1 Clean lenses and frames regularly with soap and water. Store in a clean, dry area.

3.2 Replace scratched, pitted, cracked, or broken safety eyewear immediately.

## 4.0 Proper Fit/Adjusting Glasses

4.1 PPE that fits poorly will not afford the necessary protection. When fitting devices for eye protection against dust and chemical splashes, be sure that the devices are sealed to the face. If the temple bars of the glasses are too long, the glasses will have a tendency to fall forward and slide down your nose. Check with your SH&E coordinator if you need glasses with adjustable temple bars. Standard safety glasses are 58 mm; however, smaller sizes (54 mm) are also available.

**WHEN TO WEAR PROTECTION**

| Hazard | Concern | Glasses | Goggles | Faceshield |
|---|---|---|---|---|
| Impact | Flying fragments from front/sides. | Safety glasses with sideshields. | Vented goggles. | Severe danger from impact. Wear with glasses/goggl es. |
| Chemicals | Splash. | | Indirectly vented. | Severe splash. Wear with goggles. |
| Chemicals | Fumes. | | Non-vented. | |
| Injurious Light | | | Welding goggles with appropriate shaded lens. | Welding helmet with appropriate shaded lens. |
| Dust | Dust entering the eye. | Safety glasses with sideshields. | Vented goggles. | |

## 5.0 Prescription Glasses/Contact Lenses

5.1 AECOM has selected several types of safety glasses and goggles that meet the standards specified in the OSHA PPE Standard. Prescription eyeglasses must not be substituted for safety eyeglasses. Regular eyeglasses do not offer the same impact resistance of the lens and frame assembly as safety glasses and are not ANSI-approved. Goggles can be worn over eyeglasses. If you wear corrective lenses, contact your SH&E coordinator for information about how to obtain prescription safety glasses.

5.2 Contact lenses are not recommended for any industrial job. Dust caught underneath the lens can cause painful abrasions. Some chemicals can react with your contacts to cause permanent injury.

## 6.0 Guidelines

### 6.1 Eye Protection

The following standards apply to eye and face protection:

| Association | Standard |
|---|---|
| **American National Standard (ANSI)** | Z87.1-2003, Practice for Occupational and Educational Eye and Face Protection<br>Z87.1-1989, Practice for Occupational and Educational Eye and Face Protection |
| **Canadian Standards Association (CSA)** | Z94.3-02, Eye and Face Protectors<br>Z94.3.1-02, Protective Eyewear: A User's Guide<br>Z94.3-99, Industrial Eye and Face Protectors<br>CAN/CSA-Z94.3-92, Industrial Eye and Face Protectors |

6.1.1 AECOM will offer safety glasses with permanently attached sideshields or directly vented goggles to all employees working in an area or at a process that involves flying particles.

6.1.2 Non-vented and indirectly vented goggles will be worn when employees are handling chemicals.

6.1.3 Faceshields, in combination with glasses or goggles, will be required where a severe splash or impact hazard has been identified.

6.1.4 When welding, employees must use equipment with filter lenses that have a shade number appropriate for protection against injurious light radiation.

6.1.5 Supervisors and staff are responsible for ensuring that crews have access to the eye and face protection necessary to ensure their safety. This may include:

- Safety glasses with side shields,
- Safety goggles, or
- Face shield.

6.1.6 CSA/ANSI-approved eye and face protection shall be worn by all employees while engaged in activities where a risk of injury to the eyes or face may exist. Refer to Industrial Eye and Face Protectors, Canadian Standards Association.

6.1.7 Face shields shall be worn when using grinding, drilling, buffing, or striking tools.

6.1.8 Eye protection shall be worn when handling liquid or powder chemicals and when draining or breaking joints on any pressure vessel, line, or equipment. In some situations, a face shield should be used in conjunction with goggles for additional eye and face protection.

6.1.9 Face shields shall be made available or installed whenever they may be required. Goggles shall be provided, as required.

6.1.10 Hardened glass prescription lenses and sport glasses are not an acceptable substitute for proper, required industrial safety eye protection.

6.1.11 Comfort and fit are very important in the selection of safety eyewear. Lens coatings, venting, or fittings may be needed to prevent fogging or to fit with regular prescription eyeglasses.

6.1.12 Sunglasses should be worn when glare is a concern. Glare from sun and snow or water should be taken seriously as it can cause reduced vision and fatigue.

6.1.13 A combination of types of PPE may be necessary if more than one type of hazard exists. For example, where the potential hazards are chemical splashes and flying objects, chemical splash goggles used in combination with safety glasses may be required.

6.1.14 When contact lenses are worn (and where a hazard exists), extra precautions are required to reduce the potential for injury. As previously stated, contact lenses are not protective devices. PPE for contact lens wearers includes splash or dust-resistant goggles, and safety glasses. Other workers not wearing contact lenses would wear the same PPE when exposed to the same hazards.

6.1.15 Prescription eyewear may be worn if it is safety eyewear meeting CSA/ANSI standards and appropriate to the hazard or if it is worn behind equipment that meets the above requirements.

6.1.16 Personal eye and face protection is regulated for specific job tasks. For the most up-to-date information and for guidance, application or interpretation of these laws or guidelines, you should contact your local regulatory authority directly.

6.1.17 DO:

- Replace pitted, scratched, bent, and poorly fitted PPE (damaged face/eye protection interferes with vision and will not provide the protection it was designed to deliver).
- Wear proper fitting eye protection (close to the face).
- Clean safety glasses daily, more often if needed.
- Store safety glasses in a safe, clean, dry place when not in use.

6.1.18 DON'T:

- Modify eye/face protection.
- Use eye/face protection that does not have CSA/ANSI certification (a CSA stamp for safety glasses is usually on the frame inside the temple near the hinges of the glasses).

# S3NA-208-WI3 Head Protection Fact Sheet

## 1.0 Introduction

1.1 Personal protective equipment (PPE) is designed to protect you from health and safety hazards that cannot be removed from your work environment. PPE is designed to protect many parts of your body including eyes, face, head, hands, and feet. AECOM has evaluated each of the job tasks that are performed in the office. The purpose of these evaluations was to assess the hazards associated with a specific task and to determine what type or types of PPE will adequately protect you from those hazards.

1.2 Because there is no potential for injury to the head from falling objects, head protection is not required. However, some nonroutine maintenance tasks or construction activities may require such equipment. The need for this type of PPE while performing such nonroutine tasks will be evaluated by your health and safety coordinator.

## 2.0 Types of Head Protection

2.1 The main type of head protector is the helmet. Helmets are designed to protect you from impact and penetration caused by objects hitting your head and from limited electrical shock or burns. The shell of the helmet is designed to absorb some of the impact. The suspension, which consists of a headband and strapping, not only holds the helmet in place but is critical for absorbing and distributing impact shock loads.

### Hard Hat Impact Types

**Type I Hard Hats**

Type I hard hats are intended to reduce the force of impact resulting for a blow only to the top of the head.

**Type II Hard Hats**

Type II hard hats are intended to reduce the force of impact resulting from a blow that may be received off center or to the top of the head. A Type II hard hat typically is lined on the inside with thick, high-density foam.

### Electrical Classes

**Class G (General)**

Class G hard hats are intended to reduce the danger of contact exposure to low voltage conductors. Test samples are proof-tested at 2,200 volts (phase to ground). However, this voltage is not intended as an indication of the voltage at which the hard hat protects the wearer. Please note: Class G hard hats were formerly known as Class A.

**Class E (Electrical)**

Class E hard hats are intended to reduce the danger of exposure to high voltage conductors. Test samples are proof-tested at 20,000 volts (phase to ground). However, this voltage is not intended as an indication of the voltage at which the helmet protects the wearer. Please note: Class E hard hats were formerly known as Class B.

**Class C (Conductive)**

Class C hard hats are not intended to provide protection against contact with electrical conductors.

## 3.0 Proper Fit/Maintenance

3.1 The suspension of the hard hat must be adjusted to fit the wearer and to keep the shell a minimum distance of 1-1/4 inches above the wearer's head. Periodically inspect the suspension of your hard hat. Look for loose or torn cradle straps, loose rivets, broken sewing lines, or other defects. Replace the hat after a major impact.

## 4.0 Guidelines

### 4.1 Head Protection

The following standards apply to PPE for the head:

| Association | Standard |
|---|---|
| **American National Standard (ANSI)** | Z89.1-2003, American National Standard for Industrial Head Protection<br>Z89.1-1997, American National Standard for Industrial Head Protection |
| **Japanese Industrial Standard (JIS)** | JIS T8131 - 1990, Industrial Safety Helmets |
| **CEN Standard** | EN 397: 1995, Industrial safety helmets |
| **Canadian Standards Association (CSA)** | CAN/CSA-Z94.1-92 (R1998), Industrial Protective Headwear<br>CSA Standard Z94.1-05, Industrial Protective Headwear - Performance, Selection, Care and Use |

4.1.1 On all construction projects and in the event that an overhead hazard exists, a four-point suspension Type II, Class G or E hard hat will be provided to affected employees.

4.1.2 Supervisors and staff are responsible for confirming that crews have the head protection necessary for their safety. This may include, as required by the specific job task:

- Hard hat, or
- Helmet

4.1.3 CSA/ANSI approved industrial protective headwear that is appropriate to the hazards and meets applicable legislative requirements shall be worn by all personnel while engaged in construction, operation, maintenance, or other activities where there exists a foreseeable danger of injury to a worker’s head at a work site and/or a significant possibility of lateral impact to the head.

4.1.4 Visitors to areas where the above activities are being conducted shall comply with the hardhat requirement.

4.1.5 Helmets, hard hats, and hard hat accessories (as required) shall be provided by AECOM.

4.1.6 Proper care is required for headgear to perform efficiently. The service life is affected by many factors including temperature, chemicals, sunlight, and ultraviolet radiation (welding). The usual maintenance for headgear is simply washing with a mild detergent and rinsing thoroughly.

4.1.7 DO:

- Replace headgear that is pitted, holed, cracked, or brittle.
- Replace headgear that has been subjected to a blow even though damage cannot be seen.
- Remove from service any headgear if its serviceability is in doubt.
- Replace headgear and components according to manufacturers’ instructions.
- Consult OH&S or your supplier for information on headgear.

4.1.8 DON’T:

- Drill, remove peaks, or alter the shell or suspension in any way.
- Use solvents or paints on the shells.

- Put chin straps over the brims of Class B headgear.
- Use any liner that contains metal or conductive material.
- Carry anything in the hard hat while wearing the hard hat.

# S3NA-208-WI4 Foot Protection Fact Sheet

## 1.0 Introduction

1.1 Nearly 2 million people are expected to receive disabling work-related injuries this year. More than one-fourth of these injuries will involve the head, eyes, hands, or feet. Personal protective equipment (PPE) is designed to protect you from health and safety hazards that cannot be removed from your work environment. PPE is designed to protect many parts of your body including eyes, face, head, hands, and feet.

1.2 AECOM has evaluated each of the job tasks that are performed in the offices. The purpose of these evaluations was to assess the hazards associated with a specific task and to determine what type or types of PPE will adequately protect you from those hazards. It has been determined that your job will require the use of foot protection.

- Foot injuries are most likely to occur:
- When heavy or sharp objects fall on your foot.
- When something rolls over your foot.
- When you step on an object that pierces the sole of your shoe.

## 2.0 Types of Foot Protection

2.1 Safety shoes and boots must meet the regulated standard. Safety shoes and boots are made with a steel-reinforced box toe to protect your foot from being pierced or crushed by a falling object. Safety shoes or boots with flexible steel insoles provide puncture resistance. They will stop or deflect nails or other objects that have penetrated the sole of the shoe. Oil resistant soles provide the added safety feature of preventing slips and trips on slippery work floors.

## 3.0 Limitations of Foot Protection

3.1 Wearing safety shoes will adequately protect your feet from most impact hazards. However if the load on the toebox becomes too great (75 foot-pounds or greater), the toe box will be crushed.

## 4.0 Proper Fit

4.1 With most PPE, the more comfortable it is to use, the more likely you will be to use it. The fit of the safety shoe is of the utmost importance. You must try on safety shoes before purchasing them. When selecting shoes, be sure that they are ANSI-approved. Consult with your health and safety coordinator about how to obtain safety shoes.

## 5.0 Guidelines

### 5.1 Foot Protection

The following standards apply to foot protection equipment:

| Association | Standard |
|---|---|
| **American National Standard (ANSI)** | Z41-1991, American National Standard for Personal Protection - Protective Footwear |
| **British Safety Institution Standard** | BS EN 345:1993 Specification for Safety Footwear for Professional Use<br>BS EN 346:1993 Specification for Protective Footwear for Professional Use |

| | |
|---|---|
| **Canadian Standards Association (CSA)** | Z195-02, Protective Footwear<br>Z195.1-02, Guideline on Selection, Care, and Use of Protective Footwear<br>Z195-M92 (R2000), Protective Footwear |

5.1.1 Work shoes or boots shall have leather or rubber uppers, an oil-resistant sole, and a distinctive heel (defined as a raised section 3/8" – ½" across the entire heel). When required by the regulations or the client, AECOM will provide affected employees with safety-toed shoes/boots that meet the requirements of the applicable ANSI or CSA standard.

5.1.2 Supervisors and staff are responsible for confirming that crews have foot protection necessary to ensure their safety. This may include the following types as required by the specific job task:

- Steel-toed boots
- Caulk boots
- Chemical-resistant boot covers
- Non-slip wading boots
- Rubber boots

5.1.3 CSA approved safety-toed boots shall be worn by all employees while engaged in construction, operation, maintenance, or other activities where a risk of injury to the feet may exist.

5.1.4 The purchase of normal footwear for work is the responsibility of the employee.

5.1.5 Where hazards are identified (or client/industry demands it), AECOM will supply safety-toed work boots or other protective footwear.

5.1.6 Choose the right footwear for the job to mitigate the identified hazards.

5.1.7 Project Managers must notify staff of all possible hazards and that staff have the PPE to mitigate those hazards.

5.1.8 Staff are responsible for confirming that the PPE they are provided with is in good working condition before work commences.

5.1.9 DO:

- Choose a high cut boot to provide ankle support.
- Choose footwear according to job hazard and CSA Standards.
- Lace up boot and tie laces securely. Boots do not protect if they are a tripping hazard or fall off.

5.1.10 DON'T:

- Wear defective safety footwear (e.g., exposed steel toe caps).
- Underprotect your feet or modify safety footwear.

# S3NA-208-WI5 Hand Protection Fact Sheet

## 1.0 Introduction

Personal protective equipment (PPE) is designed to protect you from health and safety hazards that cannot be removed from your work environment. PPE is designed to protect many parts of your body including eyes, face, head, hands, and feet. AECOM has evaluated each of the job tasks that are performed in the office. The purpose of these evaluations was to assess the hazards associated with a specific task and to determine what type(s) of PPE will adequately protect you from those hazards. It has been determined that your job will require the use of hand protection. This fact sheet will inform you about why and when hand protection is needed, the limits of gloves, and how to properly clean and dispose of gloves.

1.1 Gloves most commonly used in the construction industry are made from:

1.1.1 Leather

1.1.2 Cotton

1.1.3 Rubber

1.1.4 Synthetic rubbers and other manmade materials

1.1.5 Combinations of materials

## 2.0 Types of Hand Protection

2.1 Hand protection is required when there is a potential for

2.1.1 Skin absorption of harmful substances.

2.1.2 Severe cuts or lacerations, abrasions, or punctures.

2.1.3 Vibration.

2.1.4 Temperature extremes.

2.2 Gloves are the most common protectors for the hands. Unfortunately, no one type of glove provides adequate protection against all potential hand hazards. Leather gloves provide good protection from cuts and lacerations but offer no protection against chemicals. Nitrile or neoprene rubber gloves offers good resistance to chemicals but they tear and rip easily when sharp objects are handled. The chemically resistant gloves used by AECOM were selected based on the manufacturer's chemical compatibility data, which indicates how each glove material performed in breakthrough time tests against certain chemicals. Do not substitute another type of glove for the chemically resistant gloves that have been selected. They may not offer adequate protection for the chemicals you handle.

## 3.0 Proper Fit/Cleaning Disposal

3.1 Gloves will deteriorate over time depending on the types and amount of chemicals with which they come into contact. Remove excessive chemical residue that builds up on the glove. Replace cracked, ripped, or torn gloves or when breakthrough occurs. Breakthrough is the time between initial contact of the chemical on the glove surface and the detection of the chemical on the inside of the glove. Tight-fitting gloves can cause fatigue while loose-fitting gloves can be hazardous. Measure the circumference of your hand around the palm area. This measurement, in inches, is closest to your actual glove size. For example, 7" is equal to a size 7 glove. Always select the right size glove from the safety supply cabinet. Dispose of chemically resistant gloves in accordance with the established protocols at your office.

## 4.0 Guidelines

4.1 Hand Protection—Performance Characteristics as Listed by the Manufacturer

4.1.1 Leather or Kevlar gloves should be used as appropriate to prevent cuts, lacerations, abrasions, and punctures. Chemically resistant gloves such as neoprene or nitrile rubber will be issued to employees who are likely to come into direct contact with chemicals. When selecting chemically resistant gloves, AECOM will review the manufacturer's data tables regarding degradation of the glove material when exposed to the chemicals of concern, penetration of the chemicals of concern through imperfections in the gloves, and permeation (breakthrough times) of the chemicals of concern through the glove material.

- PPE must be provided to protect a worker's skin from harmful substances that may injure the skin on contact or may adversely affect a worker's health if it is absorbed through the skin.
- Employees shall wear appropriate gloves or mitts to protect their hands from workplace hazards, including hazardous material, heat, cold, abrasion, and sharp edges.
- Vinyl coated or leather gloves are good for providing protection while handling wood or metal objects.
- Inspect and maintain hand PPE regularly. If in doubt about the selection or need for glove or hand PPE, consult your safety supplier, Material Safety Data Sheet (MSDS), or local SH&E office.

4.1.2 DO:

- Inspect hand PPE for defects before use.
- Wash all chemicals and fluids off gloves before removing hand PPE.
- Use gloves that fit properly.
- Use the proper hand PPE for the job.
- Follow manufacturer's instructions on the care and use of the hand PPE you are using.
- Cover exposed skin (no gap between the sleeve and the hand).

4.1.3 DON'T:

- Wear gloves when working with moving machinery (gloves can get tangled or caught).
- Wear hand PPE with metal parts near electrical equipment.

# S3NA-208-WI6 Protective Clothing Fact Sheet

## 1.0 Introduction

1.1 Some projects require job tasks where there is a recognized hazard of injury to a person if protection is not provided to the legs or body of the individual. These hazards are effectively mitigated through the use of proper personal protection equipment (PPE).

1.2 Staff will dress appropriately for the climate & weather (cold, heat, wet, dry)

1.3 Supervisors and staff are responsible for confirming that crews have the limb and body protection necessary to ensure their safety. This may include, as required by the specific job task:

1.3.1 Leg chaps.

1.3.2 Gloves (leather, cotton, latex, chemical-resistant, etc.).

1.3.3 Fire-retardant overalls.

1.3.4 High visibility vests.

1.3.5 Retro-reflective strips.

1.3.6 Chemical resistant suits or overalls.

## 2.0 Chemically Resistant Clothing

2.1 Whenever there is a potential for chemical splashing, chemically resistant, disposable clothing, such as a coated-Tyvek coverall or apron, will be worn. Examples of when such clothing may be required include:

2.1.1 Cleaning of small spills.

2.1.2 Washing and rinsing of the printing presses.

2.1.3 Nonroutine tasks involving the use of chemicals.

2.1.4 The transfer of large quantities of chemicals from large containers to smaller ones.

2.2 The process for selecting chemically resistant clothing will be similar to that described for the selection of chemically resistant gloves. The need for chemically resistant clothing will be determined by your health and safety coordinator. The SH&E coordinator will issue the required clothing to you. If an item is routinely used by a specific group of employees within one department, the department manager can assume the purchasing responsibilities.

## 3.0 Types of Chemically Resistant Clothing

Like gloves, the objective of whole body protection is to separate the person from a contaminating or hazardous material. Disposable garments, such as Tyvek coveralls or aprons, provide this type of barrier. Uncoated Tyvek coveralls are made of a porous fabric and are designed to prevent contact with particulates. Coated Tyvek coveralls provide a nonporous barrier to protect the worker from chemical splash and vapors. Protective aprons are made from nitrile or neoprene rubber like that used to make chemically resistant gloves.

## 4.0 Proper Fit/Cleaning/Disposal

Before donning a protective coverall, inspect it for rips or tears. Promptly remove any protective clothing that becomes ripped or torn during a particular task. Be sure the garment fits properly. The garment-to-glove seam will be taped when there is a potential for liquids to directly contact the skin if the arm of the suit shifts upward.

Single-use garments, such as Tyvek coveralls, will be disposed of in accordance with the environmental protocols at your office. Some clothing, such as rubber aprons, is meant for repeated use. Wipe down the apron using soap and water to remove any remaining liquids or residues.

## 5.0 Guidelines

5.1 High-Visibility Safety Apparel – ANSI/ISEA 107-104

5.1.1 "High visibility safety apparel" means personal protective safety clothing that is intended to provide conspicuity during both daytime and nighttime usage and that meets the Performance Class II or III requirements of the ANSI/and CSA standards.

5.2 Chemically Resistant Protective Clothing – Performance Characteristics as Listed by the Manufacturer

5.2.1 Whenever there is a potential for chemical splashing, disposable, chemically resistant clothing, such as a coated Tyvek coverall or apron will be worn. Examples of when such clothing may be required include the cleaning of small spills, nonroutine tasks involving the use of chemicals, and the transfer of large quantities of chemicals from large containers to smaller ones. The process for selecting chemically resistant clothing will be similar to that described for the selection of chemically resistant gloves.

5.3 The following standards apply to limb and body protection equipment:

| Association | Standard |
|---|---|
| **BC WCB** | WCB Standard PPE 1-1997 Leg Protective Devices<br>WCB Standard Personal Protective Equipment Standard 2-1997, High Visibility Garment |
| **Canadian Standards Association (CSA)** | CAN/CSA-Z96-02, High-Visibility Safety Apparel |

5.4 All employees shall wear suitable clothing for the existing conditions and the work being performed.

5.5 If there is a specific need to be visible to the passing public, to machine operators, or to other crew members, high visibility vests shall be worn (and retro-reflective striping on arms and legs at night).

5.6 If there is a danger that a worker's hand, arm, leg, or torso may be injured, an employer ensure that the worker wears properly fitting hand, arm, leg, or body protective equipment that is appropriate to the work, the work site, and the hazards identified.

5.7 In the presence of a flash fire or electrical equipment flashover hazard, staff must wear flame resistant outerwear (overalls) and use other protective equipment appropriate to the hazard.

5.8 Where there is a risk of drowning, a personal flotation device or lifejacket must be worn, as per the applicable regulations.

5.9 Rubber gloves and rubber boots must be worn when working around electricity (waders must also be worn for electro fishing where there is an electric current passing through the water).

5.10 When wearing flame resistant outerwear (coveralls), staff must not wear against their skin clothing that is made of a fabric or material that will melt when exposed to heat (e.g., fleece).

[Contract Name or Client Name]
Contract No. [insert]
Task/Delivery Order No. [insert]

# S3NA-209-TP2 HEALTH AND SAFETY PLAN

## [PROJECT NAME]
## [SITE NAME]
## [SITE ADDRESS]
## [CITY, STATE] [SITE ZIP]

***Prepared for:***

[Client Name]
[Client Address]
[Client City, State/Province Zip]

***Prepared by:***

AECOM
[Office Address]
[Office City, State/Province Zip]

***Health and Safety Plan Expiration Date:*** [insert expiration date which is 1 year from the approval date on the next page– Month, day, year]

Project No: [insert project number]

# Project Health and Safety Plan

## *approval page*

This project Health and Safety Plan (HASP) was prepared for employees performing a specific, limited scope of work. It was prepared based on the best available information regarding the physical and chemical hazards known or suspected to be present on the project site. While it is not possible to discover, evaluate, and protect in advance against all possible hazards, which may be encountered during the completion of this project, adherence to the requirements of the HASP will significantly reduce the potential for occupational injury.

By signing below, I acknowledge that I have reviewed and hereby approve the HASP for the [site name] site. This HASP has been written for the exclusive use of AECOM, its employees, and subcontractors. The plan is written for specified site conditions, dates, and personnel, and must be amended if these conditions change.

**Prepared by:**

______________________________ ______________
[Preparer name, certs] Date
[Preparer title]
[Preparer phone number]

**Concurrence by:**

______________________________ ______________
[Safety Prof. name, certs] Date
[Safety Prof. title]
[Safety Prof. phone number]

**Approved by:**

______________________________ ______________
[Proj. mgr. name, certs] Date
Project Manager
[Proj. mgr. phone number]

## Executive Summary

The purpose of this Health and Safety Plan (HASP) is to address health and safety concerns related to AECOM managed activities at the [site name] site, located at [site address] in [city, state]. The specific roles, responsibilities, authority, and requirements as they pertain to the safety of employees and the scope of services are discussed herein. The document is intended to identify known potential hazards and facilitate communication and control measures to prevent injury or harm. Additionally, provisions to control the potential for environmental impact from these activities are included where applicable.

[insert brief scope of services and responsible party]

AECOM will be…

Subcontractor X will be…

Subcontractor Y will be…

The primary physical hazards which may be encountered include:

[list PRIMARY physical hazards]

The chemical hazards which may be encountered include:

[list anticipated chemical hazards]

All staff are bound by the provisions of this HASP and are required to participate in a preliminary project safety meeting to familiarize them with the anticipated hazards and respective onsite controls. The discussion will cover the entire HASP subject matter, putting emphasis on critical elements of the plan; such as the emergency response procedures, personal protective equipment, site control strategies, and monitoring requirements. In addition, daily tailgate safety meetings will be held to discuss: the anticipated scope of work, required controls, identify new hazards and controls, incident reporting, review the results of inspections, any lessons learned or concerns from the previous day.

TABLE OF CONTENTS

**ATTACHMENTS**

# 1.0 Introduction

This Health and Safety Plan (HASP) (including Attachments A-[xx]) provides a general description of the levels of personal protection and safe operating guidelines expected of each employee or subcontractor associated with the environmental services being conducted at the [site name] site, located at [site address] in [city, state/province]. This HASP also identifies chemical and physical hazards known to be associated with the AECOM-managed activities addressed in this document.

HASP Supplements will be generated as necessary to address any additional activities or changes in site conditions, which may occur during field operations.

## 1.1 General

1.1.1 The provisions of this HASP are mandatory for all AECOM personnel engaged in fieldwork associated with the environmental services being conducted at the subject site. A copy of this HASP, any applicable HASP Supplements and the AECOM's North America Safety, Health, and Environmental (SH&E) Procedures and Manual shall be accessible on site and available for review at all times. Record keeping will be maintained in accordance with this HASP and the applicable Standard Operating Procedures (SOPs). In the event of a conflict between this HASP, the SOPs and federal, provincial, state, and local regulations, workers shall follow the most stringent/protective requirements. Concurrence with the provisions of this HASP is mandatory for all personnel at the site covered by this HASP and must be signed on the acknowledgement page.

## 1.2 Project Policy Statement

AECOM is committed to protecting the safety and health of our employees and meeting our obligations with respect to the protection of others affected by our activities. We are also committed to protecting and preserving the natural environment in which we operate. The safety of persons and property is of vital importance to the success of this project and accident prevention measures shall be taken toward the avoidance of needless waste and loss. It shall be the policy of this project that all operations be conducted safely. Onsite supervisors are responsible for those they supervise by maintaining a safe and healthy working environment in their areas of responsibility, and by fairly and uniformly enforcing safety and health rules and requirements for all project personnel. Subcontractors shall comply with the requirements of this HASP, provisions contained within the contract document and all applicable rules, requirements and health, safety and environmental regulations. All practical measures shall be taken to promote safety and maintain a safe place to work. Contractors are wholly responsible for the prevention of accidents on work under their direction and shall be responsible for thorough safety and loss control programs and the execution of their own safety plans for the protection of workers.

## 1.3 References

This HASP conforms to the regulatory requirements and guidelines established in the following documents:

- Title 29, Part 1910 of the Code of Federal Regulations (29 CFR 1910), Occupational Safety and Health Standards (with special attention to Section 120, Hazardous Waste Operations and Emergency Response).
- Title 29, Part 1926 of the Code of Federal Regulations (29 CFR 1926), Safety and Health Regulations for Construction.
- National Institute for Occupational Safety and Health (NIOSH)/OSHA/U.S. Coast Guard (USCG)/EPA, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, Publication No. 85-115, 1985.
- In Canada there is no direct federal or provincial counterpart to HAZWOPER; however, as due diligence and in compliance with applicable provincial duty of care/general duty clauses, staff working in Canada will comply with S3NA-509-PR Hazardous Waste Operations and Emergency Response Activities.
- [Insert state or other requirements]

## 2.0 Site Information and Scope of Work

AECOM will conduct environmental services at the [site name] site. Work will be performed in accordance with the applicable Statement of Work (SOW) and associated Project Work Plan developed for project site. Deviations from the listed SOW will require that a Safety Professional review and changes made to this HASP, to ensure adequate protection of personnel and other property.

The following is a summary of relevant data concerning the project site, and the work procedures to be performed. The Project Work Plan prepared by AECOM as a companion document to this HASP provides more detail concerning both site history and planned work operations.

### 2.1 Site Information

This section provides a general description and historical information associated with the site.

#### 2.1.1 General Description

The [site name] site is located at [site address]. [Insert description. This should include any *significant* physical features of the site (i.e., terrain, buildings, size, location, bodies of water etc.)].

#### 2.1.2 Site Background/History

[Insert site background/history information. This should include all applicable activities and processes that have previously occurred on site, as well as current operations.]

#### 2.1.3 Previous Investigations

[Insert previous highest concentration investigation results in the applicable work area. This should list any known investigations and the results of the investigations. Contaminants with their concentrations (soil in mg/kg and/or groundwater in ug/l) should be listed in tabular format (2-1), if available. This should be the most recent site data available.]

**Table 2-1: Previous Investigation Data**

| Contaminants | Soil (mg/kg) | Groundwater (ug/l) |
|---|---|---|
| (insert Highest Contaminants) | | |
| (insert second Highest Contaminants | | |
| (Insert third highest Contaminants | | |

### 2.2 Scope of Work

[Provide a verbal description of the overall objective for what is being done for the job and what is supposed to be accomplished. This does not have to actually spell out the steps for the job, as that will be covered in 2.2.1]

(See HASP Description and Assistance document for examples)

#### 2.2.1 Additional Work Operations

The following additional tasks will also be performed as necessary in support of planned site activities:

(Operations at the site may require additional tasks not identified in this section or addressed in Attachment A THAs. Before performing any task not covered in this HASP a THA must be prepared, and approved by the Safety Professional.)

## 3.0 Hazard Assessment (Safety)

### 3.1 Physical Hazards

[Discuss the specifics of hazards that will/may be encountered, like haz noise, heavy equip. etc.. Limit the discussion to the scope and magnitude of the hazard on this job, don't discuss hazard control.]

(See HASP Description and Assistance document for examples)

### 3.2 Wildlife, Plant and Insect Hazards

Below is a series of tasks typically encountered on projects. While the text below may be used to describe your work, it must be elaborated on and sufficient detail included making it site specific.

See HASP Description and Assistance document for examples)

### 3.3 Radiological Hazards

[Discuss any on-site radioactive materials that are environmental contaminants (ignore RAM in devices, etc. that we bring to site.]

### 3.4 Ultraviolet Hazards

[The 2009 historical UV Index for the [Insert City here] area showed that worker's UV exposures were in the HIGH category beginning in March and lasting until November with worker's exposures in the EXTREME category from July through August. In 2009, [City Name] had 44 days in the HIGH category, 133 days in the VERY HIGH category, and 0 days in the EXTREME category. Workers performing field work outdoors may be susceptible to sunburn if not properly protected with sunscreen or protective clothing and hats. Skin can burn in minutes when the UV Index is VERY HIGH. Protective measures are advisable.

### 3.5 Weather Hazards

The Site Safety Officer will be attentive to daily weather forecasts for the project area each morning. Predicted weather conditions of potential field impact are to be included in safety briefings and the Task Hazard Analysis (THA) for that day. Weather changes should initiate a review and updates (THA) as necessary.

Severe weather can occur with little warning. Employees will be vigilant for the potentials for storms, lightning, high winds, and flash flood events.

### 3.6 Other Hazards

[Address anything not already covered that might be significant, like UXO. Don't provide control procedures here (that's for Section 5.0), just discuss what's there and what it can do].

### 3.7 Hazard Analysis

Task Hazard Analyses (THAs) have been completed for all tasks identified in the Scope of Work (Attachment A):

[List all Tasks which have been addressed in THAs]

#### 3.7.1 Unanticipated Work Activities/Conditions

As a result of unanticipated work activities or changing conditions, additional THAs may be required. All additional THAs will be reviewed and approved by the SH&E Professional.

## 3.8 Task Specific SH&E Procedures

As discussed in Section5.0, personnel may be exposed to a variety of chemical, physical, and radiological hazards resulting from task or equipment-specific activities. The controls for many of these hazards are discussed in SOPs found in the **Series 300 to 500** North America SH&E SOPs.

| | SOP# | TITLE | | SOP# | TITLE |
|---|---|---|---|---|---|
| **S3NA 300 Series Field(Common)** | | | **S3NA 500 Series Industrial Hygiene** | | |
| ☐ | S3NA-301-PR | Confined Spaces | ☐ | S3NA-501-PR | Asbestos |
| ☐ | S3NA-302-PR | Electrical, General | ☐ | S3NA-502-PR | Benzene |
| ☐ | S3NA-303-PR | Excavation and Trenching | ☐ | S3NA-503-PR | Blood borne Pathogen Program |
| ☐ | S3NA-304-PR | Fall Protection | ☐ | S3NA-504-PR | Cadmium |
| ☐ | S3NA-305-PR | Hand and Power Tools | ☐ | S3NA-505-PR | Cold Stress Prevention |
| ☐ | S3NA-306-PR | Highway and Road Work | ☐ | S3NA-506-PR | Compressed Gases |
| ☐ | S3NA-307-PR | Housekeeping, Worksite | ☐ | S3NA-507-PR | Hazardous Materials Communication / WHMIS |
| ☐ | S3NA-308-PR | Manual Lifting, Field | | S3NA-508-PR | Hazardous Materials Handling and Shipping |
| ☐ | S3NA-309-PR | Mobile or Heavy Equipment | ☐ | S3NA-509-PR | Hazardous Waste Operations and Emergency Response Activities |
| ☐ | S3NA-310-PR | Rigging, Hoisting, Cranes and Lifting Devises | ☐ | S3NA-510-PR | Hearing Conservation Program |
| ☐ | S3NA-311-PR | Scaffolding | ☐ | S3NA-511-PR | Heat Stress Prevention |
| ☐ | S3NA-312-PR | Ladders and Stairways | ☐ | S3NA-512-PR | Laboratory Safety |
| ☐ | S3NA-313-PR | Wildlife, Plants and Insects | ☐ | S3NA-513-PR | Lead |
| ☐ | S3NA-314-PR | Working Alone & Remote Travel | ☐ | S3NA-514-PR | Munitions and Explosives of Concern / Unexploded Ordnance (MEC-UXO) |
| ☐ | S3NA-315-PR | Water, Working Around | ☐ | S3NA-515-PR | Nanotechnology |
| | | | ☐ | S3NA-516-PR | Radiation Safety Programs |
| **S3NA 400 Series Field (Uncommon)** | | | ☐ | S3NA-517-PR | Radiation, Non-Ionizing |
| ☐ | S3NA-401-PR | Aircraft Charters | ☐ | S3NA-518-PR | Radiation, Gauge Source program |
| ☐ | S3NA-402-PR | All Terrain Vehicles (ATVs) | ☐ | S3NA-519-PR | Respiratory Protection Program |
| ☐ | S3NA-403-PR | Avalanches | ☐ | S3NA-520-PR | Spill Response, Incidental |
| ☐ | S4NA(US)-404-PR | Commercial Motor Vehicles | | | |
| ☐ | S3NA-405-PR | Drilling and Boring | | | |
| ☐ | S3NA-406-PR | Electrical Lines, Overhead | | | |
| ☐ | S3NA-407-PR | Electro-fishing | | | |
| ☐ | S3NA-408-PR | Elevated Work Platforms and Aerial Lifts | | | |
| ☐ | S3NA-409-PR | Forklifts (operation of) | | | |
| ☐ | S3NA-410-PR | Hazardous Energy Control | | | |
| ☐ | S3NA-411-PR | Machine Guarding | | | |
| ☐ | S3NA-412-PR | Powder-Actuated Tools | | | |
| ☐ | S4NA(US)-413-PR1 | Process Safety Management | | | |
| ☐ | S4NA(US)-414-PR | Railway Sites | | | |
| ☐ | S4NA(US)-415-PR | RCRA Regulated Facilities | | | |
| ☐ | S3NA-416-PR | Tunnel and Underground Work | | | |
| ☐ | S3NA-417-PR | Utilities, Underground | | | |
| ☐ | S3NA-418-PR | Welding, Cutting and Other Hot Work | | | |
| ☐ | S3NA-419-PR | Water, Marine Operations, Boating | | | |
| ☐ | S3NA-420-PR | Water, Underwater Diving | | | |

# 4.0 SH&E Requirements (Safety)

## 4.1 HAZWOPER Qualifications

Personnel performing work at the job site must be qualified as HAZWOPER workers (unless otherwise noted in specific THAs or by the SSO), and must meet the medical monitoring and training requirements specified in the AECOM's North America SH&E Standard Operating Procedures.

If site monitoring procedures indicate that a possible exposure has occurred above the OSHA permissible exposure limit (PEL), employees may be required to receive supplemental medical testing to document any symptoms that may be specific to the particular materials present.

## 4.2 Site-Specific Safety Training

All AECOM personnel performing activities at the site will be trained in accordance with *S3NA-003-PR SH&E Training*. All personnel are required to remain current in all of their required training and evaluate their need for additional training when there is a change in work. In addition to the general health and safety training programs, personnel will be required to complete any supplemental task specific training developed for the tasks to be performed. Administration and compliance with the requirements for additional task-specific training will be the responsibility of the project or lead manager. Any additional required training that is completed will be documented and tracked in the project files.

### 4.2.1 Competent Person Training Requirements

In order to complete the planned scope of work, an (OSHA conformance) competent person must be designated to perform the required daily on site inspections of operations and/or equipment. The competent person may be an AECOM (if responsible for supervising that activity) or the subcontractor's employee. Designated competent person(s) for this project are shown in Table 4-2:

**Table 4.2.1-2: Task-Specific Competent Persons**

| Employee Name | Organization | Area of Competency |
|---|---|---|
| | | [insert other requirements or delete rows] |
| | | |
| | | |

Note: The training requirements for competent persons are specified in the indicated SOPs and/or *S3NA-202-PR Competent Person Designation*. By identifying an employee as a "competent person", that person has now been authorized to take prompt corrective measures to eliminate hazards.

## 4.3 Tailgate Meetings

Prior to the commencement of daily project activities, a tailgate meeting will be conducted by the SSO to review the specific requirements of this HASP, applicable THA. Attendance at the daily tailgate meeting is mandatory for all employees at the site covered by this HASP and must be documented on the attendance form. All safety training documentation is to be maintained in the project file by the SSO.

## 4.4 Hazard Communication

Hazardous materials that may be encountered as existing on-site environmental or physical/health contaminants during the work activities are addressed in this HASP and their properties, hazards and associated required controls will be communicated to all affected staff and subcontractors.

In addition, any employee or organization (contractor or subcontractor) intending to bring any hazardous material onto this AECOM-controlled work site must first provide a copy of the item's Material Safety Data Sheet (MSDS) to the SSO for review and filing (the SSO will maintain copies of all MSDS on site). MSDS may not be available for locally-obtained products, in which case some alternate form of product hazard documentation will be acceptable in accordance with the requirements of *S3NA-507-PR Hazardous Materials Communication/WHMIS*.

All personnel shall be briefed on the hazards of any chemical product they use, and shall be aware of and have access to all MSDS.

All containers on site shall be properly labeled to indicate their contents. Labeling on any containers not intended for single-day, individual use shall contain additional information indicating potential health and safety hazards (flammability, reactivity, etc.).

Attachment B provides copies of MSDS for those items planned to be brought on site at the time this HASP is prepared. This information will be updated as required during site operations.

### 4.5 Confined Space Entry

The SSO/site supervisor shall identify all potential confined spaces in accordance with S3NA-*301-PR Confined Spaces*. In addition; the SSO/site supervisor will inform all employees of the location of onsite confined spaces, and their associated security controls and procedures.

### 4.6 Hazardous, Solid, or Municipal Waste

If hazardous, solid, and/or municipal wastes are generated during any phase of the project, the waste shall be accumulated, labeled, and disposed of in accordance with applicable Federal, State, Provincial, Territorial and/or local regulations. Consult the Regional SH&E Manager for further guidance.

### 4.7 General Safety Rules

All site personnel shall conduct themselves in a safe manner and maintain a working environment that is free of additional hazards, in adherence to *S3NA-001-PR Safe Work Standards and Rules* and *S3NA-103-PR General Housekeeping*.

#### 4.7.1 Housekeeping

During site activities, work areas will be continuously policed for identification of excess trash and unnecessary debris. Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal. At no time will debris or trash be intermingled with waste PPE or contaminated materials.

#### 4.7.2 Smoking, Eating, or Drinking

Smoking, eating and drinking will not be permitted inside any controlled work area at any time. Field workers will first wash hands and face immediately after leaving controlled work areas (and always prior to eating or drinking). Consumption of alcoholic beverages is prohibited at any AECOM site. Smoking, eating or drinking must be in an approved area.

#### 4.7.3 Personal Hygiene

The following personal hygiene requirements will be observed:

Water Supply: A water supply meeting the following requirements will be utilized:

> *Potable Water* - An adequate supply of potable water will be available for field personnel consumption. Potable water can be provided in the form of water bottles, canteens, water coolers, or drinking fountains. Where drinking fountains are not available, individual-use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified in order to distinguish them from non-potable water sources.
>
> *Non-Potable Water* - Non-potable water may be used for hand washing and cleaning activities. Non-potable water will not be used for drinking purposes. All containers of non-potable water will be marked with a label stating:

***Non-Potable Water***
***Not Intended for Drinking Water Consumption***

Toilet Facilities: A minimum of one toilet will be provided for every 20 personnel on site, with separate toilets maintained for each sex except where there are less than 5 total personnel on site. For mobile crews where work activities and locations permit transportation to nearby toilet facilities on-site facilities are not required.

Washing Facilities: Employees will be provided washing facilities (e.g., buckets with water and Alconox) at each work location. The use of water and hand soap (or similar substance) will be required by all employees following exit from the Exclusion Zone, prior to breaks, and at the end of daily work activities.

#### 4.7.4 Buddy System

All field personnel will use the buddy system when working within any controlled work area. Personnel belonging to another organization on site can serve as "buddies" for AECOM personnel. Under no circumstances will any employee be present alone in a controlled work area. For areas not in controlled work areas, the procedures outlined in *S3NA-314-PR Working Alone Remote Travel* will be followed at all times.

### 4.8 Stop Work Authority

All employees have the right and duty to stop work when conditions are unsafe and to assist in correcting these conditions as outlined in *S3NA-002-PR Stop Work Authority.* Whenever the SSO determines that workplace conditions present an uncontrolled risk of injury or illness to employees, immediate resolution with the appropriate supervisor shall be sought. Should the supervisor be unable or unwilling to correct the unsafe conditions, the SSO is authorized and required to stop work, which shall be immediately binding on all affected AECOM employees and subcontractors.

Upon issuing the stop work order, the SSO shall implement corrective actions so that operations may be safely resumed. Resumption of safe operations is the primary objective; however, operations shall not resume until the Safety Professional has concurred that workplace conditions meet acceptable safety standards.

### 4.9 Client Specific Safety Requirements

The client has specified no additional health and safety requirements.

or

Client-specific health and safety guidelines are included in Attachment E of this HASP. All site activities must be performed in accordance with client-specific requirements and procedures.

[or insert additional client-specific requirements]

# 5.0 Exposure Monitoring Procedures (Health)

## 5.1 Contaminant Exposure Hazards

The following is a discussion of the hazards presented to worker personnel during this project from on-site chemical and radiological hazards known, suspected or anticipated to be present on site.

Exposure symptoms and applicable first aid information for each suspected site contaminant identified in the Scope of Work are located in the following subsections.

[insert chemical/chem. group-specific discussions for what is at your site]

- 
- 
- 
- 

### 5.1.1 [insert contaminant]

[insert contaminant information]

### 5.1.2 [insert contaminant]

[insert contaminant information]

### 5.1.3 [insert contaminant]

[insert contaminant information]

## 5.2 Route of Entry Assessment of Exposure Hazards

Inhalation: [Discuss the possible hazards from inhalation based on what's there and what's being done]. [discuss any general things being done to protect, like RPP, monitoring, etc.].

Skin Contact: [Discuss the possible hazards from skin contact (irritation and absorption) based on what's there and what's being done – don't forget the eyes, etc.]. [Discuss any general things being done to protect, like PPE, decon, etc.].

Ingestion: [Discuss the possibility of ingestion exposure based on what's there and what's being done.]. Protection against exposure via ingestion can be accomplished by performance of proper decontamination procedures when exiting contaminated work areas.

Monitoring procedures will be employed during site characterization activities to assess employee exposure to chemical and physical hazards. Monitoring will consist primarily of onsite determination of various parameters (e.g., airborne contaminant concentrations and heat stress effects), but may be supplemented by more sophisticated monitoring techniques, if necessary.

## 5.3 Real-Time Exposure Measurement

Monitoring shall be performed within the work area on site in order to detect the presence and relative levels of toxic substances. The data collected throughout monitoring shall be used to determine the appropriate levels of PPE. Monitoring shall be conducted as specified in each THA as work is performed.

Table 5-1 specifies the real-time monitoring equipment, which will be used for this project. [Delete instruments from the table that are not applicable to the project.]

**Table 5-1: Monitoring Parameters and Equipment**

| INSTRUMENT | MANUFACTURER/MODEL* | SUBSTANCES DETECTED |
|---|---|---|
| **Photo Ionization Detector (PID)** | RAE Systems mini-RAE<br>Photovac Microtip<br>HNu Model Hnu<br>(min. 10.2 eV bulb) | Petroleum hydrocarbons<br>Organic Solvents |
| **Flame Ionization Detector (FID)** | Foxboro | Petroleum hydrocarbons<br>Organic Solvents |
| **Combustible Gas Indicator (CGI)**<br>May be combined with individual or multi-gas detectors. | | Explosively |
| **Individual Gas Detectors** | | Oxygen ($O_2$)<br>Carbon Monoxide (CO)<br>Hydrogen Sulfide ($H_2S$)<br>Cyanide Gases ($CN^-$) |
| **Particulate Monitor** | MIE Model PDM-3<br>mini-RAM | Aerosols, mist, dust, and fumes |
| **Colorimetric Detector Tubes** | Sensidyne<br>Draeger | Benzene 0.5–10 ppm<br>[list additional] |
| **[insert additional]** | | |

*Or similar unit, as approved by the SH&E Professional

### 5.4 Health and Safety Action Levels

An action level is a point at which increased protection is required due to the concentration of contaminants in the work area or other environmental conditions. The concentration level (above background level) and the ability of the PPE to protect against that specific contaminant determine each action level. The action levels are based on concentrations in the breathing zone.

If ambient levels are measured which exceed the action levels in areas accessible to unprotected personnel, necessary control measures (barricades, warning signs, and mitigative actions to limit, etc.) must be implemented prior to commencing activities at the specific work area.

Personnel should also be able to upgrade or downgrade their level of protection with the concurrence of SSO or the Safety Professional.

Reasons to upgrade:

- Known or suspected presence of dermal hazards.
- Occurrence or likely occurrence of gas, vapor, or dust emission.
- Change in work task that will increase the exposure or potential exposure to hazardous materials.

Reasons to downgrade:

- New information indicating that the situation is less hazardous than was originally suspected.
- Change in site conditions that decrease the potential hazard.
- Change in work task that will reduce exposure to hazardous materials.

#### 5.4.1 Monitoring Procedures

[Contact an SH&E Professional for guidance. This section must be approved by the Regional SH&E/District SH&EM prior to the start of field work.]

#### 5.4.1.1 Monitoring Equipment Calibration

All instruments used will be calibrated at the beginning and end of each work shift, in accordance with the manufacturer's recommendations. If the owner's manual is not available, the personnel operating the equipment will contact the applicable office representative, rental agency or manufacturer for technical guidance for proper calibration. If equipment cannot be pre-calibrated to specifications, site operations requiring monitoring for worker exposure or off-site migration of contaminants will be postponed or temporarily ceased until this requirement is completed.

#### 5.4.1.2 Personal Sampling

Should site activities warrant performing personal sampling (breathing zone) to better assess chemical exposures experienced by AECOM employees, the SSO, under the direction of a Certified Industrial Hygienist (CIH), Certified Safety Professional (CSP) will be responsible for specifying the monitoring required. Within five working days after the receipt of monitoring results, the CIH or CSP will notify each employee, in writing, of the results that represent that employee's exposure. Copies of air sampling results will be maintained in the SSO project files.

If the site activities warrant, the subcontractor will ensure its employees' exposures are quantified via the use of appropriate sampling techniques. The subcontractor shall notify the employees sampled in accordance with health and safety regulations, and provide the results to the SSO for use in determining the potential for other employees' exposure.

## 5.5 Heat and Cold Stress

Heat and cold stress may vary based upon work activities, PPE/clothing selection, geographical locations, and weather conditions. To reduce the potential of developing heat/cold stress, be aware of the signs and symptoms of heat/cold stress and watch fellow employees for signs of heat/cold stress.

Heat stress can be a significant field site hazard, particularly for non-acclimated personnel operating in a hot, humid setting. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim and the prevention of heat stress casualties. Work-rest cycles will be determined and the appropriate measures taken to prevent heat stress as outlined in *S3NA-511-PR Heat Stress Prevention Program*.

### 5.5.1 Responding to Heat-Related Illness

The guidance below will be used in identifying and treating heat-related illness.

**Table 5.5.1: Identification and Treatment of Heat-Related Illness**

| Type of Heat-Related Illness | Description | First Aid |
|---|---|---|
| Mild Heat Strain | The mildest form of heat-related illness. Victims exhibit irritability, lethargy, and significant sweating. The victim may complain of headache or nausea. This is the initial stage of overheating, and prompt action at this point may prevent more severe heat-related illness from occurring. | • Provide the victim with a work break during which he/she may relax, remove any excess protective clothing, and drink cool fluids.<br>• If an air-conditioned spot is available, this is an ideal break location.<br>• Once the victim shows improvement, he/she may resume working; however, the work pace should be moderated to prevent recurrence of the symptoms. |
| Heat Exhaustion | Usually begins with muscular weakness and cramping, dizziness, staggering gait, and nausea. The victim will have pale, clammy moist skin and may perspire profusely. The pulse is weak and fast and the victim may faint unless they lie down. The bowels may move involuntarily. | • Immediately remove the victim from the work area to a shady or cool area with good air circulation (*avoid drafts or sudden chilling*).<br>• Remove all protective outerwear.<br>• Call a physician.<br>• Treat the victim for shock. (*Make the victim lie down, raise his or her feet 6–12 inches, and keep him/her cool by loosening all clothing*).<br>• If the victim is conscious, it may be helpful to give him/her sips of water.<br>• Transport victim to a medical facility ASAP. |

| Type of Heat-Related Illness | Description | First Aid |
|---|---|---|
| Heat Stroke | The most serious of heat illness, heat stroke represents the collapse of the body's cooling mechanisms. As a result, body temperature may rise to 104 degrees Fahrenheit or higher. As the victim progresses toward heat stroke, symptoms such as headache, dizziness, nausea can be noted, and the skin is observed to be dry, red, and hot. Sudden collapse and loss of consciousness follows quickly and death is imminent if exposure continues. Heat stroke can occur suddenly. | • Immediately evacuate the victim to a cool/shady area.<br>• Remove all protective outerwear and as much personal clothing as decency permits.<br>• Lay the victim on his/her back w/the feet slightly elevated.<br>• Apply cold wet towels or ice bags to the head, armpits, and thighs.<br>• Sponge off the bare skin with cool water.<br>• The main objective is to cool without chilling the victim.<br>• Give no stimulants or hot drinks.<br>• Since heat stroke is a severe medical condition requiring professional medical attention, emergency medical help should be summoned immediately to provide onsite treatment of the victim and proper transport to a medical facility. |

# 6.0 Environmental Program (Environment)

## 6.1 Environmental Compliance and Management

This project and the individual tasks will comply with all federal, state, provincial, and local environmental requirements.

[Give a brief description of the environmental compliance and management requirements for the project site.]

### 6.1.1 Air Emissions

[Discuss any operations where air emissions may negatively impact the surrounding environment, air emission permits, etc. and discuss associated control of emissions in Section 6.]

### 6.1.2 Hazardous Waste Management

[Discuss any operations involving the storage, treatment, or disposal of hazardous waste at the project site, RCRA Part B permits or equivalent, 90-day storage procedures, etc. and discuss controls in Section 6.]

### 6.1.3 Storm Water Pollution Prevention

[Discuss any operations that may generate/discharge stormwater from the project site, NPDES/general construction stormwater discharge permits, etc. and discuss BMPs and other controls in Section 6.]

### 6.1.4 Wetlands Protection

[Use the FWS online wetlands mapper (http://www.fws.gov/wetlands/Data/mapper.html) to determine if any wetlands exists on your project site, are adjacent to your project, or may be negatively impacted by your project, do you need a regulatory permit, discuss wetlands protection measures/controls in Section 6, etc.] – suggest adding the map as a figure to the HASP or keeping it in the project files as the official risk assessment/determination process.

### 6.1.5 Critical Habitat Protection

[Use the FWS online critical habitat mapper tool (http://criticalhabitat.fws.gov/) to determine if any plant or animal critical habitats exists on, adjacent to, or may be otherwise impacted by your project, do you need a regulatory permit, discuss critical habitat protection/control measures in Section 6, etc.] – suggest adding the map as a figure to the HASP or keeping it in the project files as the official risk assessment/determination process.

### 6.1.6 Environmental Protection

[Discuss any environmental protection controls you will implement on your project such as sediment control, stormwater infiltration control, measures to mitigate impacts on wetlands, critical habitat protection, endangered species protection, etc.]

### 6.1.7 [add here anything else]

[specify if necessary]

# 7.0 Personal Protective Equipment

## 7.1 Personal Protective Equipment

The purpose of personal protective equipment (PPE) is to provide a barrier, which will shield or isolate individuals from the chemical and/or physical hazards that may be encountered during work activities. *S3NA-208-PR Personal Protective Equipment Program* lists the general requirements for selection and usage of PPE. Table 7-1 lists the minimum PPE required during site operations and additional PPE that may be necessary. The specific PPE requirements for each work task are specified in the individual THAs.

By signing this HASP the employee agree shaving been trained in the use, limitations, care and maintenance of the protective equipment to be used by the employee at this project. If training has not been provided, request same of the PM/SSO for the proper training before signing.

**Table 7-1: Personal Protective Equipment**

| TYPE | MATERIAL | ADDITIONAL INFORMATION |
|---|---|---|
| **Minimum PPE** | | |
| **Safety Vest** | ANSI Type II high-visibility | Must have reflective tape/be visible from all sides. |
| **Boots** | Leather | ANSI approved safety toe. |
| **Safety Glasses** | | ANSI Approved; ≥98% UV protection. |
| **Hard Hat** | | ANSI Approved; recommended wide-brim. |
| **Work Uniform** | | No shorts/cutoff jeans or sleeveless shirts. |
| **Additional PPE:** [list all applicable information or delete not applicable rows] | | |
| **Hearing Protection** | Ear plugs and/ or muffs | In hazardous noise areas. |
| **Leather Gloves** | | If working with sharp objects or powered equipment. |
| **Protective Chemical Gloves** | Inner:<br>Outer: | |
| **Protective Chemical Coveralls** | Inner:<br>Outer: | |
| **Protective Chemical Boots** | | |
| **Level C Respiratory Protection** | MSA (Full Face or equivalent) equipped with GMA/P100 | |
| **Level B Respiratory Protection** | Self Contained Breathing Apparatus (SCBA), Airline with 5 minute escape pack. | Grade “D” Certified Air (Certificate Required). Obtain certificate of analysis from compressed gas vendor. |
| **Face Shield** | | Safety glasses or goggles must be worn concurrently. |
| **Apron** | | |
| **Sunscreen** | SPF 30 or higher | |
| **Welding Equipment** | | |
| **Cooling Vest** | | |
| **Cold Weather Gear** | Hard hat liner, hand warmers, insulated gloves | |
| **Fall Protection** | | |
| **Insert** | | |
| **Insert** | | |

### 7.2 PPE Doffing and Donning (UTILIZATION) Information

The following information is to provide field personnel with helpful hints that, when applied, make donning and doffing of PPE a more safe and manageable task:

- Never cut disposable booties from your feet with basic utility knives. This has resulted in workers cutting through the booty and the underlying sturdy leather work boot, resulting in significant cuts to the legs/ankles. Recommend using a pair of scissors or a package/letter opener (cut above and parallel with the work boot) to start a cut in the edge of the booty, then proceed by manually tearing the material down to the sole of the booty for easy removal.
- When applying duct tape to PPE interfaces (wrist, lower leg, around respirator, etc.) and zippers, leave approximately one inch at the end of the tape to fold over onto itself. This will make it much easier to remove the tape by providing a small handle to grab while still wearing gloves. Without this fold, trying to pull up the tape end with multiple gloves on may be difficult and result in premature tearing of the PPE.
- Have a “buddy” check your ensemble to ensure proper donning before entering controlled work areas. Without mirrors, the most obvious discrepancies can go unnoticed and may result in a potential exposure situation.
- Never perform personal decontamination with a pressure washer.

### 7.3 Decontamination

#### 7.3.1 General Requirements

All possible and necessary steps shall be taken to reduce or minimize contact with chemicals and contaminated/impacted materials while performing field activities (e.g., avoid sitting or leaning on, walking through, dragging equipment through or over, tracking, or splashing potential or known contaminated/impacted materials, etc).

All personal decontamination activities shall be performed with an attendant (buddy) to provide assistance to personnel that are performing decontamination activities. Depending on specific site hazards, attendants may be required to wear a level of protection that is equal to the required level in the Exclusion Zone (EZ).

All persons and equipment entering the EZ shall be considered contaminated, and thus, must be properly decontaminated prior to entering the SZ.

Decontamination procedures may vary based on site conditions and nature of the contaminant(s). If chemicals or decontamination solutions are used, care should be taken to minimize reactions between the solutions and contaminated materials. In addition, personnel must assess the potential exposures created by the decontamination chemical(s) or solutions. The applicable Material Safety Data Sheet (MSDS) must be reviewed, implemented, and filed by personnel contacting the chemicals/solutions.

All contaminated PPE and decontamination materials shall be contained, stored and disposed of in accordance with site-specific requirements determined by site management.

#### 7.3.2 Decontamination Equipment

The equipment required to perform decontamination may vary based on site-specific conditions and the nature of the contaminant(s). The following equipment is commonly used for decontamination purposes:

- Soft-bristle scrub brushes or long-handled brushes to remove contaminants;
- Hoses, buckets of water or garden sprayers for rinsing;
- Large plastic/galvanized wash tubs or children's wading pools for washing and rinsing solutions;
- Large plastic garbage cans or similar containers lined with plastic bags for the storage of contaminated clothing and equipment;
- Metal or plastic cans or drums for the temporary storage of contaminated liquids; and
- Paper or cloth towels for drying protective clothing and equipment.

### 7.3.3 Personal/Equipment Decontamination

All equipment leaving the EZ shall be considered contaminated and must be properly decontaminated to minimize the potential for exposure and off-site migration of impacted materials. Such equipment may include, but is not limited to: sampling tools, heavy equipment, vehicles, PPE, support devices (e.g., hoses, cylinders, etc.), and various handheld tools.

All employees performing equipment decontamination shall wear the appropriate PPE to protect against exposure to contaminated materials. The level of PPE may be equivalent to the level of PPE required in the EZ. Other PPE may include splash protection, such as face-shields and splash suits, and knee protectors. Following equipment decontamination, employees may be required to follow the proper personal decontamination procedures above.

[The SH&E Professional will outline the personal decontamination steps here in bullet format.]

For larger equipment, a high-pressure washer may need to be used. Some contaminants require the use of a detergent or chemical solution and scrub brushes to ensure proper decontamination.

For smaller equipment, use the following steps for decontamination:

- Remove majority of visible gross contamination in EZ.
- Wash equipment in decontamination solution with a scrub brush and/or power wash heavy equipment.
- Rinse equipment.
- Visually inspect for remaining contamination.
- Follow appropriate personal decontamination steps outlined above.

All decontaminated equipment shall be visually inspected for contamination prior to leaving the Contaminant Reduction Zone (CRZ). Signs of visible contamination may include an oily sheen, residue or contaminated soils left on the equipment. All equipment with visible signs of contamination shall be discarded or re-decontaminated until clean. Depending on the nature of the contaminant, equipment may have to be analyzed using a wipe method or other means.

[The SH&E Professional, in coordination with the Corporate Radiation Safety Officer, must specify the applicable radiological decontamination procedures along with the applicable removable monitoring limits in CPM, as applicable to the project]

# 8.0 Project Health and Safety Organization

## 8.1 **Project Manager** [insert Name, if available]

The Project Manager (PM) has overall management authority and responsibility for all site operations, including safety. The PM will provide the site supervisor with work plans, staff, and budgetary resources, which are appropriate to meet the safety needs of the project operations.

## 8.2 **Site Supervisor** [insert Name, if available]

The site supervisor has the overall responsibility and authority to direct work operations at the job site according to the provided work plans. The PM may act as the site supervisor while on site.

### 8.2.1 Responsibilities

The site supervisor is responsible to:

- Discuss deviations from the work plan with the SSO and PM.
- Discuss safety issues with the PM, SSO, and field personnel.
- Assist the SSO with the development and implementation of corrective actions for site safety deficiencies.
- Assist the SSO with the implementation of this HASP and ensuring compliance.
- Assist the SSO with inspections of the site for compliance with this HASP and applicable SOPs.

### 8.2.2 Authority

The site supervisor has authority to:

- Verify that all operations are in compliance with the requirements of this HASP, and halt any activity that poses a potential hazard to personnel, property, or the environment.
- Temporarily suspend individuals from field activities for infractions against the HASP pending consideration by the SSO, the Safety Professional, and the PM.

### 8.2.3 Qualifications

In addition to being Hazardous Waste Operations and Emergency Response (HAZWOPER)-qualified (see Section 4.1), the Site Supervisor is required to have completed the 8-hour HAZWOPER Supervisor Training Course in accordance with 29 CFR 1910.120 (e)(4).

## 8.3 **Site Safety Officer** [insert Name, if available]

### 8.3.1 Responsibilities

The SSO is responsible to:

- Update the site-specific HASP to reflect changes in site conditions or the scope of work. HASP updates must be reviewed and approved by the Safety Professional.
- Be aware of changes in AECOM Safety Policy.
- Monitor the lost time incidence rate for this project and work toward improving it.
- Inspect the site for compliance with this HASP and the SOPs using the appropriate audit inspection checklist provided by an AECOM Safety Professional.
- Work with the site supervisor and PM to develop and implement corrective action plans to correct deficiencies discovered during site inspections. Deficiencies will be discussed with project management to determine appropriate corrective action(s).
- Contact the Safety Professional for technical advice regarding safety issues.

- Provide a means for employees to communicate safety issues to management in a discreet manner (i.e., suggestion box, etc.).
- Determine emergency evacuation routes, establishing and posting local emergency telephone numbers, and arranging emergency transportation.
- Check that all site personnel and visitors have received the proper training and medical clearance prior to entering the site.
- Establish any necessary controlled work areas (as designated in this HASP or other safety documentation).
- Present tailgate safety meetings and maintain attendance logs and records.
- Discuss potential health and safety hazards with the Site Supervisor, the Safety Professional, and the PM.
- Select an alternate SSO by name and inform him/her of their duties, in the event that the SSO must leave or is absent from the site.

#### 8.3.2 Authority

The SSO has authority to:

- Verify that all operations are in compliance with the requirements of this HASP.
- Issue a “Stop Work Order” under the conditions set forth in this HASP.
- Temporarily suspend individuals from field activities for infractions against the HASP pending consideration by the Safety Professional and the PM.

#### 8.3.3 Qualifications

In addition to being HAZWOPER-qualified, the SSO is required to have completed the 8-hour HAZWOPER Supervisor Training Course in accordance with 29 CFR 1910.120 (e)(4).

### 8.4 Employees

#### 8.4.1 Employee Responsibilities

Responsibilities of employees associated with this project include, but are not limited to:

- Understanding and abiding by the policies and procedures specified in the HASP and other applicable safety policies, and clarifying those areas where understanding is incomplete.
- Providing feedback to health and safety management relating to omissions and modifications in the HASP or other safety policies.
- Notifying the SSO, in writing, of unsafe conditions and acts.

#### 8.4.2 Employee Authority

The health and safety authority of each employee assigned to the site includes the following:

- The right to refuse to work and/or stop work authority when the employee feels that the work is unsafe (including subcontractors or team contractors), or where specified safety precautions are not adequate or fully understood.
- The right to refuse to work on any site or operation where the safety procedures specified in this HASP or other safety policies are not being followed.
- The right to contact the SSO or the Safety Professional at any time to discuss potential concerns.
- The right and duty to stop work when conditions are unsafe, and to assist in correcting these conditions.

## 8.5 Safety Professional [insert Name, if available]

8.5.1 The Safety Professional is the member of the AECOM Safety, Health and Environmental Department assigned to provide guidance and technical support for the project. Duties include the following:

- Approving this HASP and any required changes.
- Approving the designated Site Safety Officer (SSO).
- Reviewing all personal exposure monitoring results.
- Investigating any reported unsafe acts or conditions.

## 8.6 Subcontractors

The requirements for subcontractor selection and subcontractor safety responsibilities are outlined in *S3NA-213-PR Subcontractors*. Each AECOM subcontractor is responsible for assigning specific work tasks to their employees. Each subcontractor's management will provide qualified employees and allocate sufficient time, materials, and equipment to safely complete assigned tasks. In particular, each subcontractor is responsible for equipping its personnel with any required personnel protective equipment (PPE and all required training.

AECOM considers each subcontractor to be an expert in all aspects of the work operations for which they are tasked to provide, and each subcontractor is responsible for compliance with the regulatory requirements that pertain to those services. Each subcontractor is expected to perform its operations in accordance with its own unique safety policies and procedures, in order to ensure that hazards associated with the performance of the work activities are properly controlled. Copies of any required safety documentation for a subcontractor's work activities will be provided to AECOM for review prior to the start of onsite activities, if required.

Hazards not listed in this HASP but known to any subcontractor, or known to be associated with a subcontractor's services, must be identified and addressed to the AECOM PM or the Site Supervisor prior to beginning work operations. The Site Supervisor or authorized representative has the authority to halt any subcontractor operations, and to remove any subcontractor or subcontractor employee from the site for failure to comply with established health and safety procedures or for operating in an unsafe manner.

## 8.7 Visitors

Authorized visitors (e.g., client representatives, regulators, AECOM management staff, etc.) requiring entry to any work location on the site will be briefed by the PM on the hazards present at that location. Visitors will be escorted at all times at the work location and will be responsible for compliance with their employer's health and safety policies. In addition, this HASP specifies the minimum acceptable qualifications, training and personal protective equipment which are required for entry to any controlled work area; visitors must comply with these requirements at all times.

### 8.7.1 Visitor Access

Visitors to any HAZWOPER controlled-work area must comply with the health and safety requirements of this HASP, and demonstrate an acceptable need for entry into the work area. All visitors desiring to enter any controlled work area must observe the following procedures:

- A written confirmation must be received by AECOM documenting that each of the visitors has received the proper training and medical monitoring required by this HASP. Verbal confirmation can be considered acceptable provided such confirmation is made by an officer or other authorized representative of the visitor's organization.
- Each visitor will be briefed on the hazards associated with the site activities being performed and acknowledge receipt of this briefing by signing the appropriate tailgate safety briefing form.
- All visitors must be escorted by an AECOM employee.

If the site visitor requires entry to any EZ, but does not comply with the above requirements, all work activities within the EZ must be suspended. Until these requirements have been met, entry will not be permitted.

**Unauthorized visitors, and visitors not meeting the specified qualifications, will not be permitted within established controlled work areas.**

# 9.0 Site Control

## 9.1 General

The purpose of site control is to minimize potential contamination of workers, protect the public from site hazards, and prevent vandalism. The degree of site control necessary depends on the site characteristics, site size, and the surrounding community.

Controlled work areas will be established at each work location, and if required, will be established directly prior to the work being conducted. Diagrams designating specific controlled work areas will be drawn on site maps, posted in the support vehicle or trailer and discussed during the daily safety meetings. If the site layout changes, the new areas and their potential hazards will be discussed immediately after the changes are made. General examples of zone layouts have been developed for drilling and earth moving activities [(e.g., excavating, trenching, etc.) – post these diagrams as appropriate] and are attached to this section.

## 9.2 Controlled Work Areas

Each HAZWOPER controlled work area will consist of the following three zones:

- Exclusion Zone: Contaminated work area.
- Contamination Reduction Zone: Decontamination area.
- Support Zone: Uncontaminated or “clean area” where personnel should not be exposed to hazardous conditions.

Each zone will be periodically monitored in accordance with the air monitoring requirements established in this HASP. The Exclusion Zone and the Contamination Reduction Zone are considered work areas. The Support Zone is accessible to the public (e.g., vendors, inspectors).

### 9.2.1 Exclusion Zone

The Exclusion Zone is the area where primary activities occur, such as sampling, remediation operations, installation of wells, cleanup work, etc. This area must be clearly marked with hazard tape, barricades or cones, or enclosed by fences or ropes. Only personnel involved in work activities, and meeting the requirements specified in the applicable THA and this HASP will be allowed in an Exclusion Zone.

The extent of each area will be sufficient to ensure that personnel located at/beyond its boundaries will not be affected in any substantial way by hazards associated with sample collection activities.

(See HASP Description and Assistance document for minimum distances examples)

All personnel should be alert to prevent unauthorized, accidental entrance into controlled-access areas (the EZ and CRZ). If such an entry should occur, the trespasser should be immediately escorted outside the area, or all HAZWOPER-related work must cease. All personnel, equipment, and supplies that enter controlled-access areas must be decontaminated or containerized as waste prior to leaving (through the CRZ only).

### 9.2.2 Contamination Reduction Zone

The Contamination Reduction Zone is the transition area between the contaminated area and the clean area. Decontamination is the main focus in this area. The decontamination of workers and equipment limits the physical transfer of hazardous substances into the clean area. This area must also be clearly marked with hazard tape and access limited to personnel involved in decontamination.

### 9.2.3 Support Zone

The Support Zone is an uncontaminated zone where administrative and other support functions, such as first aid, equipment supply, emergency information, etc., are located. The Support Zone shall have minimal potential for significant exposure to contaminants (i.e., background levels).

Employees will establish a Support Zone (if necessary) at the site before the commencement of site activities. The Support Zone would also serve as the entry point for controlling site access.

### 9.3 Site Access Documentation

If implemented by the PM, all personnel entering the site shall complete the "Site Entry/Exit Log" located at the site trailer or primary site support vehicle.

### 9.4 Site Security

9.4.1 Site security is necessary to:

- Prevent the exposure of unauthorized, unprotected people to site hazards.
- Avoid the increased hazards from vandals or persons seeking to abandon other wastes on the site.
- Prevent theft.
- Avoid interference with safe working procedures.

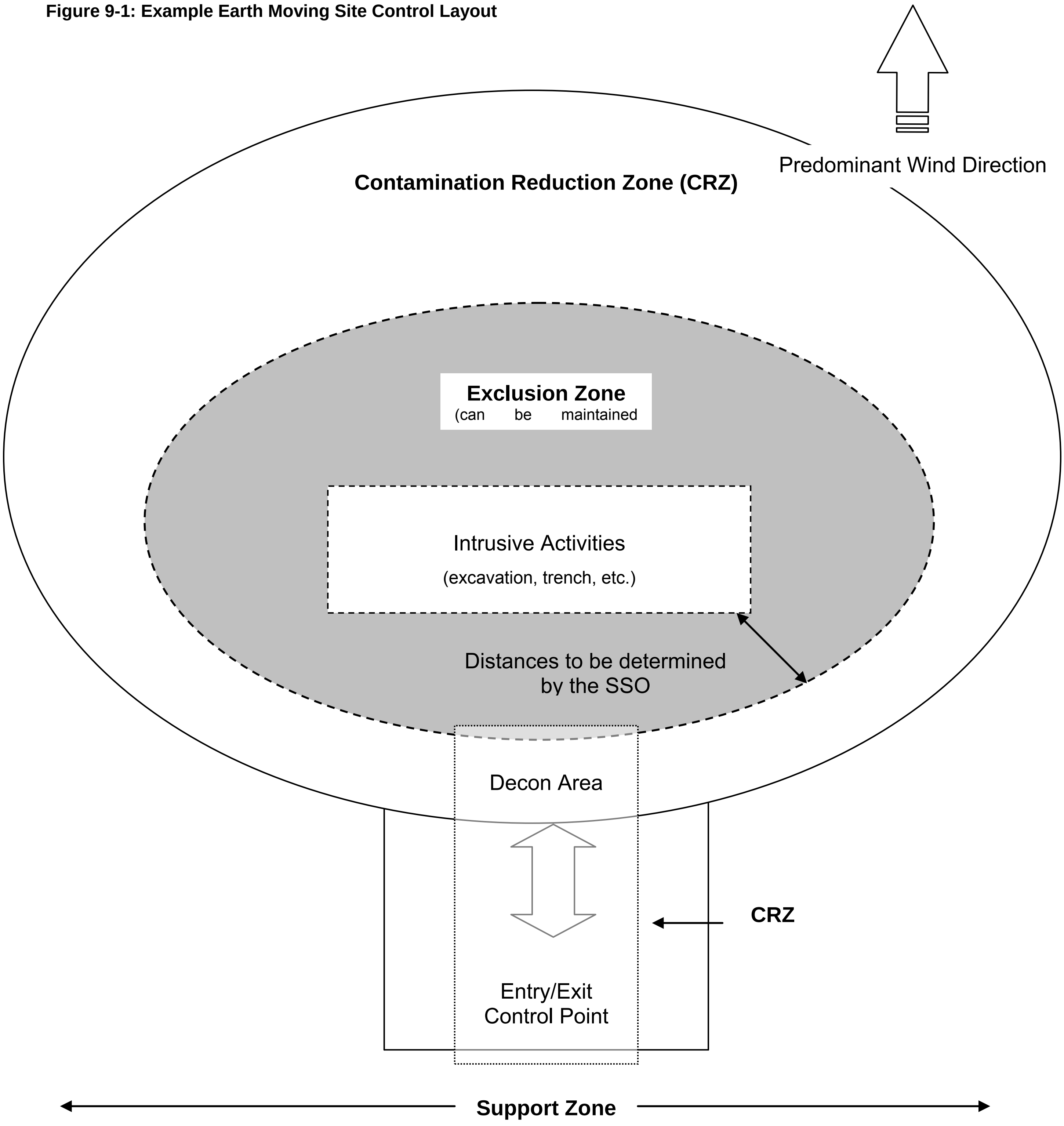
9.4.2 To maintain site security during working hours:

- Maintain security in the Support Zone and at access control points.
- Establish an identification system to identify authorized persons and limitations to their approved activities.
- Assign responsibility for enforcing authority for entry and exit requirements.
- When feasible, install fencing or other physical barrier around the site.
- If the site is not fenced, post signs around the perimeter and whenever possible, use guards to patrol the perimeter. Guards must be fully apprised of the hazards involved and trained in emergency procedures.
- Have the PM approve all visitors to the site. Make sure they have valid purpose for entering the site. Have trained site personnel accompany visitors at all times and provide them with the appropriate protective equipment.

9.4.3 To maintain site security during off-duty hours:

- If possible, assign trained, in-house technicians for site surveillance. They will be familiar with the site, the nature of the work, the site's hazards, and respiratory protection techniques.
- If necessary, use security guards to patrol the site boundary. Such personnel may be less expensive than trained technicians, but will be more difficult to train in safety procedures and will be less confident in reacting to problems around hazardous substances.
- Enlist public enforcement agencies, such as the local police department, if the site presents a significant risk to local health and safety.
- Secure the equipment.

**Figure 9-1: Example Earth Moving Site Control Layout**



# 10.0 Emergency Response Planning

## 10.1 Emergency Action Plan

Although the potential for an emergency to occur is remote, an emergency action plan has been prepared for this project should such critical situations arise. The only significant type of onsite emergency that may occur is physical injury or illness to a member of the AECOM team. The Emergency Action Plan (EAP) will be reviewed by all personnel prior to the start of field activities. A test of the EAP will be performed within the first three (3) days of the project field operations. This test will be evaluated and documented in the project records.

### 10.1.1 Three major categories of emergencies could occur during site operations:

- Illnesses and physical injuries (including injury-causing chemical exposure)
- Catastrophic events (fire, explosion, earthquake, or chemical)
- Workplace Violence, Bomb Threat
- Safety equipment problems

### 10.1.2 Emergency Coordinator

The duties of the Emergency Coordinator (EC) include:

- Implement the EAP based on the identified emergency condition.
- Notify the appropriate project and SH&E Department personnel of the emergency (Table 9-3).
- Verify emergency evacuation routes and muster points are accessible.
- Conduct routine EAP drills and evaluate compliance with the EAP.

### 10.1.3 Site-Specific Emergency Procedures

Prior to the start of site operations, the EC will complete Table 9-1 with any site-specific information regarding evacuations, muster points, communication, and other site-specific emergency procedures.

**Table 10-1: Emergency Planning**

| Emergency | Evacuation Route | Muster Location |
|---|---|---|
| **Chemical Spill** | Upwind [insert distance] | [insert location] |
| **Fire/Explosion** | [insert directions] | [insert location] |
| **Tornado** | [insert directions] | [insert location] |
| **Lightning** | [insert directions] | Vehicle |
| **[insert additional]** | | |
| **Additional Information** | | |
| **Communication Procedures** | [insert communication procedures, means of alerting personnel, etc.] | |
| **CPR/First Aid Trained Personnel** | [insert names] | |
| **Site-Specific Spill** | [insert spill response procedures for specific chemicals if required] | |

| Response Procedures | |
|---|---|

#### 10.1.4 Spill Containment Procedure

Work activities may involve the use of hazardous materials (i.e. fuels, solvents) or work involving drums or other containers. Where these activities exist, a site-specific Spill Reporting Card [project team must develop the spill reporting card] will be developed (Attachment D). Procedures outlined below will be used to prevent or contain spills:

- All hazardous material will be stored in appropriate containers
- Tops/lids will be placed back on containers after use.
- Containers of hazardous materials will be stored appropriately away from moving equipment.

At least one spill response kit, to include an appropriate empty container, materials to allow for booming or diking the area to minimize the size of the spill, and appropriate clean-up material (i.e. speedy dri) shall be available at each work site (more as needed).

- All hazardous commodities in use (i.e. fuels) shall be properly labeled.
- Containers shall only be lifted using equipment specifically manufactured for that purpose.
- Drums/containers will be secured and handled in a manner which minimizes spillage and reduces the risk of musculoskeletal injuries.

#### 10.1.5 Safety Accident/Incident Reporting

All accidents and incidents that occur on-site during any field activity will be promptly reported to the SSO and the immediate supervisor.

If any AECOM employee is injured and requires medical treatment, the Site Supervisor will report the incident in accordance with AECOM's incident reporting procedures. A copy of the final Supervisor's Report of Incident will be provided to the SH&E Professional before the end of the following shift.

If any employee of a subcontractor is injured, documentation of the incident will be accomplished in accordance with the subcontractor's procedures; however, copies of all documentation (which at a minimum must include the OSHA Form 301 or equivalent) must be provided to the SSO within 24 hours after the accident has occurred.

All accidents/incidents will be investigated. Copies of all subcontractor accident investigations will be provided to the SSO within five (5) days of the accident/incident.

#### 10.1.6 Environmental Spill/Release Reporting

All environmental spills or releases of hazardous materials (e.g., fuels, solvents, etc.), whether in excess of the Reportable Quantity or not, will be reported according to the sequence identified in the *Site-Specific Spill Reporting Card*. In determining whether a spill or release must be reported to a regulatory agency, the Site Supervisor will assess the quantity of the spill or release and evaluate the reporting criteria against the state-specific reporting requirements, your applicable regulatory permit, and/or client-specific reporting procedures. In order to support the Site Supervisor and expedite the decision to report to a state regulatory agency, a site-specific Spill Reporting Card will be developed (Attachment D). **If reporting to a US state or Federal regulatory agency is required, AECOM has 15 minutes from the time of the spill/release to officially report it.**

Chemical-specific Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Reportable Quantities for the known chemicals onsite are shown in Table 10.1.

**Table 10.1: CERCLA Reportable Quantities**

| Hazardous Substance | Regulatory Synonyms | Final RQ (lbs) |
|---|---|---|
| Benzene | N/A | 10 |
| Trichloroethylene | Trichloroethene, TCE | 100 |
| Tetrachloroethylene | Perchloroethylene, PCE | 100 |
| [insert additional rows as required] | | |

[CERCLA RQs can be found at:
http://www.epa.gov/superfund/programs/er/triggers/haztrigs/302table01.pdf.]

**Table 10.1: Emergency Contacts**

| **Emergency Coordinators / Key Personnel** | | | |
|---|---|---|---|
| **Name** | **Title/Workstation** | **Telephone Number** | **Mobile Phone** |
| [insert] | Client Contact | | |
| [insert] | Account/Client Manager | | |
| [insert] | Project Manager | | |
| [insert] | Site Supervisor | | |
| [insert] | Site Safety Officer | | |
| [insert] | Regional SH&E Manager | | |
| [insert] | District SH&E Manager | | |
| **Incident Reporting** | **Incident Reporting Line** | **(800) 348-5046** | |
| [insert] | Emergency Coordinator (EC) | | |
| [insert] | Secondary EC | | |
| Insert | TDG/IATA Shipping Expert | | |

| **Organization / Agency** | |
|---|---|
| **Name** | **Telephone Number** |
| Police Department (local) | 911 [or insert here] |
| Fire Department (local) | 911 [or insert here] |
| | |
| Ambulance Service ***(EMT will determine appropriate hospital for treatment)*** | 911 [or insert here] |
| -Emergency Hospital ***(Use by site personnel is only for non-emergency cases)*** | |
| [insert clinic Name] | |
| [insert clinic address] | |
| [insert clinic city, state, zip] | |
| Emergency Hospital Route: See Figure 9-1 | |
| | |
| Poison Control Center | (800) 222-1222 |
| Pollution Emergency | (800) 292-4706 |
| National Response Center | (800) 424-8802 |
| INFOTRAC( insert account number) | (800) 355-5053 |
| Title 3 Hotline | (800) 424-9346 |

| **Public Utilities** | |
|---|---|
| **Name** | **Telephone Number** |
| *Call Before You Dig* | 811 |

**Figure 10.1: Emergency Occupational Hospital Route/Detail Map**

[insert map if needed & available]

## 11.0 Personnel Acknowledgement

By signing below, the undersigned acknowledges that he/she has read and reviewed the AECOM Health and Safety Plan for the [site name] site. The undersigned also acknowledges that he/she has been instructed in the contents of this document and understands the information pertaining to the specified work, and will comply with the provisions contained therein.

| PRINT NAME | SIGNATURE | ORGANIZATION | DATE |
|---|---|---|---|
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# Attachment A

# Task Hazard Analyses

[attach THAs]

# Attachment B

# Material Safety Data Sheets

[attach MSDSs]

# Attachment C

# Client-Specific Health and Safety Guidelines

[attach guidelines]

# Attachment D
# Applicable SH&E SOPs

[attach SOPs]

# Attachment E

# Client Specific SH&E Guidelines and Subcontractors SH&E Information

[attach information]

# S3NA-210-PR Project Safety Meetings

## 1.0 Purpose and Scope

1.1 Establishes the requirements for conducting and documenting meetings on topics that are designed to promote Safety, Health & Environmental (SH&E) awareness and facilitate discussion regarding hazards and risks.

1.2 This procedure applies to all AECOM North America-based employees and operations in the performance of services directed and controlled by AECOM.

## 2.0 Terms and Definitions

2.1 None

## 3.0 Attachments

3.1 S3NA-210-FM Tailgate Safety Meeting Log

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Region SH&E Manager** shall provide assistance to Project Managers (PM) as required to carry out the requirements of this Standard Operating Procedure (SOP), particularly in the area of making training materials available and providing spot-checks of proper documentation.

4.1.2 **Region Manager, District and Office Managers** shall ensure that PMs of projects within their areas of responsibility are conducting and properly documenting safety meetings in accordance with requirements of this SOP.

4.1.3 **Project Managers (field task managers, supervisors)** shall ensure that all employees and personnel under the control of AECOM, e.g. subcontractors, temporary agency employees, etc, assigned to projects within their areas of responsibility participate in project initiation/kick-off meetings, special situation meetings, task hazard analyses, on-site safety inspections, and supplemental training meetings.

### 4.2 Project Initiation/Kick-off meeting

4.2.1 A project initiation/kick-off safety meeting will be conducted prior to the start of field operations. Discussion points for this meeting will come from the project-specific SH&E documentation (e.g., Health and Safety Plan (HASP), Safe Work Plan (SWP), Task Hazard Analysis (THA), etc.). The meeting will involve representatives from all organizations with a direct contractual relationship with AECOM on the job site. Topics for this meeting will include:

- Communication to all participants regarding on site SH&E responsibilities and authority.
- Establishing safety points of contact for each organization and phase of work.
- Communication of organizational SH&E performance expectations.
- Identification of significant project SH&E issues, risks, and solutions.
- Coordination of organizational SH&E conflicts and interactions.

### 4.3 Timing of Meetings

4.3.1 Change in Scope/Activity– Conducted for all AECOM staff and site personnel with a direct contractual relationship with AECOM to discuss changes to scope or a new phase of work.

4.3.2 Periodic – Conducted at a regular, recurring frequency of not less than biweekly, but preferably once per week.

4.3.3 Daily – Daily safety discussions as part of daily routine project coordination meetings. Daily meetings are required for HAZWOPER activities and other activities as identified in the safety plan. Daily safety discussions will involve representatives from all organizations with a direct contractual relationship with AECOM on the job site.

4.3.4 Significant Personnel Turn-over – Conducted at the start of any workday where a new organization begins work on site or when more than 25 percent of the day's work force is new to the site.

4.3.5 Post-Incident – Conducted at the start of the work day following the occurrence of a serious incident as defined in *S3NA-004-PR Incident Reporting*. All project initiation/kick-off safety meetings will be documented using the *S3NA-210-FM Tailgate Safety Meeting Log*.

4.3.6 All special situation safety meetings listed above will include review of applicable Task Hazard Analyses for the scope of services to be performed and be documented using the *S3NA-210-FM Tailgate Safety Meeting Log* or equivalent.

4.3.7 Daily safety discussions not otherwise required by HAZWOPER or the project safety plan will be documented.

4.4 **Supplemental Training Meetings**

4.4.1 The **Project Manager (PM), Site Supervisor** or **Site Safety Officer (SSO**) will implement worker training on general safety topics as part of routine on-site training activities. Where such training is conducted it will be documented on the *S3NA-210-FM Tailgate Safety Meeting Log*.

## 4.5 Safety Orientation

4.5.1 All project employees will attend a project-specific safety orientation and training session prior to the start of any project and/or task.

4.5.2 The **PM**, **Site Supervisor**, or **SSO** will conduct the meeting based on project specifics (e.g., location, unique hazards and risks, client requirements, etc.) and any mandatory topics required by *S3NA-003-PR SH&E Training*. The **Region SH&E Manager** can provide examples of project safety orientation material for reference.

4.5.3 The depth/level of training will be commensurate with the job function(s) to be performed. Site visitors will receive general orientation and task-specific training.

4.5.4 At a minimum, employee orientation and training will consist of the items listed below:

- Identification of hazards associated with the individual's job function and responsibilities.
- Specific safety procedural instruction needed to perform his or her required job function or task.
- Content of the HASP, SWP and any THA in accordance with *S3NA-209-PR Project Hazard Assessment and Planning*.

## 4.6 Periodic Safety Training Meetings

4.6.1 Sit-down safety training meetings will be scheduled and conducted throughout the duration of the project.

4.6.2 Meetings shall give project personnel an opportunity to maintain a high degree of safety awareness through timely and quality safety education. Meeting time will be used to discuss specific safety topics and obtain employee feedback.

4.6.3 Safety meetings will be conducted by the **PM, Site Supervisor** or **SSO** and supplemented by lead persons of the various crafts represented at the site (e.g., electrician, heavy equipment operator, foreman, inspector, resident engineer, etc.).

4.6.4 Topics for discussion will include SH&E hazards noted during routine and non-routine work situations and an explanation of job safety procedures unique to the project.

4.6.5 The **PM** and **SSO** will monitor safety meetings to ensure that subject matter is properly presented.

4.6.6 All periodic safety meetings will be documented using *S3NA-210-FM Tailgate Safety Meeting Log*. Sign-in of every meeting participant is required to ensure proper accountability and to meet AECOM project recordkeeping requirements.

4.6.7 SH&E considerations will be discussed at every project meeting. Once on-site:

- All on-site personnel must review and acknowledge the form or plan at a “tailgate” or “toolbox” meeting.
- Any new or previously unidentified hazards must be documented on the form or plan as a revision and acknowledged with initials by all on-site staff.
- The HASP or SWP must be reviewed regularly as required and documented on the plan.

4.6.8 All signed copies of the field forms and project plans must be placed in the appropriate project folder.

## 5.0 Records

5.1.1 All signed copies of the field forms and project plans must be placed in the appropriate project folder.

## 6.0 References

6.1 S3NA-003-PR SH&E Training

6.2 S3NA-004-PR Incident Reporting Procedure

6.3 S3NA-209-PR Project Hazard Assessment and Planning

# S3NA-210-FM Tailgate Safety Meeting Log

This sign-in log documents the topics of the tailgate safety briefing and individual attendance at the briefing. Personnel who perform work operations onsite are required to attend each safety briefing and acknowledge their ability to ask questions and receipt of such briefings daily. Please provide a brief narrative of the following topics as applicable to the Project.

| **Name of Meeting Leader** | **Signature** |
|---|---|
| | |

**PROJECT NAME & LOCATION**

| **PROJECT NO.** | **DATE/TIME** | **WEATHER CONDITIONS** |
|---|---|---|
| | | |

**TOPIC**
***Discussion – check one***

| | | | | | |
|---|---|---|---|---|---|
| Today's Scope of Work (All tasks) | ☐ yes | ☐ n/a | Access / Egress / Slips, Trips, & Falls | ☐ yes | ☐ n/a |
| Schedule / New Work / Scope Changes | ☐ yes | ☐ n/a | Smoking, Eating, & Drinking | ☐ yes | ☐ n/a |
| Reviewed Procedures, THA, etc. | ☐ yes | ☐ n/a | Washroom / Facilities Location | ☐ yes | ☐ n/a |
| Emergency Action Plan & Procedures | ☐ yes | ☐ n/a | Heat/Cold Stress | ☐ yes | ☐ n/a |
| Communications Protocol | ☐ yes | ☐ n/a | Exclusion Areas Barricades / Cones | ☐ yes | ☐ n/a |
| Required PPE | ☐ yes | ☐ n/a | Required Permits, Passes, Keys, etc. | ☐ yes | ☐ n/a |
| Required Monitoring / Instruments | ☐ yes | ☐ n/a | Decon Procedures / IDW Mgmt. | ☐ yes | ☐ n/a |
| Site Control / Work Zones / Security | ☐ yes | ☐ n/a | Eqpmt. Inspections/Safety Checklists | ☐ yes | ☐ n/a |

**COMMENTS/OTHER**

## Tailgate Meeting Attendees

| **Print Name** | **Signature** |
|---|---|
| | |
| | |
| | |
| | |
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| | |

**SIX QUESTIONS FOR SUCCESS** – As your final preparedness take two minutes to think through and answer these questions**:**

1. What are we about to do?
2. What equipment are we going to use?
3. Have I/we been trained to use this equipment?
4. Have I/we been trained to do this job?
5. How can I/we be hurt?
6. How can I/we prevent this incident?

*If you and your team aren't prepared to do the assigned work, STOP WORK, and take time to properly prepare.*

**END OF DAY SIGN-OFF:**

______________________________________________

Site Safety Officer Signature

☐ No Incidents Occurred

☐ Number of Near Misses/Observations Reported

☐ All Incidents Reported the Incident Reporting Line

**LESSONS LEARNED/COMMENTS/OTHER**

# S3NA-211-PR Regulatory Inspections

## 1.0 Purpose and Scope

1.1 The purpose of this procedure is to outline the process for local management to follow in response to any regulatory agency inspection at their location. This procedure applies to all AECOM Americas-based employees and operations.

## 2.0 Terms and Definitions

2.1 **Regulatory Inspection:** Any announced or unannounced inspection of an AECOM office or project site by a regulatory agency involved with SH&E laws and regulations. Periodic visits from service or local agencies to project sites to approve certain activities such as utility hook-up, utility clearance, etc, are not considered regulatory inspections.

2.2 **Regulatory Agency:** Any agency that has the authority to regulate and enforce SH&E laws and regulations. Examples include Ministry of Environment, Ministry of Labour, OSHA, EPA, NRC, DOT, or state and local agencies.

2.3 **Citation:** A written notice of violation identified by a regulatory authority. Examples include notices of violation (NOV), warning letters, complaints, official statements of observations, or other formal actions.

2.4 **Fine:** A written or other monetary penalty paid or anticipated for non-compliance.

## 3.0 Attachments

3.1 None.

## 4.0 Procedure

### 4.1 General Requirements

4.1.1 It is the policy of AECOM to have a management representative on-site to interface with a regulatory agency inspector during an inspection of work activities that AECOM controls.

4.1.2 If an inspection involves AECOM, the lead AECOM staff member will notify the regulatory agency employee that it is the policy of AECOM to inform management first before the inspection proceeds and provide the time (typically one hour is granted) needed for a management representative to participate in a conference call and/or arrive on-site.

4.1.3 Project Management will assess the need for notifying the client of inspections that may occur on client property and will notify the on-site AECOM staff member if the client will be sending a representative to participate in the site inspection.

4.1.4 It is not the policy of AECOM to request a search warrant or seek to delay an inspection from any regulatory agency unless specifically advised by management.

4.1.5 Answer all questions succinctly and truthfully; all discussions will be kept on the topic of inquiry.

4.1.6 Never admit responsibility for an apparent violation.

4.1.7 Where AECOM is in an oversight or observation role, we will participate in the opening conference, inspection tour, and closing conference in the capacity of an observer.

### 4.2 Before the Inspection Starts

4.2.1 Verify the inspector’s credentials, ask what the reason for the inspection is, and ask for an opening conference between the inspector and management staff.

4.2.2 If the inspection is the result of an employee complaint, insist that the inspection be limited to only the location associated with the complaint.

### 4.3 During the Inspection

4.3.1 Allow the inspector to view any requested documentation, electronic or printed; however, the inspector must submit a formal (written) request to AECOM before we will turn over any documents.

4.3.2 Contact Region Counsel prior to any staff interviews by the inspector so that Region Counsel may have an opportunity to provide guidance and direction.

4.3.3 Upon receipt of an agency's formal request for documentation, immediately notify the Project Manager and Region Counsel; do not provide any documentation to the agency without the approval of the Legal Department.

4.3.4 Any photos taken by an inspector shall be similarly captured from the same vantage point by the AECOM representative.

4.3.5 Document all inspections, interviews, discussions, and actions taken.

### 4.4 Post Inspection

4.4.1 Request and participate with the inspector in the closing conference; take notes of any referenced apparent violations or recommended corrective actions.

4.4.2 For any activity associated with an apparent violation, stop that activity until the appropriate corrective action can be implemented.

4.4.3 Forward all associated paperwork to both the Region Counsel and Region SH&E Manager.

### 4.5 Roles & Responsibilities

4.5.1 **Project Managers** will be responsible for the following:

- Notifying, or designating an individual to notify, the Region SH&E Manager that a regulatory inspection is in progress and submitting a SH&E Report of Incident following the inspection.
- Notifying the Client of an Agency inspection on their project site so that the Client may have representation during the inspection, at their discretion.
- Forwarding any correspondence from the inspector, as well as any notes taken by local staff during the inspection, to Region Counsel and the Region SH&E Manager within 24 hours. Send the information under the cover of "Attorney Privileged Communication."
- Where a citation was issued, direction will be given to the local staff to stop the performance of the cited activity until the appropriate corrective actions are implemented.
- Directing the onsite supervisor to post any regulatory citation in accordance with the directions outlined in the issued citation.
- Submitting a formal response to the citing agency and facilitating payment of any associated monetary fine after approval from the Legal Department.
- Serve, or designate an appropriate individual to serve, as AECOM's informal and formal agency negotiation meeting representative to discuss the citation.

4.5.2 **Field Supervisor/Office Manager** will be responsible for the following:

- Serve as the initial point of contact for the inspector
- Making all initial notifications that an inspection is in progress at the location.
- Serve as the primary contact for the inspector in the absence of a management representative.
- Confirm that the regulatory visit is fully documented.
- Verify that any cited activity was immediately stopped and not resumed until the appropriate corrective actions are implemented.

4.5.3 **Employees** will be responsible for the following:

- Answer all questions succinctly and truthfully.
- Where an employee is represented by a union, the employee may request his/her representative to be present.

4.5.4 **Region SH&E Manager** will be responsible for the following:

- Assisting project management, as applicable, during the course of the inspection.
- Supporting project management with guidance on appropriate corrective actions to address any cited activity.
- Supporting project management and the Legal Department with responses to any citation, including participation in informal or formal agency negotiation meetings regarding the citation.

4.5.5 **Region Counsel** will be responsible for the following:

- Authorizing the release of AECOM documentation to an inspector or the associated agency.
- Providing guidance to project management regarding the decision to contest the citation, including reviewing and approving any AECOM-issued response to the citation.

- Assisting employees in preparation for inspector interviews by providing guidance and direction.
- Providing, or designating, representation during informal and formal agency negotiation meetings regarding the citation.
- Authorizing payment of any monetary fine associated with a non-compliance citation.

## 5.0 Records

S3NA-004-FM1, Supervisor's Report of Incident

## 6.0 References

None.

# S3NA-212-PR Site Inspections

## 1.0 Purpose and Scope

1.1 Establishes the procedure for AECOM employees to perform and document site safety inspections, and to implement appropriate corrective actions designed to minimize risk and enhance operational SH&E performance.

1.2 This procedure applies to all AECOM North America-based employees and operations.

## 2.0 Terms and Definitions

2.1 **SH&E Self-Inspection (Walkthrough):** Informal walkthrough by Project Managers and/or designated project SH&E staff of work areas, project offices, storage areas, and other operations. Depending on the scope of work, pace of operations, and types and severity of physical and/or chemical hazards, self-inspections will be conducted on a frequent but not less than weekly basis.

2.1.1 **SH&E Inspection:** A systematic review of operations, procedures, equipment and records in order to identify, evaluate, document, and report actual or potential safety, health and/or environmental risks or hazards. An inspection is normally less formal and less consuming from a time and resources standpoint to conduct than is an audit. This does not apply to government inspections (see *S3NA-211-PR Regulatory Inspections)*.

2.2 **Corrective Action:** Actions assigned to an identified deficiency to remove, resolve or reduce the SH&E risk.

2.3 **SH&E Records:** Information and documentation related to SH&E aspects of the program, project, or other operations unit, including but not limited to Health and Safety Plans (HASP) personnel acknowledgement sheets, Task Hazard Analyses sign-off sheets, Pre-Job or Pre-Entry Briefing sign-off sheets, SH&E training attendance and course completion records, medical surveillance records, exposure monitoring results, and equipment calibration records.

## 3.0 Attachments

3.1 S3NA-212-FM Site SHE Inspection Report

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 All managers and supervisors have the responsibility to comply with AECOM SH&E procedures, and governmental requirements, and are accountable to prevent or bring any violations to the attention of the appropriate level of Management for corrective actions as per AECOM policies.

4.1.2 **Region, District and Office Managers** shall provide training and technical guidance to operations in support of the requirements of this Standard Operating Procedure (SOP) and to assure a viable SH&E inspection program is effectively implemented within the Region.

**Project Managers** (field task managers, supervisors) shall schedule and conduct project inspections, and report results in accordance with this procedure; shall actively participate in the SH&E inspection process at their sites and will provide Inspectors access to SH&E records, equipment, and work areas as appropriate.

4.1.3 **Region SH&E Manager** shall provide training and technical guidance to operations in support of the requirements of this SOP and to assure a viable SH&E inspection process is effectively implemented.

4.1.4 **Employees** shall cooperate with SH&E Department personnel, and if requested, participate in site inspections.

### 4.2 SH&E Inspections

4.2.1 Active, ongoing AECOM project sites will be inspected, e.g. monthly or at a frequency determined by the **Project Manag**er and/or **Region SH&E Manager** to meet the local regulations (*S3NA-212-FM Site SHE Inspection Report).*

4.2.2 On oversight projects where AECOM has or shares the responsibility for project safety, the AECOM supervisor will coordinate with the Contractor's SH&E inspection program and provide observations to the Contractor.

4.2.3 Unscheduled inspections may be requested by the **Region SH&E Manager** in response to project incidents such as a work-related injury, illness or significant near-miss; regulatory agency inquiry or inspection; or SH&E-related employee report of unsafe condition or similar issue.

4.2.4 Self-Inspection (Walkthrough) - Walkthrough self-inspections include identifying and correcting SH&E compliance issues, housekeeping or material storage issues, life and fire safety violations, deficiencies with mobile equipment, or other adverse conditions or unsafe behaviors. Use of a structured checklist is not required for walkthroughs. However, issues will be documented and corrective action will be taken (on the spot, where feasible) when hazards, compliance violations, and/or other deficiencies are observed.

## 5.0 Records

5.1 SH&E Inspections will be documented to the project file using *S3NA-212-FM Site SHE Inspection Report*. The checklist can be modified locally to reflect specific site operations.

5.2 Completed project review forms will be maintained in the Project Review file with findings provided to the SH&E Department for lessons learned and areas for improvement.

## 6.0 References

6.1 California Labor Code, Section 10, 6401.7.

6.2 California Code of Regulations, Title 8, Chapter 4, General Industry Safety Orders Section 3203, "Injury and Illness Prevention Program".

# S3NA-212-FM Site Inspection Report

| Region: | District: | Business Line: |
|---|---|---|
| Prepared by (name/title): | | Date: |
| Project: | | AECOM Site Supervisor: |

Summarize the findings below upon completion of the inspection.

**Summary and Recommendations**

| Section/ Item No. | Acts / Conditions Requiring Attention | Corrective Action(s) | Priority (L/M/H)* | Action By | Completed (date) |
|---|---|---|---|---|---|
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* *Prioritize the concern or condition identified using a hazard classification of either* **Low** *(not an immediateSH&E hazard),* **Medium** *(must be addressed in the short term), or* **High** *(requires immediate attention).*

**General Remarks & Comments:**

**Acknowledgement – Site Supervisor**

**Signature:** **Date:**

| **Region:** | **District:** | **Business Line:** | | |
|---|---|---|---|---|
| **Prepared by (name/title):** | | **Date:** | | |
| **Project:** | | **AECOM Site Supervisor:** | | |

Use this checklist when conducting your regular site safety inspections for projects where AECOM has a site office to identify applicable hazards.

| Item | Yes | No | N/A |
|---|---|---|---|
| **1. Documentation** | | | |
| 1. Site-specific health and safety plan on-site? | ☐ | ☐ | ☐ |
| 2. OH&S/OSHA regulations available? | ☐ | ☐ | ☐ |
| 3. AECOM safety policy and procedures manual readily available on-site? | ☐ | ☐ | ☐ |
| 4. Tailgate safety briefings performed and documented? | ☐ | ☐ | ☐ |
| 5. Project safety orientations provided to staff and documented? | ☐ | ☐ | ☐ |
| 6. Documentation of site/task specific SH&E personnel training located on-site | ☐ | ☐ | ☐ |
| 7. Personnel medical monitoring information up to date as applicable? | ☐ | ☐ | ☐ |
| 8. All incidents reported to AECOM and the Site Safety Officer? | ☐ | ☐ | ☐ |
| 9. Emergency procedures in place with contact numbers posted? | ☐ | ☐ | ☐ |
| **2. Hazard-specific Documentation** | | | |
| 1. Task Hazard Analysis completed as new hazards are identified? | ☐ | ☐ | ☐ |
| 2. Hazardous substance exposure sampling documented? | ☐ | ☐ | ☐ |
| 3. Hot work permits completed, signed and posted? | ☐ | ☐ | ☐ |
| 4. Lockout/Tagout procedures implemented and documented? | ☐ | ☐ | ☐ |
| **3. Housekeeping** | | | |
| 1. Drinking water containers provided? | ☐ | ☐ | ☐ |
| 2. Adequate waste receptacles provided and routinely replaced? | ☐ | ☐ | ☐ |
| 3. Adequate toilet facilities provided? | ☐ | ☐ | ☐ |
| 4. Walkways, corridors and work areas in general kept clear of trash and debris? | ☐ | ☐ | ☐ |
| **4. Personal Protective and Safety Equipment** | | | |
| 1. Personal protective equipment used as required? | ☐ | ☐ | ☐ |
| a) Safety boots? | ☐ | ☐ | ☐ |
| b) Hard hats? | ☐ | ☐ | ☐ |
| c) Reflective vests? | ☐ | ☐ | ☐ |
| d) Safety glasses? | ☐ | ☐ | ☐ |
| e) Respiratory protection? | ☐ | ☐ | ☐ |
| f) Fall protection? | ☐ | ☐ | ☐ |
| g) Vehicle beacon? | ☐ | ☐ | ☐ |
| h) Other | ☐ | ☐ | ☐ |
| 2. Personal protective equipment properly stored, maintained and clean? | ☐ | ☐ | ☐ |
| 3. Personal protective equipment in good condition? | ☐ | ☐ | ☐ |
| 4. Personnel instructed on use and care of personal protective equipment? | ☐ | ☐ | ☐ |

| Region: | District: | Business Line: |
|---|---|---|
| Prepared by (name/title): | | Date: |
| Project: | | AECOM Site Supervisor: |

| Item | Yes | No | N/A |
|---|---|---|---|
| **5. Fire Protection** | | | |
| 1. Fire extinguishers provided, marked and placed as required? | ☐ | ☐ | ☐ |
| 2. Fire extinguishers accessible and in proper working order? | ☐ | ☐ | ☐ |
| 3. Fire extinguishers inspected in the last month? | ☐ | ☐ | ☐ |
| **6. Mobile Equipment** | | | |
| 1. Proper warning signs and barricades in place? | ☐ | ☐ | ☐ |
| 2. Where AECOM employees are operating mobile equipment: are they properly trained; is the machinery properly inspected; are safe work practices adhered to? | ☐ | ☐ | ☐ |
| **7. First Aid** | | | |
| 1. First Aid trained personnel on site? | ☐ | ☐ | ☐ |
| 2. Names of First Aid Personnel posted? | ☐ | ☐ | ☐ |
| 3. Appropriate First aid supplies available on site? | ☐ | ☐ | ☐ |
| **8. Hazardous Materials** | | | |
| 1. Materials in storage kept in safe condition? | ☐ | ☐ | ☐ |
| 2. MSDS sheets on site readily available and up to date? | ☐ | ☐ | ☐ |
| 3. Hazard Communications/WHMIS training complete? | ☐ | ☐ | ☐ |
| The following may or may not be present on the worksite. Please obtain assistance from an experienced individual to complete these sections if necessary. | | | |
| **9. Confined Spaces** **Present on site?** | ☐ | ☐ | ☐ |
| 1. Employees that enter confined spaces have required training? | ☐ | ☐ | ☐ |
| 2. Confined spaces identified and posted? | ☐ | ☐ | ☐ |
| 3. Confined space hazard assessment forms completed? | ☐ | ☐ | ☐ |
| 4. Confined space entry permits completed, signed and filed? | ☐ | ☐ | ☐ |
| **10. Tools** **Present on site?** | ☐ | ☐ | ☐ |
| 1. The right tools used for the right job? | ☐ | ☐ | ☐ |
| 2. All guards in place for the tools? | ☐ | ☐ | ☐ |
| 3. Electrical and pneumatic tools in safe conditions? | ☐ | ☐ | ☐ |
| 4. Electrical cables and hoses in good condition and out of the way? | ☐ | ☐ | ☐ |
| 5. Personnel using tools properly trained? | ☐ | ☐ | ☐ |
| **11. Electrical** **Present on site?** | ☐ | ☐ | ☐ |
| 1. Electrical installations in a safe condition? | ☐ | ☐ | ☐ |
| 2. Equipment grounded as required? | ☐ | ☐ | ☐ |
| 3. Panels, disconnects or breakers covered and clear access provided? | ☐ | ☐ | ☐ |
| 4. Lock out/tag outs used? | ☐ | ☐ | ☐ |
| 5. Live circuits protected from worker contact? | ☐ | ☐ | ☐ |

| Region: | District: | Business Line: | | |
|---|---|---|---|---|
| Prepared by (name/title): | | Date: | | |
| Project: | | AECOM Site Supervisor: | | |

| Item | Yes | No | N/A |
|---|---|---|---|
| **12. Scaffolds** **Present on site?** | ☐ | ☐ | ☐ |
| 1. Scaffolds erected by a qualified individual? | ☐ | ☐ | ☐ |
| 2. Handrails, mid-rails, and toe-boards in place? | ☐ | ☐ | ☐ |
| 3. Platforms fully planked and secured? | ☐ | ☐ | ☐ |
| 4. Screens installed where personnel are required to work/walk below? | ☐ | ☐ | ☐ |
| 5. Scaffold parts in safe condition, free from damage? | ☐ | ☐ | ☐ |
| 6. Mobile scaffold wheels locked when the scaffold is used? | ☐ | ☐ | ☐ |
| 7. Proper fall protection used when guardrails are not used? | ☐ | ☐ | ☐ |
| **13. Floors, Wall Openings and Stairways** **Present on site?** | ☐ | ☐ | ☐ |
| 1. Barricades placed to guard all floor and wall openings that are 4 feet or more above the lower level? | ☐ | ☐ | ☐ |
| 2. All floor openings covered, secured and marked? | ☐ | ☐ | ☐ |
| 3. Handrail provided for stairs having more than 4 risers? | ☐ | ☐ | ☐ |
| 4. No materials stored within 6 feet of floor or wall openings? | ☐ | ☐ | ☐ |
| 5. Stairways kept clear of trash, obstructions and tripping hazards? | ☐ | ☐ | ☐ |
| **14. Ladders** **Present on site?** | ☐ | ☐ | ☐ |
| 1. Ladders stored properly? | ☐ | ☐ | ☐ |
| 2. Stepladders used safely? | ☐ | ☐ | ☐ |
| 3. Straight ladders angled properly and tied in or secured? | ☐ | ☐ | ☐ |
| 4. Ladders extend a minimum of 36 inches above level of access? | ☐ | ☐ | ☐ |
| 5. Job made ladders constructed properly? | ☐ | ☐ | ☐ |
| **15. Excavation and Trenching** **Present on site?** | ☐ | ☐ | ☐ |
| 1. Underground utilities have been identified, marked, protected AND verified (before digging? | ☐ | ☐ | ☐ |
| 2. All trenches/excavations supervised by a competent person? | ☐ | ☐ | ☐ |
| 3. Equipment or materials stored no closer than 5 feet from edge of excavation/ trench? | ☐ | ☐ | ☐ |
| 4. Spoils no closer than 2 feet from edge of excavation/ trench? | ☐ | ☐ | ☐ |
| 5. Excavations requiring employee entry sloped or benched 1:1 or provided shoring/ boxes? | ☐ | ☐ | ☐ |
| 6. Excavations properly barricaded? | ☐ | ☐ | ☐ |
| 7. Safe access and exit provided? | ☐ | ☐ | ☐ |
| 8. Ladders for egress placed no greater than 25 feet from workers? | ☐ | ☐ | ☐ |

# S3NA-213-PR Subcontractors

## 1.0 Purpose and Scope

1.1 Provides a process through which AECOM Subcontractors ("Subcontractors") are evaluated to determine whether the use of that Subcontractor will pose an unacceptable risk to AECOM and/or its clients, employees, equipment, or property.

1.2 This policy applies to all AECOM Americas-based operations.

## 2.0 Terms and Definitions

2.1 **Subcontractor:** Any contractor, third party, or organization procured to provide direct services for, or in support of, an AECOM managed activity or operation. This is inclusive of any AECOM managed activity or operation that requires the physical presence of that Subcontractor at the location to conduct the field-related work ("SOW"). Examples include, but are not limited to:

- Heavy equipment operations
- Surveying
- Construction/renovation/clean-construction operations
- Demolition
- Well abandonment
- Electrical system installation/service
- HAZWOPER Activities

2.2 **AECOM field site:** A site at which AECOM is providing field-related services.

## 3.0 Attachments

3.1 S3NA-213-FM Subcontractor SH&E Evaluation

3.2 S3NA-213-GL Subcontractor Safety Criteria Questionnaire Scoring Key

## 4.0 Procedure

4.1 **Roles and Responsibilities**

4.1.1 **Region/Project Management** is responsible for:

- Providing the resources to implement the subcontractor evaluation process.
- Maintaining all subcontractor SH&E performance data (developing and managing a database recommended).

4.1.2 **Project Managers** are responsible for confirming that all Subcontractors have been properly evaluated for SH&E performance and potential risk and included in job related safety meetings and pre-job safety hazard analysis. This includes but is not limited to:

- Communicating the requirements established in this procedure to the Subcontractor and providing them with the Subcontractor SH&E Evaluation form.
- Reviewing the completed subcontractor evaluation and confirming their potential risk prior to the start of the SOW.
- Providing a completed evaluation to the project file and the administrator or database manager in their AECOM Region.
- Verifying a Subcontractor's minimum level of insurance coverage as stipulated by AECOM's Legal and Procurement Departments (Workers' Compensation, Auto Insurance, General Liability, etc.).
- Subcontractors will be included in pre-job meeting or kick-off meeting and safety or hazard assessments and on the job safety inspections.
- A post-job safety performance review will be conducted.

4.1.3 **Region SH&E Manager** is responsible for:

- Providing support to the project managers in understanding the subcontractor evaluation process and requirements.

4.2 **Subcontractor Selection Requirements**

4.2.1 For all Subcontractors, the selection process will include consideration of the candidate firms' SH&E management and performance indicators.

4.2.2 Subcontractor bids/submittals shall include a completed Subcontractor SH&E Evaluation. Each questionnaire will be evaluated during the subcontractor selection process to identify any organizations whose past SH&E performance may disqualify them from selection.

4.2.3 Prior to the start of their on-site operations, the selected Subcontractors are required to provide copies of any applicable SH&E documentation (e.g., insurance certificates, safety plan, manual of safety procedures, employee training/medical monitoring certifications) to the Project Manager and/or AECOM's subcontractor selection manager.

4.2.4 Although the questionnaire is to be used as guidance to determine whether a Subcontractor's safety and health record is acceptable, there are no simple pass/fail criteria. The PM is expected to exercise reasoned judgment in the selection of Subcontractors. The guidance outlines the standards AECOM's SH&E Department has established to reflect performance acceptability. Marginal performance (Score is less than 3) will require evaluation for final approval of a subcontractor by the PM in coordination with the SH&E Department. Priority will be given to Subcontractors who have obtained certification standards (e.g., OHSAS 18001; Certificate of Recognition).

4.3 **Procurement Phase.** Prior to starting fieldwork, each Subcontractor organization shall provide the AECOM **Project Manager** (or AECOM representative) with at least one of the following for review and acceptance:

4.3.1 Site-specific SH&E documentation addressing specific performance requirements for the Subcontractor's SOW, site safety coordinator's name and responsible persons; or

4.3.2 A written statement of adoption of the provisions in AECOM's project SH&E documentation as the subcontractor's *minimum* procedures while working on the job site. This documentation must be in letter format (company letterhead), and must include the following information:

- Site location/name of Project
- Anticipated SOW to be performed and equipment to be used by the Subcontractor
- Name of the Subcontractor's Site Safety Officer, with contact phone numbers
- Name of the Subcontractor's Health and Safety Manager, with contact phone numbers
- In addition to the Subcontractor's own SH&E requirements, a statement adopting the AECOM's project SH&E documentation as the Subcontractor's *minimum* requirements for the project
- A clear statement that Subcontractor fully understands and agrees that AECOM's project SH&E documentation only establishes the *minimum* requirements required by AECOM; that the

Subcontractor is solely responsible for evaluating the full risk associated with the Subcontractor's SOW; that AECOM is relying upon Subcontractor to properly identify and address such additional risk, and that Subcontractor will take any additional actions that the Subcontractor deems necessary to fully address any needed SH&E issues related to the Subcontractor's SOW

- Statement requiring that only qualified and trained personnel (to the level of assigned responsibilities) will perform the SOW
- Designation of required personal protective equipment ("PPE") anticipated for the Subcontractor's SOW
- Copies of supplemental or additional subcontractor-specific provisions, policies, procedures and/or protocols that will be implemented by the Subcontractor during performance of the SOW

4.4 **On-Site Subcontractor SH&E Requirements**

4.4.1 Subcontractor organizations are responsible for safely performing their SOW in accordance with all applicable federal and state/provincial/territorial occupational safety and health regulations, acts, and codes, industry standards and contractual requirements.

4.4.2 Subcontractors are responsible for providing AECOM with a copy of their project-specific SH&E documentation for the SOW. The specification of minimum acceptable on-site SH&E performance is to be included.

4.4.3 Subcontractors are responsible for confirming that their employees are provided the appropriate PPE, tools, equipment and training to perform the work safely.

4.4.4 Subcontractors must provide input to, and be orientated to, the hazards associated with the site and activities of the project, including the Subcontractor's SOW.

4.4.5 Subcontractors must provide proof of safety training and current certification as required for the hazards identified, inclusive of any required medical surveillance documentation.

4.4.6 Subcontractors will be provided with a copy of AECOM's project-specific SH&E documentation for the specification of minimum acceptable on-site SH&E performance.

4.4.7 If at any time the Subcontractor obtains the services of lower-tier subcontractors or consultants for any portion of the work to be performed, a copy of the Subcontractor's SOW and the approved project-specific SH&E documentation shall be provided as part of the package submitted to each respective lower-tier subcontractor or consultant. Lower-tier subcontractors and consultants shall fully comply with subcontractor's contractual obligations to AECOM.

4.4.8 Prior to the start of work, the Subcontractor shall submit in writing to the PM, AECOM's subcontractor selection manager, or their designee the names of any lower-tier subcontractors or consultants that may be used in the project who have yet to be approved. AECOM approval is a precondition to Subcontractor's use of lower-tier subcontractors or consultants.

## 5.0 Records

5.1 Subcontractor evaluations and associated documentation will be maintained either in the project file, or, preferably, in a centralized database for tracking purposes.

## 6.0 References

6.1 None

# S3NA-213-GL Subcontractor Safety Criteria Questionnaire Scoring Key

| EMR[1] | Incident Rate (RCFR)[2] | OSHA Compliance[4] | Scores and Ratings | |
|---|---|---|---|---|
| < 1.1 | < 5.0 | No *REPEAT*, *WILLFUL*, or *CRIMINAL* citations | 3 | ***Preferred*** - Meets AECOM requirements as acceptable. |
| 1.1 - 1.5 | 5.0 – 7.5 | 1 *REPEAT*, *WILLFUL*, or *CRIMINAL* citation | 2 | ***Qualified*** - Acceptable with concurrence from the SH&E Dept and provision of a method statement describing avoidance of associated experience. |
| > 1.5 | > 7.5 | 2 or more *REPEAT*, *WILLFUL*, or *CRIMINAL* citations | 1 | ***Not Recommended*** - Not recommended that the company receive subcontracts at this time. |
| No data | No Data[3] | No Data | 0 | ***Non-responsive*** - Cannot receive subcontracts at this time. |

1 – Use the greater of: (a) the most current year, or (b) The 3-year average value.

2 – If there are any job-related fatalities in the last 3 years then the highest possible score is 2, regardless of reported RCFR.

3 – If Question 2.a) is checked **YES** then the RCFR must be calculated by the evaluator using the formula found in row f) and the information reported in rows d) and e). If this data is not supplied to AECOM, then the score is 0.

4 – OSHA Compliance experience for the prior 3 year

# S3NA-213-FM Subcontractor SH&E Evaluation

## INSTRUCTIONS TO SUBCONTRACTOR/ORGANIZATION
## COMPLETING THE AECOM SUBCONTRACTOR SH&E EVALUATION

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1. Complete the administrative information related to your organization (*Company name, address, etc.*)
2. List the service(s) to be performed for AECOM by your organization (direct hire or own forces only, not subcontracted). Examples include (*but are not limited to*):
   a. Subsurface drilling
   b. Excavation operations
   c. Surveying
   d. Construction/renovation/clean-construction operations
   e. Demolition
   f. Well abandonment
   g. Electrical system installation
   h. HAZWOPER
3. Provide an Intrastate and Interstate EMR letter (Experience Modification Rate) for your organization (entire company, not a local office, division, subsidiary, or joint venture) from the past three years. This information can be obtained from your organization's Workers' Compensation Insurance Carrier. If your organization's EMR is greater than **1.0**, an explanation must be provided in the appropriate space provided. <u>NOTE:</u> *EMR is separate from the Experience Modification Factor (EMF) also provided by your Workers' Compensation Insurance Carrier. EMR is a whole number, while EMF is a percentage*
4. Provide the applicable injury and illness data for your organization from the past three years in the table provided. Using the formulas included in the table, calculate the requested Recordable Case Frequency Rate (e.g., Recordable Incident Rate or RIR). If your company has less than ten employees, you are not required to maintain this information according to Title 29 of the Code of Federal Regulations (CFR) Part 1904, Section 1, Subsection (a)(1) [29 CFR 1904.1(a)(1)]; however, if your organization does have less than 10 employees, AECOM still requires that you provide the information for rows d) *Total Recordable Cases* and e) *Total Corporate Hours Worked*.
5. List any fatalities your organization has incurred during the past three years and for each occurrence please provide the following information (*Supplemental material may be attached to this questionnaire*):
   a. Location where the fatality occurred
   b. Cause of the fatality
   c. What corrective action(s) your organization has taken as a result of the fatality
6. List and describe any SERIOUS, REPEAT, WILLFUL, or CRIMINAL citations issued to your organization by a regulatory authority (e.g., OSHA, OH&S, Environment) (*Supplemental information related to the specific citation(s) may be attached to the questionnaire*).
7. After reading the Compliance Statement on page 3, list the name and phone number of the representative from your organization who completed the questionnaire, sign the questionnaire, and write in the date the questionnaire was completed. By signing the questionnaire, the representative states that they have truthfully answered all questions, that all of the information provided is accurate, and that if selected by AECOM, your organization shall adhere to the requirements identified in the Compliance Statement.
8. Based on the types of services to be provided by the contractor, other qualification criteria is recommended for use including but not limited to:
   a. Identity and qualifications of site safety officer
   b. Training qualification(s) of employees (e.g., certifications, permits, etc.)

Should the subcontractor have any questions regarding this evaluation, please contact the AECOM Project Manager or representative.

Failure to provide truthful and accurate information can result in the rejection of subcontractor to perform work for AECOM and/or termination of services.

| | |
|---|---|
| **Company Name:** | **Date:** |
| **Address:** | |
| **City:** | **State/Province:** |
| **Has company name changed in the last 3 years:** **Yes** ☐ **No** ☐<br>If YES, please provide previous operating name(s): | |
| **List Service(s) to be provided:** | |

**1. Experience Modification Rates**

a) List your firm's Experience Modification Rate (EMR) for the three (3) most recent years. (*Information is available from your Workers' Compensation Insurance Carrier*)

| Year | Interstate EMR | Intrastate EMR |
|---|---|---|
| | | |
| | | |
| | | |

b) If your organization does not have an EMR or your EMR is greater than 1.0, please explain why.

2. **Please consolidate your injury and illness data for the last three (3) years and complete the following:**

| | Data | Year | Year | Year |
|---|---|---|---|---|
| | | | | |
| a) | Number of Lost Workday Cases (not days lost) | | | |
| b) | Number of Restricted Workday Cases (not restricted days) | | | |
| c) | Number of Medical Treatment Cases (not including first aid) | | | |
| d) | Total Recordable Cases (a + b + c) | | | |
| e) | Total Corporate Hours Worked (hourly and salaried employees) | | | |
| f) | Recordable Case Frequency Rate (RCFR) ([d x 200,000] / e) | | | |

a) Does your organization have fewer than 10 employees? Yes ☐ No ☐

**Note:** If you check Yes, you are required to only complete rows d), e), and f) in the above table.

| | |
|---|---|
| 3. **List any fatalities your firm has had in the last three (3) years.** Include location, cause, and corrective actions. (*Attach supplemental information as required*) | |
| 4. **List any SERIOUS, *REPEAT*, *WILLFUL*, or *CRIMINAL* citations your firm has had in the last three (3) years.** Please describe. (*Attach supplemental information as required*) | |
| 5. **Do you have a written safety and health manual? Yes ☐ No ☐**<br>If yes, provide the Table of Contents.<br>If no, please indicate how you confirm that the following are addressed: training, incident reporting and investigation, inspections, hazard assessments, emergency response procedures | |
| 6. **Do you have any certificates or awards related to SH&E** (e.g., OHSAS 18001, COR, etc.)**? Yes ☐ No ☐**<br>If yes, please list: | |
| **Completed by Subcontractor Manager (Print Name):** | **Completed by (Signature):** |
| **Phone Number:** | **Date Completed:** |

| **Procurement/Safety/Management Use Only** | | | |
|---|---|---|---|
| **Evaluated by (Print Name):** | **Evaluated by (Signature):** | **Region** | **Date:** |
| | | | |

| **EMR Rating** | **RCFR Rating** | **# of Citations** | **OVERALL RATING*** |
|---|---|---|---|
| | | | |

**The lowest of the three individual criteria ratings.*

*Evaluator Note: If the organization checked YES to 2.a), they only need to provide the applicable data for rows d) and e) in the table in Section 2, and the evaluator will calculate the RCFRs by applying the formula found in row f). If the organization checked NO, then they must provide **all** requested data to be considered compliant.*

# S3NA-214-PR Site Safety Officer

## 1.0 Purpose and Scope

1.1 Defines the responsibilities of the Site Safety Officer (SSO) within the overall structure of a project's Safety, Health & Environmental (SH&E) support organization.

1.2 This procedure applies to AECOM North America based employees and operations where:

1.2.1 AECOM assumes the role of Prime Contractor or Constructor;

1.2.2 The project is a Design Build;

1.2.3 A SSO is requested by the client; or

1.2.4 The project involves conventional Construction Administration, but is either large enough or has environmental risk, that we name a full or part time safety professional.

## 2.0 Terms and Definitions

2.1 **HAZWOPER Site:** A project site where investigation, remediation cleanup, or other environmental work activities are to be planned for and conducted under the regulatory requirements of OSHA's Hazardous Waste Operations and Emergency Response (HAZWOPER) standard.

2.2 **Imminent Danger:** A condition or situation in which, if left uncorrected, could potentially result in death or serious injury. Examples include entry into a confined space without a permit, working in an excavation that is not properly shored or sloped, or working in an environment where the concentration of a contaminant exceeds its "immediate dangerous to life of health" (IDLH) level.

2.3 **Site Safety Officer(SSO):** An AECOM employee or contract employee, designated in writing by the Project Manager (PM), with primary responsibility for implementing and monitoring applicable elements of the AECOM SH&E program at a project site in accordance with the governing Health and Safety Plan (HASP) or other project-specific document, as delineated in *S3NA-209-PR Project Hazard Assessment and Planning*. Depending on the size of the project and risk level, the Site Supervisor can also serve as the SSO, if qualified. The SSO can be known by other names, including but not limited to Site Safety Inspector (SSI), Site Safety Coordinator (SSC), Site Safety and Health Supervisor (SSHS), and Safety and Occupational Health (SOH) Manager.

## 3.0 Attachments

3.1 None

## 4.0 Procedure

### 4.1 Roles & Responsibilities

4.1.1 **Region, District, Office and Department Managers** shall verify that **Project Managers (PM)** of projects within their areas of responsibility make prudent **SSO** assignments and that SH&E program implementation on projects is facilitated through the **SSO** in accordance with requirements of this procedure.

4.1.2 **PMs** shall: appoint a **SSO** in writing for applicable projects; confirm that all project personnel are aware of the assignment and how to contact the **SSO**; verify that the **SSO** fulfills project SH&E responsibilities; review the performance of the appointed **SSO** on a regular basis to confirm that he/she is maintaining effectiveness in the position.

4.1.3 **Group SH&E Director,** as required, shall provide guidance to **Region SH&E Managers** and/or Operations Managers regarding the qualification and assignment of **SSOs** to best support the specific operational needs (e.g., support of long-duration projects having unique client interface and/or contract considerations, etc.).

4.2 **Region SH&E Manager** shall provide assistance to **PMs** and **SSOs** as required for carrying out the requirements of this SOP, including approving **SSO** assignments as appropriate. Shall make training materials available, help review SH&E documentation (e.g., medical surveillance information, training certificates, competent person qualifications, etc.) pertinent to personnel considered for project assignments, and provide other technical SH&E counsel to the **PM** and **SSO** as needed.

### 4.3 Site Safety Officer (SSO) Appointments

4.3.1 Prior to the commencement of field activities, the **PM** will appoint a member of the field team to serve as **SSO** for the project. If the **PM** deems it necessary, an alternate **SSO** will be designated in the event that the primary SSO is rotated out of the project or otherwise is unable to fulfill responsibilities as the **SSO**.

4.3.2 All members of the project team will be notified of the **SSO** appointment. The **SSO** (and alternate if applicable) will be identified in the HASP.

### 4.4 SSO Qualifications and Selection

4.4.1 The **SSO** must be able to identify SH&E risks and hazards on site. The selected individual must have considerable field experience and be familiar with company SH&E policies, procedures and applicable legislation.

4.4.2 The **SSO** on HAZWOPER sites must have up-to-date training certifications in 40-hour HAZWOPER (including annual 8-hour HAZWOPER Refresher training if applicable) and the 8-hour HAZWOPER Supervisor Course. It is recommended that **SSOs** be similarly trained for non-HAZWOPER project sites.

4.4.3 The selected individual shall be willing to accept the responsibilities of the position, and appreciate and respect those responsibilities.

4.4.4 The **SSO** shall make SH&E hazard identification/control and SH&E compliance a priority in the field and have a high level of safety consciousness and commitment.

4.4.5 The **SSO** shall be able to respond in a calm, controlled and organized manner in the event of an emergency.

4.4.6 The **SSO** shall have good leadership abilities and communication skills.

4.4.7 The **SSO** shall be willing and able to correct violations of established SH&E procedures involving AECOM employees and contract personnel. When necessary, particularly in situations involving imminent danger, the **SSO** shall be knowledgeable of, and willing to, issue a Stop Work order until SH&E potential violations are corrected.

4.4.8 The **SSO** shall be able to interface with clients, emergency providers, and agency representatives as directed by the **PM** or Site Supervisor.

### 4.5 SSO Responsibilities

4.5.1 The responsibilities of the **SSO** will vary depending upon the complexity of the field program.

4.5.2 The **SSO** will be on site as determined in the project safety plan, and has the authority of the **PM** and the **Region SH&E Manager** for implementing and enforcing the HASP or other documents governing AECOM's SH&E program requirements for the project.

4.5.3 The **SSO** has the authority and responsibility to take corrective action against any situations where noncompliance with the HASP, Regulations or industry-accepted SH&E procedures are noted, and to issue a Stop Work order in cases where an imminent danger is perceived.

### 4.6 SSO Responsibilities - All Sites

4.6.1 Intervene on behalf of safety where employees could be exposed to work hazards.

4.6.2 Review with the **PM** any client-specific SH&E requirements to be followed at the site.

4.7 Procure and distribute personal protective equipment (PPE) needed for the project (*S3NA-208-PR Personal Protective Equipment Program)*

4.7.1 Verify that PPE and safety equipment used at the site is in good condition, and that maintenance programs are adhered to by project personnel to ensure safe operation.

4.7.2 Collect all SH&E-related documentation as required for the project, including training certificates, respirator fit-test records, and material safety data sheets (MSDS), etc.

4.7.3 Establish any necessary controlled work areas as designated in the HASP or other safety documentation.

4.7.4 Confirm that site personnel and visitors have received the proper training and medical clearance prior to entering the site.

4.7.5 Schedule and/or conduct tailgate safety meetings and maintain attendance logs and records.

4.7.6 Encourage and provide a means for employees to communicate SH&E concerns to management (i.e., suggestion box, project SH&E hotline, etc.).

4.7.7 Confirm that all chemicals and compressed gases brought on site are being handled and stored properly.

4.7.8 Verify emergency response procedures and emergency phone numbers with site/client representatives prior to initiating work; confirm emergency evacuation routes and emergency contact and hospital/care facility information is posted; initiate emergency response procedures in accordance with HASP requirements.

4.7.9 Verify that site personnel maintain effective line-of-sight contact and voice communication; confirm that effective communication equipment is available for the duration of the project so that emergency assistance can be coordinated if needed.

4.7.10 Inspect the site for compliance with the governing SH&E project plan (e.g., HASP) using the appropriate inspection or audit checklist provided by the **Region SH&E Manager** or designee.

4.7.11 Work with the **PM** to determine and implement the appropriate corrective action(s) to correct deficiencies discovered during site inspections.

4.7.12 Monitor incident trends on site, provide injury and incident rates to the project team and assist in developing corrective action plans. .

4.7.13 At the direction of the **PM** and/or site supervisor, initiate and conduct incident investigations and prepare incident investigation reports.

4.7.14 Interface with the client, local emergency responders, and/or agency personnel on project issues relating to SH&E.

4.7.15 Notify the client if equipment provided by the client or other site personnel, such as scaffolding, is unsatisfactory.

4.7.16 Notify the **PM** and **Region SH&E Manager** of all potential SH&E non-compliance situations and seek advice on remediation measures, as appropriate.

4.8 *S3NA-509-PR Hazardous Waste HAZWOPER Activities* additional responsibilities – HAZWOPER Sites

4.8.1 Procure air monitoring instrumentation as designated in the HASP.

4.8.2 Perform and document worker breathing zone air monitoring as required by the HASP.

4.8.3 Set up and maintain the decontamination zone and ensure proper decontamination of all site personnel.

4.8.4 Report any changes in site condition or the types or extent of contamination to the **PM** and **Region SH&E Manager** immediately.

## 5.0 Records

5.1 None

## 6.0 References

6.1 OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard 29 CFR 1910.120

6.2 S3NA-208-PR Personal Protective Equipment Program

6.3 S3NA-209-PR Project Hazard Assessment and Planning

6.4 S3NA-509-PR Hazardous Waste HAZWOPER Activities

# S3NA-302-PR Electrical, General

## 1.0 Purpose and Scope

1.1 To minimize and control electrical hazards in the workplace.

1.2 This procedure applies to all AECOM North America-based employees and operations.

1.3 As a general rule, AECOM employees should not work on exposed, energized systems with a potential greater than 50 volts. This work should be subcontracted to a qualified electrician. Should it be necessary for an AECOM employee to perform work on exposed, energized systems with a potential greater than 50 volts, the requirements of this procedure will be followed.

## 2.0 Terms and Definitions

2.1 **Arc Rating:** The maximum incident energy resistance demonstrated by a material prior to breakdown or at the onset of a second-degree skin burn (expressed in cal/cm$^2$).

2.2 **Arc Flash:** A dangerous condition associated with the release of energy during an electrical arc.

2.3 **Arc Flash Analysis:** A mathematical determination of the energy released by an electric arc and the distance from the source that a flash hazard exists. The process for an Arc Flash Analysis is defined in NFPA 70E of the National Electric Code.

2.4 **Circuit Protective Device:** A load-rated switch, circuit breaker, or other device specifically designed as a disconnecting means for opening, reversing, or closing of live circuits.

2.5 **Energized Electrical Equipment:** Electrically connected to or having a source of voltage.

2.6 **Flash Hazard:** A dangerous situation associated with the release of energy caused by an electric arc.

2.7 **Ground Fault Circuit Interrupter (GFCI):** An electrical device that protects the users of all devices connected to it from electrical shock. The GFCI is part of the circuit or device in use and continuously measures the current in that circuit. If a leakage of current is detected, as in the case of an electrical short circuit, the circuit is opened at the GFCI and current cannot flow beyond the GFCI.

2.8 **Hazardous Atmospheres:** Areas that contain or may contain explosive or flammable atmospheres require specific electrical precautions. OSHA regulates the use of electrical devices in explosive atmospheres according to National Electrical Code criteria and classifications for hazardous atmospheres.

2.9 **Portable Electric Equipment:** Cord- and plug-connected equipment and extension cords.

2.10 **Qualified Persons:** Individuals who have specific and documented training to avoid the hazards of working on or near energized electrical equipment and have been specifically permitted to work on or near exposed energized and parts.

2.11 **Shock Hazard:** A dangerous situation associated with the possible release of energy caused by contact or approach to live parts.

2.12 **Unqualified Persons:** Individuals with little or no training to avoid the hazards of energized electrical parts or equipment.

## 3.0 Attachments

3.1 S3NA-302-FM Energized Electrical Work Permit

3.2 S3NA-302-ST Electrical Regulations

3.3 S3NA-302-WI1 Electrical Safe Work Practices

3.4 S3NA-302-WI2 Ground Fault Protection Safe Work Practices

3.5 S3NA-302-WI3 Generator Safety Card

# 4.0 Procedure

## 4.1 Roles and Responsibilities

### 4.1.1 Project Manager (Field Task Manager, Supervisor)

- The **Manager** of any **employee** performing work on exposed, energized systems above a potential of 50 volts will trained to the same level as a Qualified Person (1910.332).
- The AECOM **Project Manager, Field Task Manager,** or **Supervisor** is responsible for determining if AECOM employees are exposed to electrical hazards.
- The **Manager** or **Supervisor** will determine the appropriate safe guards to be put in place to protect employees.
- The **Manager** or **Supervisor** will confirm that only Qualified Persons are assigned duties that expose them or others to live electrical current above 50 volts.

4.1.2 **Region\District SH&E Manager** is responsible for the following:

- Approving all Energized Electrical Work Permits.
- Providing technical guidance in support of this procedure.

4.1.3 **Site Safety Coordinator** shall assist the site **manager/supervisor** in compliance with the requirements of this procedure.

### 4.1.4 Employees

- All AECOM **employees** engaged in project field activities shall follow these procedures.
- AECOM **employees** will stop work if workers, other than Qualified Persons, are exposed to live electrical systems at unknown voltages or potentials greater than 50 volts
- No staff shall open electrical panels unless they are a Qualified Person.

## 4.2 Training

4.2.1 **Employees** who have potential exposures to electrical hazards, Qualified Persons, shall be trained in and be familiar with the electrical safety-related work practices required by the applicable regulations.

4.2.2 All other on-site personnel, Unqualified Persons, will be advised of the electrical hazards and the procedures to mitigate their risk.

## 4.3 General Requirements for Use of Electricity

4.3.1 AECOM personnel who meet the requirements of a Qualified Person and have been specifically designated as such in the project health and safety plan may set up temporary circuits up to 240 volts. Maintenance or installation of circuits over 240 volts will require professionally trained personnel (i.e. professional electricians).

4.3.2 All electrical panels, lines, equipment, and facilities are to be considered energized unless confirmation that they are de-energized can be obtained from a Qualified Person or electrician.

4.3.3 All work on de-energized systems will be performed using established Hazardous Energy Control procedures. Lockout devices will be used to prevent the operation/energizing of equipment or circuits during maintenance or other work. Tagout devices will be used only where it is not feasible to use a lockout device.

4.3.4 Insulated tools and electrical handling equipment shall be inspected prior to use to confirm that their protective properties are not damaged. Damaged equipment will be tagged “DAMAGED” and removed from service.

4.3.5 *S3NA-302-WI1 Electrical Work Safe Work Practices* outlines additional requirements for working on live electrical systems located on AECOM job sites. All work on exposed, energized electrical systems at potentials above 50 volts will be approved by the **Region** or **District Safety Manager**

## 4.4 General Requirements for Field/Worksite Use of Electricity

4.4.1 Electrical outlets utilized to supply power for electrical equipment during field operations shall be of the three-wire grounding type. Whenever possible, they should be tested for correct polarity and adequacy of the ground with a circuit analyzer. If it is determined that the outlet is incorrectly wired or inadequately grounded, it should not be used.

4.4.2 Ground Fault Circuit Interrupter (GFCI) devices will be in place between the equipment and power source for all temporary circuits unless protected by an assured equipment grounding program as defined in this procedure and *S3NA-302-WI2 Ground Fault Protection Safe Work Practices* (i.e., circuits that are not part of a permanently installed facility electrical system, such as on a construction site or temporary field installation).

## 4.5 Distribution System Setup

4.5.1 Only qualified personnel shall perform electrical wiring or connections.

4.5.2 Under no circumstances shall electrical lines be routed through doorways, hatches, windows, or other openings where lines could be crimped, bent, or cut.

4.5.3 Electric lines crossing work areas, personnel, or vehicular traffic areas shall be either fastened securely overhead (at a height that provides safe clearance for work operations), or protected by a cover capable of withstanding the imposed loads without creating a trip hazard.

4.5.4 Circuit breakers shall be labeled to indicate their use.

4.5.5 All circuit breaker panels shall be kept covered when not in use.

4.5.6 A fuse puller shall be used to remove cartridge fuses where one or more energized circuits are present.

4.5.7 All live parts of electrical equipment operating at 50 volts or more shall be properly guarded against accidental contact, which includes:

- Limit access to the equipment to qualified employees only.
- Unqualified Persons shall remain at least one meter (three feet) from exposed, energized systems managed by AECOM Qualified Persons. This distance shall be nine meters (10 feet) for systems with a potential greater than 240 volts.
- Label using the proper accident prevention sign, stating DANGER as well as the voltage of the equipment.
- Provide a conductor of the ampacity of not less than the rating of the circuit breaker or fuses protecting that circuit.
- Confirm that a bare conductor or earth return is not used for any temporary circuit.
- Confirm that all electrical wiring is protected from physical damage by covering and by not placing it in a location where it can be crimped or cut, etc.

4.5.8 **Extension Cord Use**

- Extension cords and electrical connections on handheld and other power tools will be inspected prior to use for cuts, kinks, frayed wires, etc. If any deficiency is noted, the equipment will be tagged “DAMAGED” and removed from service. Manufacturer-installed insulated electrical cords will not be repaired or spliced.
- Extension cords are to be kept clean, free of kinks, and protected from oil, hot or sharp surfaces, and chemicals. Extension cords are not to be placed across aisles, through doors, through holes in a wall, or in areas where the cord may be damaged or create a tripping hazard. Extension cords will be appropriate for the specific task and environment.
- Extension cord sets for use in field operations should be of the three-wire grounding type and should be designed for hard or extra-hard use. This type of cord will typically utilize insulated wires within an outer insulated sleeve. Examples of such cord include the type marked S, ST, SO, STO, SJ, SJO, or SJTO. Molded wire (flat) cord sets should not be used in field situations. The cord will minimally be rated for the intended current (e.g., heavy duty extension cords are often available in both 15 and 20 amp versions).
- Use of extension cords is allowed only for temporary installations not to exceed 90 days (e.g., decorations).
- Extension cords shall be provided with a plug cap that is either molded to the cord or equipped with a cord clamp to prevent strain on the terminal screws.
- Extension cords shall not be fastened with staples or otherwise hung in a manner that could damage the outer jacket or insulation.

- Extension cords shall be inspected prior to each use to confirm that there is no damage or defects. Defective cords shall not be used.
- Extension cords used with grounding-type equipment (e.g., three-prong plug) shall contain a grounding-type conductor (have three plugs to accept the ground plug).
- Ground fault circuit interrupters shall be used for all nonpermanent wiring needed for construction purposes or when working in wet or moist areas or onboard ships.
- Extension cords used in highly conductive work locations (e.g., wet areas) shall be of the type approved for such locations.
- Grounding-type equipment (e.g., three-prong plugs) shall not be modified to mate to incompatible outlets (e.g., cut off grounding prong to fit two prong outlets).

4.5.9 **Temporary Lights/Task Lights**

- A temporary light shall not be suspended by the cord unless the cord and light are designed for suspension.
- Temporary lights shall be equipped with bulb protectors unless they are installed at least 7 or more feet overhead.

## 4.6 Working on or Near Energized Parts

4.6.1 Working on Energized Circuits

Working on or near energized parts covers either potential direct physical contact or contact by means of tools or equipment and working close enough to the energized part to draw an arc. Any AECOM **employee** (Qualified Person) assigned to work on exposed, live electrical systems above 50 volts shall have a person knowledgeable about the task to be performed and emergency response procedures assigned to observe the Qualified Person during the task with the potential exposure. This observer shall have no other assignments during the potential exposure.

- Prior to performing any work near exposed, energized systems, the Qualified Person shall:
  - Perform a Shock Hazard Analysis.
  - Perform an Arc Flash Analysis.
  - Establish emergency contacts.
  - Complete and have approved the Energized Electrical Work Permit.
  - Have all required personal protective equipment (PPE), insulated tools, and test equipment tested and ready to use.
  - Know and understand the procedures to be followed.
  - Ensure that adequate lighting and clearance space is available.
  - Remove all conductive clothing and jewelry.

4.6.2 Working Near Overhead Power Lines

- Personnel working in the vicinity of overhead power lines, either on the ground or elevated, shall comply with *S3NA-406-PR Electrical Lines, Overhead.*
- All workers and equipment including cranes and drill rigs shall maintain a clearance distance of at least 50 feet from overhead power lines unless a detailed assessment demonstrating that a smaller clearance distance provides protection has been completed.

## 4.7 Grounding

4.7.1 The path to ground from circuits, equipment, and enclosures will be permanent and continuous.

4.7.2 Electrical installations at project sites will be protected by either an equipment grounding conductor program or GFCIs. The two options are:

- All 120-volt, single-phase, 15- and 20-amp receptacles that are not part of permanent wiring will be protected by GFCIs.
- The equipment grounding conductor program will cover extension cords, receptacles, and cord- and plug-connected equipment. The program will include the following elements:

- A written description of the program.
- At least one competent person to implement the program.
- Daily visual inspections of extension cords and cord- and plug-connected equipment for defects. Equipment found damaged or defective shall be removed from use and not used until repaired.
- Continuity tests of the equipment grounding conductors or receptacles, extension cords, and cord- and plug-connected equipment every three months.
- Compliance with the requirements for grounding of systems, circuits, and equipment (see 1926.404 in the US).

4.7.3 If the equipment grounding conductor program option is chosen, the designated competent person at the site shall maintain inspection records.

### 4.8 Assured Grounding

4.8.1 Where AECOM Operations is responsible, projects will have in place a program for the testing and inspection of all temporary electrical supply systems.

4.8.2 Assured grounding is applicable to all cord sets, receptacles that are not a part of the permanent wiring of a building or structure, and all equipment and tools connected by cord or plug.

4.8.3 All cord sets and receptacles will be visually inspected for damage before use.

4.8.4 All items covered by this procedure shall have their grounding conductor tested for continuity and all cord attachments and receptacles shall be tested for polarity to be sure the ground conductor is connected to the proper terminal.

4.8.5 Testing will be done on the following intervals:

- Before first use of any item.
- After repairs and before placing back into service.
- After every incident that might reasonably be suspected of causing damage.
- At intervals not to exceed 3 months.\
  - Any tool, cord, or service that does not pass the required tests may not be made available to employees. Such equipment shall be tagged out of service and delivered to the supervisor or competent person for repair or replacement.
  - Only a qualified employee (electrician) designated as the competent person may test electrical devices and will:
    - Prior to testing any item, remove any and all of the old color-coding tape or zip strips.
    - Perform the required ground conductor testing and polarity verifications.
    - After passing the necessary tests, the items will be marked by putting a wrap of the color coding tape or zip strip (of the appropriate color) around the cord close to the male and female ends of the electrical cord or by the male end on tools. Receptacle outlets will be marked in the most practical manner.

### 4.9 Personal Protective Equipment/Work Practices

4.9.1 PPE requirements shall be determined based on the results of each of the following: Task Hazard Analysis, Shock Hazard Analysis, and Arc Flash Analysis.

4.9.2 Nonconductive hardhats shall be worn when there is danger of head injury from electric shock or burns due to exposure to energized parts.

4.9.3 Jewelry shall not be worn when working around or with energized parts.

4.9.4 Insulated tools shall be used to work with energized parts. Tools that have insulation that might be damaged (e.g., rubber handles) shall be inspected prior to each use to confirm the insulation is not damaged.

4.9.5 Eye protection with side shields shall be worn when working with energized parts.

4.9.6 Rubber mats, non-conductive shields, or protective barriers shall be used as needed to protect employees from electrical hazards.

4.9.7 Appropriate insulating gloves shall be worn to pick up or unplug connections that are in highly conductive areas, such as in water.

4.9.8 Do not plug in or unplug electric equipment with wet hands.

### 4.10 Portable Electrical Equipment

4.10.1 Double-insulated, portable, industrial-type electrical tools meeting the requirements of the National Electrical Code (NEC) are authorized for use (ground wire not required). Where this type of tool is used, the equipment will be distinctly marked.

4.10.2 Portable electrical tools not provided with special insulating or grounding protection are not for use in damp, wet, or conductive locations (e.g., by persons standing on the ground or on metal floors).

4.10.3 All portable electrical appliances and equipment with non-current-carrying metal parts to which personnel may be exposed shall be grounded by a continuous conductor of adequate capacity from the device to a grounded receptacle. The Site Safety Officer shall resolve any question of whether or not a particular appliance should be grounded.

4.10.4 Manufacturer-installed guards shall not be tampered with, modified, or removed. These guards will be in place and utilized during operation of equipment.

4.10.5 The dimension of the working space in the direction of access to energized parts in switchboards, control panels, fused switches, circuit breakers, panel boards, motor controllers, and similar equipment that requires examination, adjustment, servicing, or maintenance while energized shall not be less than 36 inches deep and 30 inches wide or the width of the equipment, whichever is greater.

4.10.6 Portable electrical equipment shall be handled in a manner that will not cause physical damage to the equipment.

4.10.7 Portable electrical equipment shall not be carried by the cord.

4.10.8 Cords shall not be used to raise or lower equipment.

4.10.9 Extension cords shall not be fastened with staples, nails, wire, or otherwise hung in such a fashion that could damage the outer jacket or insulation.

4.10.10 Electrical cords shall not be removed from a receptacle by pulling on the cord line.

4.10.11 Employees' hands shall not be wet when plugging and unplugging cord and plug connected equipment and extension cords.

4.10.12 Disconnect portable electric equipment when not in use, before servicing, and when changing accessories such as blades, bits, and cutters.

4.10.13 Portable electric equipment and extension cords used in potentially wet locations shall be approved for use in those locations by a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation (e.g., F.M., UL, etc.).

4.10.14 Portable electric equipment and extension cords used in areas exposed to gases, fumes, vapors, liquids, or other agents having a deteriorating effect shall be approved for use in those locations.

4.10.15 Portable electric equipment and extension cords used in areas in which hazardous concentrations of flammable gases or vapors exist shall be approved for use in those locations.

4.10.16 If an adapter is used to accommodate a three-wire cord to a two-hole receptacle, the adapter wire will be attached to a known ground. The third prong shall never be removed from the plug.

4.10.17 After a circuit is de-energized by a circuit protective device, the circuit may not be manually reenergized until it has been determined that the equipment and circuit can be safely energized.

4.10.18 The outlet box for portable extension cords for outdoor use shall be weatherproof and shall be maintained in good condition.

## 5.0 Records

5.1 The Shock Hazard Analysis and the Arc Flash Analysis forms shall be retained in the project file.

5.2 The completed *S3NA-302-FM Energized Electrical Work Permit* shall be retained in the project file.

## 6.0 References

6.1 S3NA-406-PR Electrical Lines, Overhead

6.2 S3NA-410-PR Hazardous Energy Control

# S3NA-302-FM Energized Electrical Work Permit

## PART 1: To be completed by the requester

Job Work Number

(1) Description of circuit/equipment/job location:

(2) Description of work to be done:

(3) Justification of why the circuit/equipment cannot be de-energized or the work cannot be deferred until the next scheduled outage:

Requester/Title Date Time

## PART II: To be completed by the electrically qualified persons *doing* the work:

| | Check When Complete |
|---|---|
| (1) Detailed job description procedure to be used in performing the above detailed work: | ☐ |
| (2) Description of the Safe Work Practices to be employed: | ☐ |
| (3) Results of the Shock Hazard Analysis: | ☐ |
| (4) Determination of Shock Protection Boundaries: | ☐ |
| (5) Results of Flash Hazard Analysis: | ☐ |
| (6) Determination of the Flash Protection Boundary: | ☐ |
| (7) Necessary personal protective equipment to safely perform the job: | ☐ |
| (8) Means employed to restrict the access of unqualified persons from the work area: | ☐ |
| (9) Evidence of completion of a Job Briefing including discussion of any job-related hazards: | ☐ |

(10) Do you agree that the above described work can be done safely? ☐ Yes ☐ No
(If *no*, return to requester)

Electrically Qualified Person(s) Date/Time Electrically Qualified Person(s) Date/Time

Electrically Qualified Person(s) Date/Time Electrically Qualified Person(s) Date/Time

Authorized by:

Authorized Supervisor Date/Time

Notes:

# S3NA-302-ST Electrical Regulations

## 1.0 Regulations

| Jurisdiction | Regulation |
|---|---|
| **United States** | |
| **OSHA** | National Fire Protection Association (NFPA)<br>Publication 70, National Electrical Code<br>Occupational Health and Safety Administration<br>29 CFR 1910, Subpart S Electrical<br>Occupational Health and Safety Administration<br>29 CFR 1926, Subpart K Electrical |
| **Canada** | |
| **Alberta** | OHS Code (2009) Sect 225 – 227, Schedule 4<br>Alberta Electrical and Communication Utility Code (2002) |
| **British Columbia** | OHS Regulation (1997) Sect 19.1 – 19.40 Electrical Safety Act |
| **Manitoba** | Workplace Health and Safety Regulation (217/2006)<br>Sect 25.0 – 25.8, 26.45, 38.1 – 38.17 |
| **New Brunswick** | OHS Regulation (91-191) Sect 286 – 298 |
| **Newfoundland/Labrador** | OHS Regulation (C.N.L.R. 1165/96) Sect 84 – 87 |
| **Nova Scotia** | OHS Regulation (N.S. Reg. 44/99) Sect 120 – 128 |
| **NWT/NU Territories** | General Safety Regulations (R.R.N.W.T. 1990, c. S-1), Safety Act (SI-013-92)<br>Sect 96 |
| **Ontario** | Reg. 213/91 Sect 181 – 195.3<br>Reg. 851 Sect 41, 60 |
| **Prince Edward Island** | OHS Regulations (EC180/87) Sect 36.1 – 36.44 |
| **Quebec** | OHS Regulation (R.R.Q., c. S-2.1, r.19.01 O.C. 885-2001) Sect 331<br>Safety Code for the Construction Industry (R.R.Q. 1981, c. S-2.1, r. 6)<br>Sect 2.11.1 – 2.11.6, 5.1.1 – 5.3.1, Schedule 7 |
| **Saskatchewan** | OHS Regulation (R.R.S., c. O-1, r. 1) Sect 450 – 466, Schedule Table 22 |
| **Yukon Territory** | OHS Regulations (O.I.C. 2006/178) Sect 9.18 – 9.20 |

## 2.0 Standards

| | |
|---|---|
| **Canadian Standards Association** | C22.1-98, Canadian Electrical Code - Part I |

# S3NA-302-WI1 Electrical Safe Work Practices

## 1.0 Purpose

The purpose of this guideline is to confirm that all live electrical work conducted under the control of AECOM personnel is carried out in accordance with recognized best practices in order to provide adequate protection to workers from the hazards of potential arc flash and/or electrical shock.

## 2.0 Associated AECOM Policies

In addition to this guideline, AECOM will also follow all Federal and State/Provincial Regulations, in particular NFPA-70E and 29CFR part 1910 as well as relevant AECOM SH&E procedures, including *S3NA-302-PR Electrical, General* and *S3NA-410-PR Hazardous Energy Control*.

## 3.0 Responsibilities

### 3.1 AECOM's Project Manager

3.1.1 Be familiar with all precautions and Federal and State/Provincial regulations and Best Practices, including NFPA-70E.

3.1.2 Provide training on this Best Management Practice to authorized employees covering:

- Nature and control of known shock and arc flash hazards.
- Means of eliminating and controlling shock and arc flash hazards.
- Special electrical personal protective equipment (PPE) requirements (task-specific).
- Procedure for reporting any deviations to this Best Practice.

3.1.3 Control access to energized electrical equipment with potential of shock or arc flash to authorized personnel only.

3.1.4 Confirm availability of proper tools for the operation and maintenance of electrical equipment.

3.1.5 Proper identification and guarding of potentially hazardous electrical equipment.

3.1.6 Providing available electrical one-line diagrams.

3.1.7 Confirm proper housekeeping around energized electrical equipment at all times.

3.1.8 Provide proper working conditions, including adequate lighting, to facilitate work in a safe environment.

3.1.9 Proper supervision of employees.

3.1.10 Maintaining a list of authorized electrical supervisor, authorized electrical worker, and attendant.

3.1.11 Implementation and ongoing evaluation of this Best Management Practice.

3.1.12 Terminate the work and cancel the permit when live work has been completed or any new electrical hazard arises.

3.1.13 Verify that communication modes are available and have been tested.

3.1.14 Remove unauthorized individuals who enter or who attempt to enter the approach boundaries during live work.

3.1.15 Confirm that live work remains consistent with terms of the live work permit and that acceptable working conditions are maintained.

3.1.16 Withdraw the live work permit and stop all work if unsafe conditions are reported during any live work (e.g. sparking, smoldering etc.). Do not permit work on that equipment until the cause of any unsafe condition is thoroughly investigated and the live work procedure has been reviewed to prevent reoccurrence.

## 3.2 Authorized Electrical Attendant

3.2.1 Practice all precautions and federal and state/provincial regulations and Best Practices including NFPA-70E.

3.2.2 Understand the hazards that may be faced during live work, including the potential for arc flash, shock hazard, and other related hazards.

3.2.3 Be aware of the potential of arc flash or shock possible to the authorized worker.

3.2.4 Maintain an accurate count of authorized workers working near the live equipment or inside approach boundaries.

3.2.5 Remain near the approach boundary until relieved by another authorized electrical attendant.

3.2.6 Communicate with authorized workers as necessary to confirm maintenance of safe conditions at all times.

3.2.7 Monitor activities inside and outside the approach zone to determine if it is safe for the worker to continue to remain in the approach zone. Order the authorized worker to stop live work under any of the following conditions:

- The attendant detects a problem;
- The attendant detects the signs of short-circuiting, such as electrical sparking, smoldering, or any other abnormality;
- The attendant detects a situation outside the approach zone that could endanger the worker; and
- If the attendant cannot effectively and safely perform all assigned duties.

3.2.8 Perform no other duties that might interfere with the attendant’s primary duty to monitor and protect the authorized worker.

## 3.3 Authorized Electrical Worker

3.3.1 Practice all precautions and federal and state/provincial regulations and Best Practices including NFPA-70E.

3.3.2 Be continuously alert, focused, and aware of the hazards of performing the task.

3.3.3 Understand AECOM Safety, Health and Environmental policies and standards as well as site-specific electrical safe work practices.

3.3.4 Examine and understand all the documents provided by AECOM and manufacturers, including all specific hazards, advisories, cautions, etc.

3.3.5 Perform all work in accordance with applicable federal and state/provincial regulations, AECOM policies, safe work practices, and this Best Management Practice.

3.3.6 Be knowledgeable of the use and selection of the proper tools to safely perform the electrical task safely.

3.3.7 Complete a Safe Work Plan prior to the start of a task and during work, if conditions change.

3.3.8 Maintain good housekeeping around work areas. Remove all debris, materials, etc., at the completion of tasks.

3.3.9 Report any hazardous (uncontrolled) conditions to AECOM’s authorized supervisor.

3.3.10 Understand the hazards that may be faced during live work, including arc flash, shock, or other electrical hazards.

3.3.11 Properly use required PPE and electrical tools as specified in this best practice.

3.3.12 Communicate with the attendant as necessary.

3.3.13 Alert the attendant whenever any abnormality occurs (e.g., sparking, minor shock, burning smell, etc.) or symptoms of unsafe conditions are observed.

3.3.14 Stop all work and exit from the approach zone whenever:

- An order to evacuate is given by the authorized attendant or the authorized supervisor; or
- When the worker observes any warning sign or symptom of short circuiting or a dangerous situation; or
- When the supervisor gives an order to stop work.

## 4.0 Multi-employer Live Electrical Work Coordination

4.1 **AECOM's Requirements:** When using another employer to perform work involving live electrical work, AECOM will:

4.1.1 Inform the contractor that the workplace contains shock and/or arc flash potential and that live work is allowed only through compliance with a live work permit program meeting the requirements of NFPA-70E.

4.1.2 Appraise the contractor of the elements of the work, including the hazards identified and all past experiences with the live work that make the live work hazardous.

4.1.3 Appraise the contractor of any precautions or procedures that have been implemented for the protection of employees in the approach zone where contractor personnel will be working.

4.1.4 Coordinate live work operations with the contractor when both AECOM employees and contractor employees will be working in or near approach zone, so that employees of AECOM and the contractor do not endanger each other.

4.1.5 Debrief the contractor at the conclusion of the live work operations.

4.2 **Contractor Requirements:** In addition to complying with the live work permit requirements, each contractor who is retained to perform live electrical work will:

4.2.1 Obtain any available information regarding live work from the project manager.

4.2.2 Coordinate live work operations with the project manager when both AECOM personnel and contractor personnel will be jointly working in or near the approach zone.

4.2.3 Practice all precautions and federal and state/provincial regulations and Best Practices including NFPA-70E.

4.2.4 Inform AECOM's project manager of the live work permit that the contractor will be using and of any hazards confronted or created during live work, either through debriefing or during live work.

## 5.0 Review and Update

This Best Management Practice will be reviewed and updated annually.

## 6.0 Definitions

6.1 **Arc Rating:** The maximum incident energy resistance demonstrated by a material prior to breakdown or at the onset of a second-degree skin burn (expressed in cal/cm2).

6.2 **Flash Hazard:** A dangerous situation associated with the release of energy caused by an electric arc.

6.3 **Energized Electrical Equipment:** Electrically connected to or having a source of voltage.

6.4 **Shock Hazard:** A dangerous situation associated with the possible release of energy caused by contact or approach to live parts.

## 7.0 Required Minimum Qualifications

7.1 All electrical work including instrumentation, installations, maintenance, troubleshooting, calibration, and operation of breakers will only be conducted by qualified, trained, and skilled personnel (this includes AECOM personnel and contractors/subcontractors). These personnel will meet all qualification requirements mandated by the federal/state regulations as well as applicable electrical associations and trade bodies.

7.2 The Project Manager, in consultation with SH&E Department, will determine the minimum qualifications requirements for any work with the potential for arc flash.

## 8.0 Working on or Near Electrical Conductors of Circuit Parts

8.1 Safe work practices shall be used to safeguard employees from injury when working on or near exposed electric conductors or circuit parts that can be energized.

8.1.1 Live Parts – Safe Work Conditions: Live parts to which an employee might be exposed shall be put into an electrically safe work condition before an employee works on or near them.

8.1.2 Live Parts – Unsafe Work Conditions: Only qualified persons shall be permitted to work on electrical conductors or circuit parts that have not been put into electrically safe conditions.

8.2 Working on or near exposed electrical conductors OR circuit parts that are, or might become, energized – Prior to working on or near exposed electrical conductors and circuit parts operating at 50 volts or more, lockout/tagout devices shall be applied in accordance with AECOM and site-specific policies.

8.3 Electrical Hazard Analysis – If the live parts operating at 50 volts or more are not placed in electrically safe condition, other safety-related work practices shall be used to protect employees who might be exposed to electrical hazards. Safe work practices mentioned below shall be established before any person approaches exposed live parts within limited approach boundary:

8.3.1 Shock Hazard Analysis – A shock hazard analysis shall determine the voltage to which personnel will be exposed, boundary requirements, and the PPE necessary in order to minimize the possibility of electrical shock.

8.3.2 Flash Hazard Analysis – A flash hazard analysis shall be done in order to protect personnel from the possibility of being injured by an arc flash. The analysis shall determine the flash protection boundary and the PPE that people within the flash protection boundary shall use.

## 9.0 Shock Hazard Analysis and Approach Boundaries

9.1 The National Fire Protection Association (NFPA) has determined that a comprehensive Shock Hazard Analysis Survey is the best method to:

9.1.1 Systematically analyze shock hazards,

9.1.2 Identify approach boundaries, and

9.1.3 Identify appropriate PPE.

9.2 Before permitting live work on electrical equipment, each project site having electrical equipment operating at more than 50 volts is required to conduct Shock Hazard Analysis Survey. Upon completion of the survey, the applicable electrical areas/spaces will be labeled in accordance with survey results.

9.3 Shock hazard analysis for individual equipment is not required if a facility-wide shock hazard analysis has been conducted and if conditions (including labels and signage) are maintained at all times.

*NOTE: Only authorized personnel are allowed to work within the approach boundaries.*

9.4 No qualified person shall approach or take any conductive object closer to exposed live parts operating at 50 volts or more than the restricted approach boundary set forth in Appendix A-1 [Table 130.2 (C) of NFPA 70-E].

9.5 In the absence of facility-wide survey, a shock hazard analysis (including the identification of approach boundaries) shall be conducted in accordance with NFPA 70E Section 130.2 and Table 130.2 (C) (see Appendix A-1 of this Practice) for all electrical equipment operating at over 50 volts.

9.6 Results of both facility-wide as well as individual shock hazard survey shall be made available to all authorized employees. Additionally, any recommendations given by the survey generated from the survey shall be reviewed by the project manager and shall be addressed in a timely manner.

## 10.0 Arc Flash Hazard Analysis and Approach Boundaries

10.1 Arc flash safety requirements apply to all electrical equipment operating at 50 volts or more.

10.2 Similar to the shock hazard analysis, the NFPA has determined that a comprehensive Arc Flash Hazard Analysis Survey is the best method to:

10.2.1 Systematically analyze the potential for arc flash,

10.2.2 Identify the limits of the approach, and

10.2.3 Identify appropriate PPE.

10.3 Once a comprehensive facility arc flash survey has been conducted and electrical work areas/spaces are labeled in accordance with survey results, an individual arc flash hazard analysis is not required, provided that qualified personnel confirm that the conditions, as indicated on the labels and signs, are maintained.

*NOTE: Only authorized personnel are allowed to work within the limits of approach.*

10.4 Please refer to Appendix A-1 for details.

10.5 Prior to performing any work on energized electrical systems, an arc flash hazard analysis [including the identification of approach boundaries) will be conducted in accordance Appendix F of this practice (taken from NFPA 70E Section 130.3)].

## 11.0 Required PPE Categorized by Exposure

The following specialized PPE requirements will be used while working on energized electrical systems:

11.1 PPE as prescribed by the shock hazard analysis and arc flash analysis; or

11.2 PPE requirements identified in Appendix A-2 of this practice (taken from NFPA 70E Sections 130.2 and 130.7).

## 12.0 Required Tools and Equipment

12.1 Only tools and testing or protective equipment approved by ANSI/ASTM for the relevant voltage rating [see Table130.7(C)(8) or Canadian Standards Association for appropriate voltage rating] will be used when working on energized electrical systems. All tools and testing or protective equipment will be visually inspected prior to use to confirm that the protection systems associated with the tool or equipment are not damaged or impaired and that diagnostic meters and tools are configured properly. Any tool or testing or protective equipment suspected of being compromised will be immediately taken out of service and will be tagged for disposal.

## 13.0 Work on Energized Electrical Systems

13.1 It is the policy of AECOM that all electrical maintenance or troubleshooting will be done on de-energized circuits, to the extent practical. Work on energized circuits can only be done under special circumstances using a “Live Work Permit” issued by authorized electrical supervisor. This permit takes into consideration the voltage levels, known electrical hazards, communication requirements, and need for watch persons, etc. The following procedure will be observed for a live work permit:

13.1.1 The person requesting the work (authorized worker) will complete the permit and will retain the original with him or her during the work. Copy of the permit will be displayed at a prominent location in the control room as a notice that live work has been authorized in certain part of the plant/project.

13.1.2 Permit will be reviewed for correctness, proper safety precautions, and adequacy of controls by the authorized electrical supervisor. After satisfying all safety requirements, an authorized electrical supervisor will sign the permit and will give the original copy to the authorized electrical worker.

13.1.3 Upon work completion, the authorized worker will note any observation on the permit and will return the original to the authorized supervisor.

13.1.4 Authorized supervisor will keep both copies of the permit as a controlled record for a period of 12 months.

13.2 The following conditions will be met for live electrical work:

13.2.1 If any equipment or instrumentation is to be disabled while other related components or systems are still functioning, the Live Work Permit should record how process safety of the remaining systems will be maintained.

13.2.2 All electrical and instrumentation work conducted will be recorded in the applicable MCC log. The documentation will include a reference to the permit number where appropriate.

13.2.3 The worker will inform the operations supervisor that he or she intends to de-energize a circuit. He or she will also inform the operations supervisor when the work is complete and that the system can be returned to service.

13.3 See *S3NA-302-FM Energized Electrical Work Permit* for a suggested template for a “Live Work Permit.”

## 14.0 Lockout/Tagout Policy and Procedures

14.1 All equipment will be locked out prior to any work commencing in accordance with AECOM’s policy *S3NA-410-PR Hazardous Energy Control* and applicable site specific lockout/tagout program.

## 15.0 Troubleshooting Procedure

15.1 The troubleshooting of electrical equipment often requires working with live circuits. Where possible, work will be done on de-energized circuits following the relevant AECOM and site-specific lockout/tagout policy. However, troubleshooting may require limited work on live circuits; if such work is required it will be done using the "Live Work Permit" and site-specific Troubleshooting Guidelines.

## 16.0 Housekeeping

16.1 All areas containing electrical equipment will:

16.1.1 Be maintained and kept clean.

16.1.2 Be well illuminated.

16.1.3 Not be used for storage of supplies.

16.1.4 Not be used for the storage of any flammable materials.

16.1.5 Be assessed for safety hazards.

16.1.6 Be suitably ventilated to control dust, temperature, and humidity.

## 17.0 Communication

17.1 Personnel working in or around equipment with electrical hazards will employ a suitable means of communication to confirm their safety.

17.2 The means of communication may include:

17.2.1 Authorized attendant (required for ALL live work conducted on 600 volts and above) (CFR 29 1910.335(b)(3) in the United States).

17.2.2 Permits.

17.2.3 Two-way radios.

## 18.0 Signage and Labels

18.1 MCCs, ECRs, battery rooms, and electrical panels are required to have the following labeling to identify arc flash and shock hazards. The information on the label will include:

18.1.1 Flash Hazard Boundary (Arc Flash Current).

18.1.2 Flash Hazard at 18 inches in cal/cm$^2$ or joules.

18.1.3 Hazard Risk Categories (PPE requirements).

18.1.4 Shock Hazards.

18.1.5 Limited Approach Boundaries.

18.1.6 Restricted Approach.

18.1.7 Prohibited Approach.

18.1.8 Log book to record all electrically related activities.

18.2 All doorways to buildings and enclosures containing energized electrical equipment will be signed to indicate that:

18.2.1 Access is restricted to authorized personnel only.

18.2.2 Electrical hazards exist beyond this (boundary, door, etc.).

## 19.0 Management of Change

19.1 Any changes to electrical and/or project instrumentation will be conducted following the prescribed management of change policy.

**APPENDIX A-1**

**Table 130.2(C) Approach Boundaries to Live Parts for Shock Protection**

**(All dimensions are distance from live part to employee.)**

| Nominal Voltage Range (Phase to Phase) | Limited Approach Boundary | | Restricted Approach Boundary; includes inadvertent movement adder | Prohibited Approach Boundary |
|---|---|---|---|---|
| | Exposed Moveable Conductor | Exposed Fixed Circuit Parts | | |
| Up to 50 Volts | Not Specified | Not Specified | Not Specified | Not Specified |
| 50-300 | 10 ft | 3.5 ft | Avoid Contact | Avoid Contact |
| 300-750 | 10 ft | 3.5 ft | 1 ft | 1 inch |
| More than 750 volts | Consult NACO's Master Electrician or other authorized electrician. | | | |

## APPENDIX A-2

### Table 130.7(C)(10) Protective Clothing and Personal Protective Equipment (PPE) Matrix

### Table 130.7(C)(11) Protective Clothing Characteristics

| Hazard/Risk Category | Clothing Description (Typical number of clothing layers is given in parentheses) | Required Minimum Arc Rating of PPE [(J/cm2 (cal/cm2)] |
|---|---|---|
| 0 | Non-melting, flammable materials (i.e., untreated cotton, wool, rayon, or silk, or blends of these materials) with a fabric weight at least 4.5 oz/yd$^2$ (1) | N/A |
| 1 | FR shirt and FR pants or FR coverall (1) | 16.74 (4) |
| 2 | Cotton underwear – conventional short sleeve and brief/shorts, plus FR shirt and FR pants (1 or 2) | 33.47 (8) |
| 3 | Cotton underwear plus FR shirt and FR pants plus FR coverall, or cotton underwear plus two FR coveralls (2 or 3) | 104.6 (25) |
| 4 | Cotton underwear plus FR shirt and FR pants plus multilayer flash suit (3 or more) | 167.36 (40) |

NOTE:

**Arc rating**: Arc rating is defined in Article 100 and can be either ATPV or $E_{BT}$.

**ATPV**: ATPV is defined in ASTM F 1959-99 as the incident energy on a fabric or material that results in sufficient heat transfer through the fabric or material to cause the onset of a second-degree burn based on the Stoll curve.

**$E_{BT}$:** $E_{BT}$ is defined in ASTM F 1959-99 as the average of the five highest incident energy exposure values below the Stoll curve where the specimens do not exhibit breakopen. $E_{BT}$ is reported when ATPV cannot be measured due to FR fabric breakopen.

## APPENDIX B

| **Protective Clothing and Equipment** | **Protective Systems for Hazard/Risk Category** | | | | | |
|---|---|---|---|---|---|---|
| **Hazard/Risk Category Number** | **-1 (Note 3)** | **0** | **1** | **2** | **3** | **4** |
| **Non-melting (according to ASTM F 1506-00) or Untreated Natural Fiber** | | | | | | |
| a. T-shirt (short-sleeve) | X | | | X | X | X |
| b. Shirt (long-sleeve) | | X | | | | |
| c. Pants (long) | X | X | X (Note 4) | X (Note 6) | X | X |
| **FR Clothing (Note 1)** | | | | | | |
| a. Long-sleeve shirt | | | X | X | X (Note 9) | X |
| b. Pants | | | X (Note 4) | X (Note 6) | X (Note 9) | X |
| c. Coverall | | | (Note 5) | (Note 7) | X (Note 9) | (Note 5) |
| d. Jacket, parka, or rainwear | | | AN | AN | AN | AN |
| **FR Protective Equipment** | | | | | | |
| a. Flash suit jacket (multilayer) | | | | | | X |
| b. Flash suit pants (multilayer) | | | | | | X |
| c. Head protection | | | | | | |
| 1. Hard hat | | | X | X | X | X |
| 2. FR hard hat liner | | | | | AR | AR |
| d. Eye protection | | — | — | — | — | — |
| 1. Safety glasses | X | X | X | AL | AL | AL |
| 2. Safety goggles | | | | AL | AL | AL |
| e. Face and head area protection | | — | — | — | — | — |
| 1. Arc-rated face shield, or flash suit hood | | | | X (Note 8) | | |
| 2. Flash suit hood | | | | | X | X |
| 3. Hearing protection (ear canal inserts) | | | | X (Note 8) | X | X |
| f. Hand protection | | | — | — | — | — |
| Leather gloves (Note 2) | | | AN | X | X | X |
| g. Foot protection | | | | | | |
| Leather work shoes | | | AN | X | X | X |
| AN = As needed AL = Select one in group AR = As required X = Minimum required | | | | | | |

NOTES:
1. See Table 2. Arc rating for a garment is expressed in cal/cm$^2$.
2. If voltage-rated gloves are required, the leather protectors worn external to the rubber gloves satisfy this requirement.
3. Hazard/Risk Category Number “-1” is only defined if determined by Notes 3 or 6 of Table 130.7(C)(9)(a).
4. Regular weight (minimum 12 oz/yd$^2$ fabric weight), untreated, denim cotton blue jeans are acceptable in lieu of FR pants. The FR pants used for Hazard/Risk Category 1 shall have a minimum arc rating of 4.
5. Alternate is to use FR coveralls (minimum arc rating of 4) instead of FR shirt and FR pants.
6. If the FR pants have a minimum arc rating of 8, long pants of non-melting or untreated natural fiber are not required beneath the FR pants.
7. Alternate is to use FR coveralls (minimum arc rating of 4) over non-melting or untreated natural fiber pants and T-shirt.
8. A face shield with a minimum arc rating of 8, with wrap-around guarding to protect not only the face, but also the forehead, ears, and neck (or, alternately, a flash suit hood), is required.
9. Alternate is to use two sets of FR coveralls (the inner with a minimum arc rating of 4 and outer coverall with a minimum arc rating of 5) over non-melting or untreated natural fiber clothing, instead of FR coveralls over FR shirt and FR pants over non-melting or untreated natural fiber clothing.

**Table 2: Protective Clothing Characteristics**

| Hazard/Risk Category | Clothing Description (Typical number of clothing layers is given in parentheses) | Required Minimum Arc Rating of PPE [(J/cm2 (cal/cm2)] |
|---|---|---|
| 0 | Non-melting, flammable materials (i.e., untreated cotton, wool, rayon, or silk, or blends of these materials) with a fabric weight at least 4.5 oz/yd$^2$ (1) | N/A |
| 1 | FR shirt and FR pants or FR coverall (1) | 16.74 (4) |
| 2 | Cotton underwear – conventional short sleeve and brief/shorts, plus FR shirt and FR pants (1 or 2) | 33.47 (8) |
| 3 | Cotton underwear plus FR shirt and FR pants plus FR coverall, or cotton underwear plus two FR coveralls (2 or 3) | 104.6 (25) |
| 4 | Cotton underwear plus FR shirt and FR pants plus multilayer flash suit (3 or more) | 167.36 (40) |

NOTE:

Arc rating is defined in Article 100 and can be either ATPV or $E_{BT}$. ATPV is defined in ASTM F 1959-99 as the incident energy on a fabric or material that results in sufficient heat transfer through the fabric or material to cause the onset of a second-degree burn based on the Stoll curve. $E_{BT}$ is defined in ASTM F 1959-99 as the average of the five highest incident energy exposure values below the Stoll curve where the specimens do not exhibit breakopen. $E_{BT}$ is reported when ATPV cannot be measured due to FR fabric breakopen.

## APPENDIX C

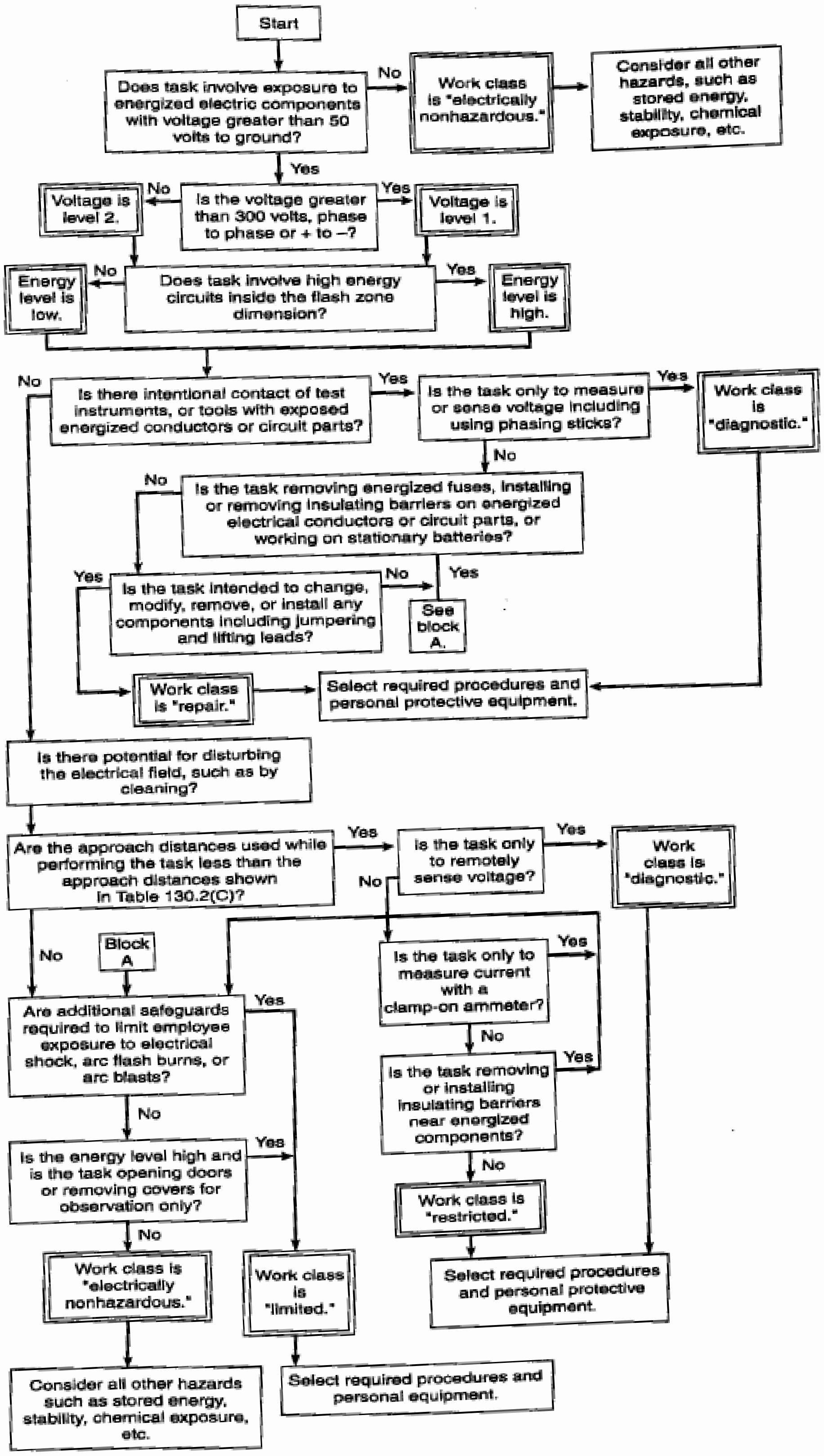



**Figure F.1 Hazard/Risk Analysis Evaluation Procedure Flow Chart.**

## APPENDIX E

### Flash Protection Boundary

For system that are above 600 volts or less, the Flash Protection Boundary shall be 4.0 ft., based on the product of clearing time of 6 cycles (0.1 second) and the available bolted fault current of 50 kA, or any combination not exceeding 300 kA cycles (5,000 ampere seconds).

For clearing times and bolted fault currents other than 300kA cycles, or under engineering supervision, the Flash Protection Boundary shall alternatively permitted to be calculated in accordance with the following general formula:

$D_c = [2.65 \times MVA_{bf} \times t]^{1/2}$

or

$D_c = [53 \times MVA \times t]^{1/2}$

where:

$D_c$ = distance in feet from an arc source for a second-degree burn

$MVA_{bf}$ = bolted fault capacity available at point involved (in mega volt-amps)

MVA = capacity rating of transformer (mega volt-amp). For transformer with an MVA rating below 0.75 MVA, multiply the transformer MVA rating by 1.25

t = time of arc exposure (in seconds)

At voltage levels above 600 volts, the Flash Protection Boundary is the distance at which the incident energy equals 5 J/cm2 (1.2 cal/cm$^2$). For situations in which fault-clearing time is 0.1 second (or faster), the Flash Protection Boundary is the distance at which the incident energy equals 6.24 J/cm$^2$ (1.5 cal/cm$^2$).

# S3NA-302-WI2 Ground Fault Protection Safe Work Practices

## 1.0 Background

1.1 OSHA standard 1926.404(b)(1) requires “ground fault protection” on construction sites. The standard allows two different approaches to providing the required protection for employees from electrical ground faults. Either “ground fault circuit interrupters” (GFCI) are to be used with temporary receptacles, or an “assured equipment grounding conductor program” is to be established in which plug-connected electrical equipment, extension cords, and temporary receptacles are tested on a periodic basis.

## 2.0 Ground Fault Circuit Interrupters

2.1 A GFCI is an electrical device that is designed to prevent electrocution from electrical leakage. It is designed to measure the difference in amperage between the “hot” wire and the “neutral” wire in a circuit. Under ideal conditions, the amperage should be the same in both wires. If there is electrical leakage (a ground-fault), the amperages will be different. If the difference is more than a predetermined amount, the GFCI “trips” and stops the flow of electricity.

2.2 GFCIs may trip from many causes:

2.2.1 Electrical leakage in the tool from internal defects.

- Electrical leakage in the extension cord from damaged insulation or from normal leakage in long runs of cords.

2.2.2 Moisture in the air or cords lying in water or on moist dirt.

2.2.3 Too many tools on one GFCI circuit.

- Electromagnetic interference from two-way radios or from power transmission lines.

2.2.4 Faulty wiring of the GFCI into the circuit.

2.2.5 Defective GFCI.

2.2.6 Any such tripping will require the problem to be corrected before the protected circuit can be re-set.

2.3 All 120-volt, single phase, 15 and 20 ampere temporary receptacles shall be protected with “approved” GFCIs. “Approved” means listed by Underwriters Laboratories.

2.4 There are several types of GFCIs.

2.4.1 A combination circuit breaker and GFCI that is installed in place of the ordinary circuit breaker.

2.4.2 A receptacle containing a built-in GFCI.

2.4.3 A portable GFCI that plugs into a receptacle and allows the extension cord or tool to be plugged into the GFCI.

2.4.4 A portable unit containing several GFCI protected receptacles.

2.5 GFCIs contain a test button and a reset button. Each GFCI needs to be tested prior to use and on a periodic basis depending upon the manufacturer's recommendations (at a minimum monthly).

## 3.0 Assured Equipment Grounding Conductor Program

3.1 If an assured equipment grounding conductor program is to be used instead of GFCIs to provide ground fault protection, the program shall be governed by the following requirements.

3.1.1 Temporary receptacles shall be electrically grounded in accordance with the temporary wiring requirements of the National Electrical Code.

3.1.2 Extension cords shall be three-wire cords containing an equipment grounding conductor (ground wire).

3.1.3 Electrical equipment that is plugged into a receptacle or extension cord (portable electrical tools, bench grinders, electric heaters, etc.) shall have a ground wire properly attached to the non-current-carrying metal parts of the equipment. (Double-insulated tools have no ground wire and are therefore exempt from these testing and recording requirements but still need to be inspected for defects.)

3.1.4 The Worksite Manager and/or Supervisor are required to designate one or more competent persons to administer this testing and recording program.

3.1.5 Periodic testing of all plug-connected equipment, all extension cords, and all temporary receptacles is to be conducted at the following times:

- Before a new item (equipment, cord, or receptacle) is put into use.
- After any repairs to the item.
- After any incident in which the item may have been damaged.
- Within 3 months of the last test. (An exception is allowed in the Standard in which extension cords, and temporary receptacles, which are fixed in place and are not exposed to damage, may be tested every 6 months.)

3.1.6 The purpose of the test is to determine the following:

- Temporary receptacles—to be sure that the receptacle is grounded.
- Extension Cords—to be sure that the ground wire is connected to the proper terminal at each end and that the ground wire is continuous throughout the length of the cord.
- Plug Connected Equipment—to be sure that the ground wire is connected to the proper terminal and to the non-current carrying metal parts of the equipment and that the ground wire is continuous from the equipment to the plug.

3.1.7 The tests may be conducted using the following instruments:

- A receptacle tester may be used to test receptacles and to test extension cords when plugged into a receptacle.
- A continuity tester, or a volt-ohm meter, may be used to test equipment and to test extension cords when not plugged into a receptacle.

3.1.8 Records must be kept to show which items have passed the test and when the test was conducted. These records may be either written inspection logs, a color coding system using colored tape attached to the item, or some other effective means.

3.1.9 Color coding shall be used in the following manner:

- After a plug-connected piece of equipment or an extension cord has passed the test, colored tape is to be placed around the cord near the plug. After a temporary receptacle has passed the test, colored tape is to be placed on the cover plate.
- Any set of colors may be used, with the exception of white, black, or silver.
- If there has been no overall site requirements established by the general contractor, use the following colors for the test periods.

| | |
|---|---|
| January, February, March | Red |
| April, May, June | Blue |
| July, August, September | Orange |
| October, November, December | Green |

3.1.10 The tests administered every three months are to begin on the first working day of each quarter. Testing and color coding are to be continued until all items covered by this program have been tested. The test administered every six months, for those receptacles and extension cords needing only semi-annual testing, are to be color coded using the quarterly color current at the time of the semi-annual test.

3.1.11 A visual inspection of plug-connected equipment, extension cords, and temporary receptacles is to be made by the user before each use. The purpose of the visual inspection is to look for damage or defects that could affect the safe use of the item. (Exception: extension cords and temporary receptacles that are fixed in place and not exposed to damage are not required to be give a daily visual inspection, but it is a good idea to do the daily visual inspection anyway.)

3.1.12 Equipment, cords, or receptacles showing damage or defects that could affect its safe operation are not to be used. This applies not only to the visual inspection before each use but also applies to any evidence of damage observed any time during use. Damaged items are to be taken out of service and are not to be used until properly repaired and retested.

3.1.13 Equipment covered by this program is not to be used until the equipment has been tested and color coded according to the requirements of this program.

3.1.14 A copy of this program is to be kept at the worksite.

# S3NA-302-WI3 Generator Safety Card

## 1.0 Objective/Overview

1.1 Portable generators should be used with extreme caution in order to prevent personal injury. When using a portable generator it is important to follow the manufacturer's instructions to avoid injuring someone or damaging your generator or appliances. Allow only trained, authorized personnel to operate the generator. Along with training, other safety measures include proper maintenance of equipment and personal protective equipment (PPE). Remember muscle strains are the most common injury associated with portable generators.


## 2.0 Safe Operating Guidelines:

2.1 Follow manufacturer's recommended operating instructions; every generator is not the same. Maintain adequate ventilation. Generators emit carbon monoxide (CO). Never operate a generator in an enclosed building without proper ventilation. Turn the generator off to refuel. Gasoline and its vapors may ignite if they come into contact with hot components or an electrical spark, so store fuel in a properly designed container in a secure location. To avoid a shock, make sure that your hands are dry and that you are standing in a dry place whenever you operate the generator. Turn off equipment and lights supplied by the generator until it is running. Use the right extension cord. Use only UL-listed, three-prong extension cords. Be sure the extension cord is the proper size (wire-gauge) to handle the electric load that will be plugged into it. Make sure the generator is properly grounded prior to each use. Using a portable generator to tie into the wiring of an existing structure shall be done only by a licensed electrician.

2.1.1 Potential Hazards:

- Lifting, carrying, and pulling starter cords.
- Burns from contact with the hot muffler or engine.
- Shocks/electrocution.
- Noise exposure.
- Inhaling exhaust gases, CO.

2.1.2 Training Requirements:

- Review of Applicable SOPs.
- Back Injury Prevention.
- Demonstrated knowledge on the use of a generator.
- Review of manufacturers operating guidelines.

2.1.3 Personal Protective Equipment (Level D PPE):

- Leather Gloves.
- Hearing Protection.
- Long Sleeve Shirt (i.e., to shield from burns, etc.).

2.1.4 Other Safety Tips:

- Have a Class A:B:C fire extinguisher readily available at all times.

# S3NA-305-PR Hand and Power Tools

## 1.0 Purpose and Scope

1.1 Provides the AECOM requirements for all manually-operated hand and power tools and equipment use, handling and storage.

1.2 This procedure applies to all AECOM North America based employees and operations.

## 2.0 Terms and Definitions

2.1 None

## 3.0 Attachments

3.1 S3NA-305-GL Hand and Power Tools Guide

3.2 S3NA-305-WI1 Chainsaw Safety Card

3.3 S3NA-305-WI2 Circular Saw Safety Card

3.4 S3NA-305-WI3 Cut Off Saw Safety Card

3.5 S3NA-305-WI4 Hand-held Grinder Safety Card

3.6 S3NA-305-WI5 Impact Wrench Safety Card

3.7 S3NA-305-WI6 Nail Gun Safety Card

3.8 S3NA-305-WI7 Pentak Vacuum Safety Card

3.9 S3NA-305-WI8 Power Drill Safety Card

3.10 S3NA-305-WI9 Pressure Washer Safety Card

3.11 S3NA-305-WI10 Reciprocating Saw Safety Card

3.12 S3NA-305-WI11 Sander Safety Card

3.13 S3NA-305-WI12 Utility Knife Safety Card

3.14 S3NA-305-WI13 Wood Chipper Safety Card

3.15 S3NA-305-WI14 Clearing and Grubbing Equipment Safety Card

3.16 S3NA-305-WI15 Pneumatic Tools Safety Card

3.17 S3NA-305-WI16 Manual Hand Tools Safety Card

3.18 S3NA-305-WI17 Small Engines Safety Card

3.19 S3NA-305-WI18 Electric and Battery Powered Hand Tools Safety Card

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Project Managers/Field Task Managers/Supervisors**. Each **Manager/Supervisor** must ensure that all aspects of this procedure are followed and adhered to on all AECOM projects, sites and locations. If a specific tool is not included in this work instruction section of this SOP, appropriate guidelines shall be established prior to work associated with that equipment, including following manufacturer's recommendations.

4.1.2 **Region SH&E Manager** provides technical guidance and support as to this procedure.

4.1.3 **Employees. Employees** shall not work with any tool that they are not familiar with without first obtaining training associated with that equipment. In addition, **employees** must following manufacturer's recommendations for its use and must not modify the equipment without first obtaining authorization from the manufacturer.

### 4.2 Restrictions

4.2.1 No **employee** shall use any hand tool, unless they are familiar with the use and operation of the equipment or have received specific instruction on its use and operation.

4.2.2 All tools will be used in accordance with manufacturer's specifications.

### 4.3 Training

4.3.1 Instruction in the proper use, safe handling, and maintenance of tools will be provided to employees unfamiliar with the tool.

### 4.4 Personal Protective Equipment

4.4.1 Lockout devices (padlocks, multiple lock hasps, tags), gloves appropriate to the task, safety-toed boots, as required, hard hats and eye & face protection, as required.

### 4.5 Inspections

4.5.1 All tools must be inspected prior to each use. Any tool that is defective or has missing parts must not be used. Every broken or defective tool must be tagged or identified as such. Tagged tools will be returned to your supervisor for repair or replacement. Tagged tools will be immediately removed from service.

4.5.2 All tools must be inspected to manufacture's specifications according to tool rests and guard adjustment tolerances. All tools will be inspected to ascertain that all safety devices are present and functioning properly.

## 5.0 Records

5.1 None

## 6.0 References

6.1 S3NA-208-PR Personal Protective Equipment Program

6.2 S3NA-302-PR Electrical, General

6.3 S3NA-305-GL1 Hand and Power Tools

6.4 S3NA-410-PR Hazardous  Energy Control

6.5 S3NA-510-PR Hearing Conservation Program

# S3NA-305-GL Hand and Power Tools

## 1.0 Exposure

1.1 Employees who use hand and power tools and are exposed to the hazards of falling, flying, abrasive, and splashing objects, or to harmful dusts, fumes, mists, vapors, or gases must be provided with the appropriate personal protective equipment.

## 2.0 Basic Safety rules

2.1 Keep all tools in good condition with regular maintenance.

2.2 Use the right tool for the job.

2.3 Examine each tool for damage before use and do not use damaged tools.

2.4 Operate tools according to the manufacturers' instructions.

2.5 Provide and use properly the right personal protective equipment.

2.6 All electrical connections for these tools must be suitable for the type of tool and the working conditions (wet, dusty, flammable vapors).

2.7 When a temporary power source is used for construction a ground-fault circuit interrupter should be used

2.8 Eye protection is required, and head and face protection is recommended for employees working with pneumatic tools.

2.9 Screens must also be set up to protect nearby workers from being struck by flying fragments around chippers, riveting guns, staplers, or air drills.

2.10 Compressed air guns should never be pointed toward anyone.

2.11 Workers should never "dead-end" them against themselves or anyone else.

2.12 A chip guard must be used when compressed air is used for cleaning.

2.13 Use of heavy jackhammers can cause fatigue and strains. Heavy rubber grips reduce these effects by providing a secure handhold.

2.14 Workers operating a jackhammer must wear safety glasses and safety shoes that protect them against injury if the jackhammer slips or falls. A face shield also should be used.

2.15 Noise hazard associated with pneumatic tools. Working with noisy tools such as jackhammers requires proper, effective use of appropriate hearing protection.

## 3.0 Hazard Prevention Sharp Objects

3.1 Employees, when using saw blades, knives, or other tools, should direct the tools away from aisle areas and away from other employees working in close proximity.

3.2 Knives and scissors must be sharp; dull tools can cause more hazards than sharp ones.

3.3 Cracked saw blades must be removed from service.

3.4 Wrenches must not be used when jaws are sprung to the point that slippage occurs.

3.5 Impact tools such as drift pins, wedges, and chisels must be kept free of mushroomed heads.

3.6 The wooden handles of tools must not be splintered.

3.7 Iron or steel hand tools may produce sparks that can be an ignition source around flammable substances. Where this hazard exists, spark-resistant tools made of non-ferrous materials should be used where flammable gases, highly volatile liquids, and other explosive substances are stored or used.

## 4.0 Hazard Prevention of Power tools

### 4.1 Precautions

4.1.1 Never carry a tool by the cord or hose.

4.1.2 Never yank the cord or the hose to disconnect it from the receptacle.

4.1.3 Keep cords and hoses away from heat, oil, and sharp edges.

4.1.4 Disconnect tools when not using them, before servicing and cleaning them, and when changing accessories such as blades, bits, and cutters.

4.1.5 Keep all people not involved with the work at a safe distance from the work area.

4.1.6 Secure work with clamps or a vise, freeing both hands to operate the tool.

4.1.7 Avoid accidental starting. Do not hold fingers on the switch button while carrying a plugged-in tool.

4.1.8 Maintain tools with care; keep them sharp and clean for best performance.

4.1.9 Follow instructions in the user's manual for lubricating and changing accessories.

4.1.10 Be sure to keep good footing and maintain good balance when operating power tools.

4.1.11 Wear proper apparel for the task. Loose clothing, ties, or jewelry can become caught in moving parts.

4.1.12 Remove all damaged portable electric tools from use and tag them: "Do Not Use."

### 4.2 Guards

4.2.1 The exposed moving parts of power tools need to be safeguarded. Belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating, or moving parts of equipment must be guarded.

4.2.2 Machine guards, as appropriate, must be provided to protect the operator and others from the following:

- Point of operation.
- In-running nip points.
- Rotating parts.
- Flying chips and sparks.

4.2.3 Safety guards must never be removed when a tool is being used. Portable circular saws having a blade greater than 2 inches (5.08 centimeters) in diameter must be equipped at all times with guards.

4.2.4 An upper guard must cover the entire blade of the saw.

4.2.5 A retractable lower guard must cover the teeth of the saw, except where it makes contact with the work material. The lower guard must automatically return to the covering position when the tool is withdrawn from the work position.

## 5.0 Operating Controls and Switches

5.1 The following hand-held power tools must be equipped with a constant-pressure switch or control that shuts off the power when pressure is released: drills; tappers; fastener drivers; horizontal, vertical, and angle grinders with wheels more than 2 inches (5.08 centimeters) in diameter; disc sanders with discs greater than inches (5.08 centimeters); belt sanders; reciprocating saws; saber saws, scroll saws, and jigsaws with blade shanks greater than 1/4-inch (0.63 centimeters) wide; and other similar tools.

5.2 These tools also may be equipped with a "lock-on" control, if it allows the worker to also shut off the control in a single motion using the same finger or fingers.

5.3 The following hand-held power tools must be equipped with either a positive "on-off" control switch, a constant pressure switch, or a "lock-on" control:

5.3.1 Disc sanders with discs 2 inches (5.08 centimeters) or less in diameter.

5.3.2 Grinders with wheels 2 inches (5.08 centimeters) or less in diameter.

5.3.3 Platen sanders, routers, planers, laminate trimmers, nibblers, shears, and scroll saws; and jigsaws, saber and scroll saws with blade shanks a nominal 1/4-inch (6.35 millimeters) or less in diameter.

5.3.4 It is recommended that the constant-pressure control switch be regarded as the preferred device.

5.3.5 Other hand-held power tools such as circular saws having a blade diameter greater than 2 inches (5.08 centimeters), chain saws, and percussion tools with no means of holding accessories securely must be equipped with a constant-pressure switch.

## 6.0 Electrical Shock Caution

6.1 Electrical shocks, which can lead to injuries such as heart failure and burns, are among the major hazards associated with electricpowered tools. Under certain conditions, even a small amount of electric current can result in fibrillation of the heart and death.

6.2 An electric shock also can cause the user to fall off a ladder or other elevated work surface and be injured due to the fall.

6.3 To protect the user from shock and burns, electric tools must have a three-wire cord with a ground and be plugged into a grounded receptacle, be double insulated, or be powered by a lowvoltage isolation transformer.

6.4 Three-wire cords contain two currentcarrying conductors and a grounding conductor. Any time an adapter is used to accommodate a two-hole receptacle, the adapter wire must be attached to a known ground.

6.5 The third prong must never be removed from the plug.

6.6 Double-insulated tools are available that provide protection against electrical shock without third-wire grounding. On doubleinsulated tools, an internal layer of protective insulation completely isolates the external housing of the tool.

## 7.0 Electric Tools General Practice

7.1 Operate electric tools within their design limitations.

7.2 Use gloves and appropriate safety footwear when using electric tools.

7.3 Store electric tools in a dry place when not in use.

7.4 Do not use electric tools in damp or wet locations unless they are approved for that purpose.

7.5 Keep work areas well lighted when operating electric tools. Ensure that cords from electric tools do not present a tripping hazard.

7.6 In the construction industry, employees who use electric tools must be protected by ground-fault circuit interrupters or an assured equipment-grounding conductor program.

## 8.0 Pneumatic Tools (powered by compressed air)

8.1 There are several dangers associated with the use of pneumatic tools. First and foremost is the danger of getting hit by one of the tool’s attachments or by some kind of fastener the worker is using with the tool.

8.2 Pneumatic tools must be checked to see that the tools are fastened securely to the air hose to prevent them from becoming disconnected.

8.3 A short wire or positive locking device attaching the air hose to the tool must also be used and will serve as an added safeguard.

8.4 If an air hose is more than 1/2-inch (12.7 millimeters) in diameter, a safety excess flow valve must be installed at the source of the air supply to reduce pressure in case of hose failure.

8.5 In general, the same precautions should be taken with an air hose that are recommended for electric cords, because the hose is subject to the same kind of damage or accidental striking, and because it also presents tripping hazards.

8.6 When using pneumatic tools, a safety clip or retainer must be installed to prevent attachments such as chisels on a chipping hammer from being ejected during tool operation.

8.7 Pneumatic tools that shoot nails, rivets, staples, or similar fasteners and operate at pressures more than 100 pounds per square inch (6,890 kPa), must be equipped with a special device to keep fasteners from being ejected, unless the muzzle is pressed against the work surface.

8.8 Airless spray guns that atomize paints and fluids at pressures of 1,000 pounds or more per square inch (6,890 kPa) must be equipped with automatic or visible manual safety devices that will prevent pulling the trigger until the safety device is manually released.

## 9.0 Liquid Fuel Tools (operated with gasoline)

9.1 The worker must be careful to handle, transport, and store gas or fuel only in approved flammable liquid containers, according to proper procedures for flammable liquids.

9.2 Before refilling a fuel-powered tool tank, the user must shut down the engine and allow it to cool to prevent accidental ignition of hazardous vapors.

9.3 When a fuel-powered tool is used inside a closed area, effective ventilation and/or proper respirators such as atmosphere-supplying respirators must be utilized to avoid breathing carbon monoxide.

9.4 Noise hazards associated with gasoline engines must be mitigated by proper hearing protection utilization. Ear Plugs, ear muffs or a combination of the two must be used to protect workers from excessive noise levels.

9.5 Fire extinguishers must also be available in the area.

## 10.0 Hydraulic Power Tools (fluid run)

10.1 The fluid used in hydraulic power tools must be an approved fireresistant fluid and must retain its operating characteristics at the most extreme temperatures to which it will be exposed. The exception to fire-resistant fluid involves all hydraulic fluids used for the insulated sections of derrick trucks, aerial lifts, and hydraulic tools that are used on or around energized lines. This hydraulic fluid shall be of the insulating type.

10.2 The manufacturer's recommended safe operating pressure for hoses, valves, pipes, filters, and other fittings must not be exceeded.

10.3 All jacks—including lever and ratchet jacks, screw jacks, and hydraulic jacks—must have a stop indicator, and the stop limit must not be exceeded. Also, the manufacturer's load limit must be permanently marked in a prominent place on the jack, and the load limit must not be exceeded.

10.4 A jack should never be used to support a lifted load. Once the load has been lifted, it must immediately be blocked up. Put a block under the base of the jack when the foundation is not firm, and place a block between the jack cap and load if the cap might slip.

10.5 To set up a jack, make certain of the following:

10.5.1 The base of the jack rests on a firm, level surface;

10.5.2 The jack is correctly centered;

10.5.3 The jack head bears against a level surface; and

10.5.4 The lift force is applied evenly.

10.6 Proper maintenance of jacks is essential for safety. All jacks must be lubricated regularly. In addition, each jack must be inspected according to the following schedule:

10.6.1 For jacks used continuously or intermittently at one site—inspected at least once every 6 months;

10.6.2 For jacks sent out of the shop for special work—inspected when sent out and inspected when returned; and

10.6.3 For jacks subjected to abnormal loads or shock—inspected before use and immediately thereafter.

# S3NA-305-WI1 Chainsaw Safety Card


## 1.0 Objective / Overview

1.1 Available in a variety of types and capacities, chainsaws are one of the most powerful, yet dangerous cutting tools available.

1.2 Working safely with a chain saw begins with training.

1.3 Additional safety measures include proper training, good body mechanics and felling technique, well-maintained equipment, and protective clothing.

## 2.0 Safe Operating Guidelines

2.1 A sharp chainsaw is safer than a dull one.  Keep the saw clean, lubricated, and adjusted. Before starting work inspect and test the chain brake, chain catch, throttle lock, handles and guards, all nuts and bolts, spark arrestor, and muffler and air filter. The chain tension should be properly adjusted and the carburetor tuned.  Never “drop start” the saw.

2.2 A chainsaw is not only dangerous to the operator but to those around him. Keep the saw close to the body. Bend from the knees, not the waist. Improper lifting techniques and poor posture contribute to injuries.

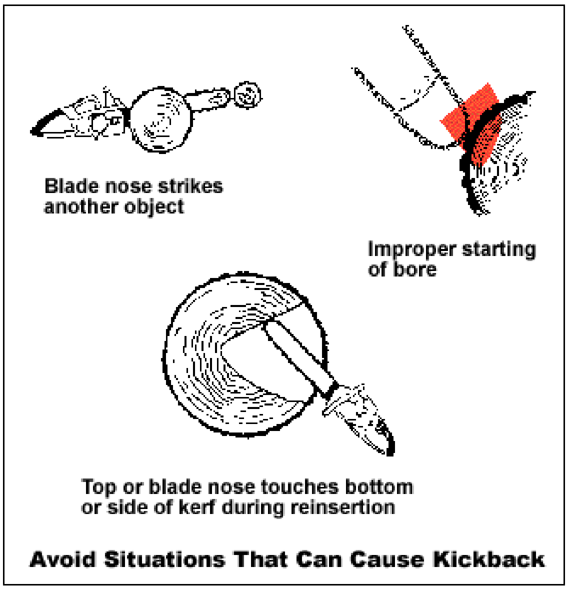
## 3.0 Potential Hazards

3.1 Kickback – Sudden and violent reverse movement of the saw

3.2 Hand / arm vibration syndrome

3.3 Flying / falling debris

3.4 Severe cuts




## 4.0 Training Requirements

4.1 Review of Applicable SOPs

4.2 Demonstrated knowledge on the use of a chainsaw

4.3 Review of manufacturers operating guidelines

## 5.0 Personal Protective Equipment (Level D PPE )

5.1 Debris Shield

5.2 Chainsaw Chaps

5.3 Leather Gloves

5.4 Hearing Protection

## 6.0 Other Safety Tips

6.1 Always avoid standing on the log and making cuts with the saw between your legs; always cut with the saw to the outside of your legs.

6.2 Determine where the tree/limb will fall prior to cutting.  Always ensure that personnel and equipment are not in the path the falling tree/log, and that you have time to move away.  If necessary, flag/or fence off the area to prevent entry.

6.3 Always stand to one side of the limb you are to cut, never straddle it.

6.4 Always keep in mind where the chain will go if it breaks, never position yourself or other people in line with the chain.

6.5 Keep the chain out of the dirt, debris will fly, the teeth will be dulled and the chain life shortened.

# S3NA-305-WI2 Circular Saw Safety Card

## 1.0 Objective / Overview


1.1 Among professionals, the circular saw is probably the most commonly used powered saw and perhaps the most commonly abused. Familiarity should not breed carelessness.

1.2 Safe measures include proper training, good body mechanics and felling technique, well-maintained equipment, and protective equipment.

1.3 The circular saw is used in cutting wood products (i.e., plywood, construction lumber, etc.).

## 2.0 Safe Operating Guidelines

2.1 Use sharp blades. Dull blades cause binding, stalling and possible kickback.

2.2 Use the correct blade for the application and check for proper operation before each cut.

2.3 Check often to ensure that guards return to their normal position quickly. Never defeat the guard to expose the blade.

2.4 Before starting a circular saw, be sure the power cord and extension cords are out of the blade path and are long enough to freely complete the cut. A sudden jerk or pulling on the cord can cause loss of control of the saw and a serious accident.

2.5 For maximum control, hold the saw firmly with both hands after securing the work piece.

2.6 Check frequently to be sure clamps remain secure.

2.7 Avoid cutting small pieces that can't be properly secured and material on which the saw shoe can't properly rest.

2.8 When you start the saw, allow the blade to reach full speed before contacting the work piece.

## 3.0 Potential Hazards


3.1 Kickback – Sudden and violent reverse movement of the saw

3.2 Hearing loss

3.3 Flying debris

3.4 Severe cuts

## 4.0 Training Requirements

4.1 Review of Applicable SOPs.

4.2 Demonstrated knowledge on the use of a circular saw.

4.3 Review and follow manufacturer's operating guidelines.

## 5.0 Personal Protective Equipment (Level D PPE )

5.1 Leather Gloves

5.2 Hearing Protection

## 6.0 Other Safety Tips

6.1 Circular saws are designed for right-hand operation; left-handed operation will demand more care to operate safely.

6.2 Disconnect power supply before adjusting or changing the blade.

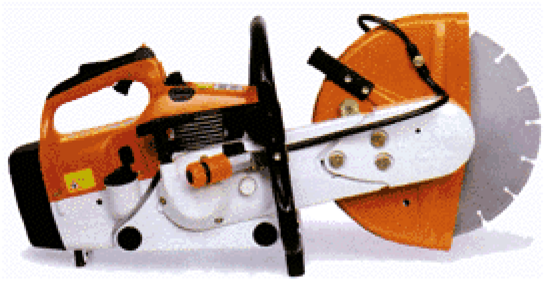
6.3 Do not place hand under or in front of the shoe or guard of the saw when operating.

6.4 Cut at the proper depth (¼ in.) below work surface (see picture).

6.5 Circular saw must be double-insulated or protected by a GFCI.

# S3NA-305-WI3 Cut Off Saw Safety Card

## 1.0 Objective / Overview



1.1 Cut-off saws are high-speed cutting tools and very dangerous to operate. Therefore, it is very important to review the general safety rules, training, PPE and procedures for working with portable cut off saws.

1.2 Cut off saws are used in a variety of activities (i.e. concrete, piping, metal, etc.).

## 2.0 Safe Operating Guidelines

2.1 **Starting** - Start the saw on firm ground or other solid surface in an open area. Never attempt to drop-start the engine. Clear the working area. Avoid operating the saw if the terrain is wet and/or frozen.

2.2 **Handling** - Hold the saw firmly with two hands when the engine is running, *and whenever the blade is rotating until it comes to a complete stop*. Carry the saw with engine stopped, muffler away from your body, while protecting the cutting wheel from striking the ground or other objects.

2.3 **Cutting** - Begin cutting at full throttle and continue at full throttle until the cut is finished. Avoid standing in a direct line with the cutting wheel. Use only downward pressure on the saw, as lateral pressure may cause the blade to break and shatter. Do not change the direction of the cut once started, as this can also cause the blade to break and shatter. Do not use abrasive-type wheels for rough grinding. Do not cut above shoulder height.

2.4 **Maintenance** - Shut off the engine and remove the spark plug wire before adjusting or working on the saw.

2.5 Hearing loss

2.6 Flying debris

2.7 Severe cuts

2.8 Burns from engine

2.9 Fire Hazard from sparks and gasoline

2.10 Hand / arm vibration syndrome

## 3.0 Potential Hazards

3.1 Kickback – Sudden and violent reverse movement of the saw

Never drop-start saw

## 4.0 Training Requirements

4.1 Review of Applicable SOPs

4.2 Demonstrated knowledge on the use of a cut off saw

4.3 Review and follow manufacturers operating guidelines

## 5.0 Personal Protective Equipment (Level D PPE)

5.1 Face shield

5.2 Chainsaw Chaps

5.3 Leather gloves

5.4 Hearing protection: earplugs and/or earmuffs

5.5 Respirator if required (concrete operations)

## 6.0 Other Safety Tips

6.1 Keep flammable and combustible materials away from saw while cutting metal.

6.2 Make sure the fuel cap is properly secured.

6.3 Inspect the abrasive wheel for cracks and chips. If cracked or chip replace wheel before use.

6.4 Ensure guard is positioned properly prior to start-up (*S3NA-411-PR Machine Guarding*).

6.5 Never try to drop-start the engine (see picture).

# S3NA-305-WI4 Hand-Held Grinder Safety Card

## 1.0 Objective / Overview

1.1 Hand held grinders are high-speed electric- or pneumatic-powered grinding tools used to shape or cut metal, and can be dangerous to operate.

1.2 Grinders are used in a variety of activities (i.e., piping installation/repair, metal, restoring, polishing, sharpening, etc.).

## 2.0 Potential Hazards

2.1 Kickback – Sudden and violent reverse movement of the grinder.

2.2 Flying debris.

2.3 Severe cuts.

2.4 Fire Hazard from sparks igniting nearby debris or objects.

2.5 Hand / arm vibration syndrome.

## 3.0 Safe Operating Guidelines

3.1 Basic safety rules can help prevent hazards associated with the use of hand-held grinders:

3.1.1 Never carry the tool by the cord (or the hose for pneumatic tools).

3.1.2 Never yank the cord or the hose to disconnect the tool from the receptacle.

3.1.3 Keep cords and hoses away from heat, oil, and sharp edges.

3.1.4 Denergize tools when not in use, before servicing, and when changing accessories such as blades/bits/cutters.

3.1.5 All observers should be kept at a safe distance from the work area.

3.1.6 Always secure work with clamps or a vise, freeing both hands to operate the tool.

3.1.7 Avoid accidental starting; do not hold a finger on the trigger/switch while carrying a powered tool.

3.1.8 Tools should be maintained with care. They should be kept clean and sharp for the best performance. Follow instructions in the user’s manual for lubricating and care instructions.

3.1.9 Be sure to keep your footing and maintain proper balance.

3.1.10 The proper apparel should be worn. Loose clothing or jewelry can become caught in moving parts.

3.1.11 Inspect the tool before every use. Damaged tools must be removed from use and tagged “DO NOT USE”.

## 4.0 Training Requirements

4.1 Review applicable SOPs.

4.2 Demonstrated knowledge on the use of a hand-held grinder.

4.3 Follow manufacturers operating guidelines, especially for proper grinding wheel attachment.

## 5.0 Personal Protective Equipment

5.1 Leather gloves

5.2 Safety glasses with sideshields

5.3 Hearing protection: earplugs and/or earmuffs

5.4 Other PPE as necessary for the worksite/activity

## 6.0 Other Safety Tips

6.1 Keep flammable and combustible materials away from the grinder.

6.2 Have a fire extinguisher on hand while using grinder.

6.3 Inspect the abrasive wheel for cracks and chips. If cracked or chipped replace wheel before use.

6.4 Ensure safety guard(s) is positioned properly prior to start-up.

6.5 Never clamp a hand held grinder in a vice.

# S3NA-305-WI5 Impact Wrench Safety Card

## 1.0 Objective / Overview

1.1 Impact wrenches are mainly used for tire changing but that does not limit their use. They can be used in all applications when a certain amount of torque is needed to loosen or tighten nuts and bolts.

1.2 The danger comes in to play when employees try to use the wrong sockets with an air wrench. Employees using air wrenches must have a general understanding of how to use them.

## 2.0 Safe Operating Guidelines

2.1 Drain water from air compressor tank and condensation from air lines.

2.2 Disconnect the tool from the air supply before lubricating or changing sockets. Impact wrench sockets and accessories must be used with this tool.

2.3 Do not use hand sockets and accessories. Select the required impact socket.

2.4 Connect tool to air hose of recommended size. The use of a quick connect set makes connecting easier.

2.5 Never use a wire, soft pin, or nail to hold the socket onto the square spindle of the impact wrench.

2.6 If the proper retaining device on the tool is broken, the tool should be repaired.

2.7 On applications where a low or critical level of torque is required, it is recommended that you impact each fastener lightly, and then perform the final tightening with a hand torque wrench.

## 3.0 Potential Hazards

3.1 Flying debris

3.2 Hearing loss

3.3 Cuts

3.4 Hand / arm vibration syndrome

## 4.0 Training Requirements

4.1 Review of Applicable SOPs.

4.2 Demonstrated knowledge on the use of a electric drill.

4.3 Review and follow manufacturers operating guidelines.

## 5.0 Personal Protective Equipment (Level D PPE)

5.1 Leather gloves/anti-vibration gloves

5.2 Hearing protection

## 6.0 Other Safety Tips

6.1 Be sure no one is below when using the tool in high locations.

6.2 The proper fastening torque may differ depending upon the kind or size of the bolt.

6.3 Check the torque with a torque wrench.

# S3NA-305-WI6 Nail Gun Safety Card

## 1.0 Objective / Overview

1.1 Nail guns are useful tools, but must be handled with care, and have been shown to be the cause of unnecessary injuries when the design of the gun places emphasis on speed, rather than safety.

## 2.0 Safe Operating Guidelines

2.1 Watch out for other crewmembers working near you.

2.2 Never let an inexperienced crewmember use a nail gun without supervised training.

2.3 Never use bottled gas as a power source for pneumatic tools.

2.4 Disconnect a nail gun before you service it.

2.5 Hold your hand a good 12 inches back from the ends of studs or joists when you are nailing.

2.6 Keep the gun properly aligned with your work both vertically and horizontally.

2.7 Never nail with the gun pointed toward you or anyone else on the job.

2.8 Never try to nail beyond your reach.


## 3.0 Potential Hazards

3.1 Flying debris/nails

3.2 Imbedded object

3.3 Puncture wounds

## 4.0 Training Requirements

4.1 Review of Applicable SOPs.

4.2 Demonstrated knowledge on the use of a coring machine.

4.3 Review and follow manufacturers operating guidelines.

## 5.0 Personal Protective Equipment (Level D PPE)

5.1 Leather gloves

5.2 Hearing protection

## 6.0 Other Safety Tips

6.1 When you are moving about the work area - keep your finger off the trigger until you are ready to fire. Make sure you have only placed the nose guard against the material you are going to nail together.

6.2 Never rest the gun against any part of your body, or try to climb a ladder with the gun cradled against your body.

6.3 Be aware of what is located behind the nailing surface. Never place hands or other body parts directly behind the nailing surface.

6.4 Use only for intended work.

6.5 Avoid nailing into knots as nail can splinter wood.

6.6 Never disable safety tip on gun.

# S3NA-305-WI7 Pentak Vacuum Safety Card

## 1.0 Objective / Overview

*Worker is using the roto-peen (scabbler) attachment; VAC-PAC collection system shown with 55 gal drum.*

1.1 Pentek's dustless decontamination system removes and packages surface contamination from concrete and steel structures.

1.2 The Pentek integrated suite of manually operated equipment (e.g., squirrel III, corner cutter, roto-peen, and crack chaser) is designed for the safe removal of radioactive materials, lead-based paints, PCBs, pesticides, chemical residues, and other contaminated coatings.

1.3 The Pentek system incorporates a high-performance vacuum and waste packaging unit, the VAC-PAC, in conjunction with pneumatically operated equipment to remove contaminated material. Dust and debris are captured at the cutting tool surface. Supporting equipment required to operate the unit includes a 60 kW generator and an air compressor (minimum 350 $ft^3$ capacity), as well as a drum grappler for drum handling activities.

## 2.0 Safe Operating Guidelines

2.1 Prior to use, a pre-operation inspection must be completed to determine if the unit is in safe working condition.

2.2 The vacuum unit should be placed a minimum of 50 feet away from the work area.

2.3 Once in position to begin work, apply the brake to stabilize the unit. When raising the VAC-PAC to insert/remove a drum, do not place your body or any extremity under the VAC-PAC while it is in the raised position.

2.4 Two workers should be used to maneuver the unit into place.

2.5 A minimum 10 ft clearance will be established around the unit while in operation.

2.6 Workers should be aware of their position in relation to the hoses and cable to minimize tripping hazards.

2.7 A competent person will train each worker in the operation of the unit.

2.8 Maintenance in excess of preventive maintenance activities (e.g., lubrication) will be performed by manufacturer personnel ONLY.

## 3.0 Potential Hazards

3.1 Hazardous noise

3.2 Vibration

3.3 Tripping hazard from cables and hoses

3.4 Hot surfaces (vacuum unit)

3.5 Electrical (high voltage)

3.6 Pinch hazard

3.7 Back strain

3.8 High pressure air

## 4.0 Personal Protective Equipment (Level D ensemble)

4.1 Leather gloves (maintenance)

4.2 Tyvek suit (with hood)

4.3 Vibration gloves (operation)

4.4 Hearing protection (plugs or muffs)

## 5.0 Other Safety Tips

5.1 Always know where the emergency stop is located.

5.2 Operators of a motorized drum grappler must be trained IAW the powered industrial truck standard.

5.3 Review *S3NA-302-PR Electrical, General* prior to refueling the electrical generator and/or compressor.

# S3NA-305-WI8 Power Drill Safety Card

## 1.0 Objective / Overview

1.1 Available in a variety of types and capacities, portable power drills are undoubtedly the most used power tools.

1.2 Because of their handiness and application to a wide range of jobs, drills often receive heavy use. For this reason, you'll need to carefully check your drill's capacity limitations and accessory recommendations.

## 2.0 Safe Operating Guidelines

2.1 Check carefully for loose power cord connections and frays or damage to the cord.

2.2 Replace damaged tool and extension cords immediately.

2.3 Be sure the chuck is tightly secured to the spindle. This is especially important on reversible type drills. Tighten the bit securely as described by the owner / operators manual.

2.4 The chuck key must be removed from the chuck before starting the drill.

2.5 A flying key can be an injury-inflicting missile.

2.6 Check auxiliary handles, if part of the tool. Be sure they are securely installed.

2.7 Always use the auxiliary drill handle when provided. It gives you more control of the drill, especially if stalled conditions occur.

2.8 Grasp the drill firmly by insulated surfaces.

2.9 Always hold or brace the tool securely. Brace against stationary objects for maximum control. If drilling in a clockwise -- forward -- direction, brace the drill to prevent a counter-clockwise reaction.

2.10 Don't force a drill. Apply enough pressure to keep the drill bit cutting smoothly. If the drill slows down, relieve the pressure. Forcing the drill can cause the motor to overheat, damage the bit and reduce operator control.

## 3.0 Potential Hazards

3.1 Electrical shock

3.2 Leaving chuck wrench in tool

3.3 Puncture wounds

3.4 Flying debris

3.5 Severe cuts

3.6 Fire

3.7 Burns (hot bits)

3.8 Sprains/strains (wrist)

## 4.0 Training Requirements

4.1 Review of Applicable SOPs.

4.2 Demonstrated knowledge on the use of a power drill.

4.3 Review and follow manufacturers operating guidelines.

## 5.0 Personal Protective Equipment (Level D PPE)

5.1 Leather Gloves

## 6.0 Other Safety Tips

6.1 Electric drills must be double-insulated or plugged into a GFCI outlet.

6.2 Never carry tool by cord or yank it to disconnect from receptacle.

6.3 Keep cord away from sharp edges.

# S3NA-305-WI9 Pressure Washer Safety Card

## 1.0 Objective / Overview

1.1 High pressure washers can operate up to pressures of 5,000 psi and come in a variety of types ranging from gas operated to electrical. If not used correctly and safely, pressure washers can be dangerous piece of work equipment.

1.2 AECOM only allows trained, authorized personnel to operate the high pressure washers. Along with training, other safety measures include: reviewing the manufacturers instructional booklet, proper maintenance of equipment, and personal protective equipment.

## 2.0 Safe Operating Guidelines

2.1 The gun valve must always be pointed at the work area, NEVER point the gun valve at yourself or another person.

2.2 High pressure washers shall be used to clean or decontaminate equipment, surfaces or structures only.

2.3 High pressure washers WILL NOT be used to clean or decontaminate workers or personal protective equipment while it is being worn.

2.4 Always set the tripper safety lock when the gun valve is not in use.

## 3.0 Training Requirements

3.1 Review of Applicable SOPs

3.2 Demonstrated knowledge on the use of a pressure washer

3.3 Review of manufacturers operating guidelines

## 4.0 Potential Hazards

4.1 Kickback – Sudden and violent reverse movement of the gun

4.2 Flying debris

4.3 Slips and trips on wet surfaces and hoses

4.4 Exhaust fumes/carbon monoxide (CO) in enclosed spaces

4.5 Severe cuts

## 5.0 Personal Protective Equipment (Level D PPE)

5.1 Hard hat with faceshield

5.2 Heavy gloves

5.3 Hearing protection

5.4 PVC (or equivalent) rain suit

## 6.0 Other Safety Tips

6.1 Never fill a pressure washer fuel tank with fuel while the engine is running or if the engine is still hot.

6.2 Non-operators must remain a minimum of 25 feet from the operator.

6.3 High pressure washing equipment should be cleaned often to avoid dirt buildup, especially around the trigger and guard area.

6.4 Always set the trigger safety lock when the gun valve is not in use.

6.5 Relieve the pressure in the system before coupling and uncoupling hoses.

6.6 Visually inspect the full length of high pressure discharge hose and inspect other high pressure fluid-handling components for abrasions or cuts, damage caused by exposure to chemicals and for damage caused by kinks in the hose.

# S3NA-305-WI10 Reciprocating Saw Safety Card

## 1.0 Objective / Overview

1.1 The versatility of the reciprocating saw, in cutting metal, pipe, wood and other materials have made it a widely used tool.

1.2 By design, it is a simple tool to handle. Its demands for safe use, however, are very important.

## 2.0 Safe Operating Guidelines

2.1 Use sharp blades. Dull blades can produce excessive heat, make sawing difficult, result in forcing the tool, and possibly cause an accident.

2.2 Position yourself to maintain full control of the tool, and avoid cutting above shoulder height.

2.3 To minimize blade flexing and provide a smooth cut, use the shortest blade that will do the job.

2.4 The work piece must be clamped securely, and the shoe of the saw held firmly against the work to prevent operator injury and blade breakage.

2.5 Maintain firm contact between the saw's shoe and the material being cut.

2.6 When making a "blind" cut (you can't see behind what is being cut), be sure that hidden electrical wiring, or water pipes are not in the path of the cut.

2.7 If wires are present, they must be disconnected at their power source by a qualified person or avoided, to prevent the possibility of lethal shock or fire.

2.8 Water pipes must be drained and capped.

2.9 Always hold the tool by the insulated grouping surfaces. When making anything other than a through cut, allow the tool to come to a complete stop before removing the blade from the work piece. This prevents breakage of the blade, and possible loss of tool control.

2.10 Different work surfaces demand different blades.

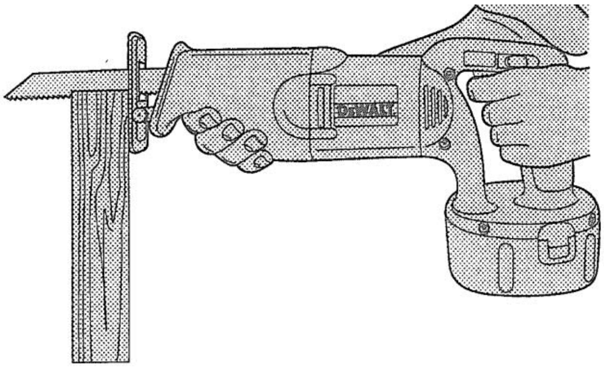
## 3.0 Potential Hazards

3.1 Flying debris

3.2 Hearing loss

3.3 Cuts

3.4 Hand / arm vibration syndrome




The correct way to hold the reciprocating saw while operating.

## 4.0 Training Requirements

4.1 Review of Applicable SOPs

4.2 Demonstrated knowledge on the use of a reciprocating saw

4.3 Review and follow manufacturers operating guidelines

## 5.0 Personal Protective Equipment (Level D PPE)

5.1 Leather Gloves/anti-vibration gloves

5.2 Hearing protection

## 6.0 Other Safety Tips

6.1 Do not operate reciprocating saw in explosive atmospheres.

6.2 Do not overreach. Keep proper footing and balance at all times.

6.3 Do not use tool if switch is not operating correctly.

6.4 Check for misalignment or binding of moving parts, breakage or parts and any other condition that may affect the tool's operation.

6.5 Always use two hands to operate saw (see picture).

# S3NA-305-WI11 Sander Safety Card

## 1.0 Objective / Overview

1.1 Sanders are commonly used at project sites for a variety of tasks.

1.2 Often times the hazards associated with sanders are overlooked; they don't appear threatening because they don't have sharp blades or bits. These misconceptions can be prevented through proper training and PPE selection.

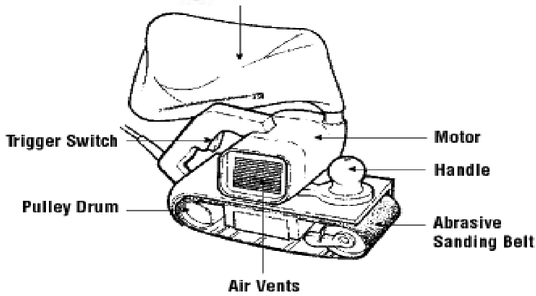
## 2.0 Safe Operating Guidelines

2.1 Make sure the sander is switched "OFF" before connecting the power supply. Disconnect power supply before changing a sanding belt, making adjustments, or emptying dust collector. Inspect sanding belts before using them.

2.2 Replace those belts that are worn or frayed. Install sanding belts that are the same widths as the pulley drum.

2.3 Adjust sanding belt tension to keep the belt running true and at the same speed as pulley drum.

2.4 Secure the sanding belt in the direction shown on the belt and the machine. Keep hands away from the sanding belt.




2.5 Use two hands to operate sanders – one on the trigger and the other on the front handle knob.

2.6 Clean dust from the motor and vents on a regular basis.

2.7 Do not use a sander without an exhaust system or dust collector present that is in good working order.

2.8 Empty the collector when ¼ full.

2.9 Do not exert excessive pressure on a moving sander. The weight of the sander provides adequate pressure for the job.

2.10 Do not work on unsecured stock unless it is heavy enough to stay in place.

2.11 Do not overreach. Always keep proper footing and balance.

2.12 Do not cover air vents of the sander.

2.13 Check often to ensure that guards are in their normal position.

2.14 Before starting a sander, be sure the power cord and extension cords are out of the belt path and are long enough to freely complete the task. The sander must be either double insulated or connected to a GFCI.

## 3.0 Potential Hazards

3.1 Kickback – Sudden and violent reverse of the sander

3.2 Hearing loss

3.3 Flying debris

3.4 Severe abrasive cuts

3.5 Electrocution

3.6 Explosion/fire hazard from the dust

## 4.0 Training Requirements

4.1 Review of Applicable SOPs.

4.2 Review and follow manufacturers operating guidelines.

## 5.0 Personal Protective Equipment (Level D PPE)

5.1 Hearing protection

5.2 Leather gloves

# S3NA-305-WI12 Utility Knife Safety Card

## 1.0 Objective / Overview

1.1 Utility knives serve a variety of purposes at worksites, and can be a useful tool, when used safely and correctly.

1.2 Learning proper positioning and correctly using a utility knife will drastically reduce the potential of cut related injuries.

## 2.0 Safe Operating Guidelines

2.1 Always be sure that knives are sharp and not dull. A dull blade will require more force to cut, increasing the likelihood of slipping.

2.2 Be sure to blade is seated in the frame of the knife correctly, closed, and fastened together properly.

2.3 Always keep body parts away from the cut line, (e.g., fingers), and ensure that the material being cut is on firm ground and not against a body part (e.g. cutting rope against your leg).

2.4 Always pull the knife, never push the knife (the blade may break, and momentum could cause the body to come into contact with broken blade).

2.5 Always retract the blade when not in use.

## 3.0 Potential Hazards

3.1 Lacerations from direct contact with the blade

3.2 Lacerations from blade breaking or shattering

3.3 Ergonomics

## 4.0 Training Requirements

4.1 Review of Applicable SOPs.

4.2 Review of client specific requirements.

4.3 Demonstrated knowledge on the safe use of a utility knives.

4.4 Review and follow manufacturers operating guidelines for specialized or unusual knives.

## 5.0 Personal Protective Equipment (Level D PPE)

5.1 Cut resistant gloves (Kevlar, thick leather, etc.).

## 6.0 Other Safety Tips

6.1 Purchase safety equipped utility knives with guarding or automatically retracting blades.

6.2 Replace dull blades – When knife begins to tear rather than cut, it is a good indicator the blade is dull.

6.3 Always wear a cut resistant glove on your free hand.

6.4 Always use the right tool for the job – NEVER use the blade as a screwdriver or prying tool.

6.5 When using a knife to cut thicker materials, use several passes. Increased force on the blade can cause it to stray from the intended cut path, or break the blade.

6.6 When changing blades, always handle from the non-sharp side. Cover blade with duct tape and dispose.

6.7 Use an alternate tool when possible (scissors, wire cutters, etc.).

Utility Knives with Gaurding

# S3NA-305-WI13 Wood Chipper Safety Card

## 1.0 Objective / Overview

1.1 Wood chippers should be used with extreme caution in order to prevent personal injury, as the wood chipper is open to receive tree branches and other wooden material.

1.2 AECOM only allows trained, authorized personnel to operate the wood chipper.

1.3 Along with training, other safety measures include: reviewing the manufacturers instructional booklet, proper maintenance of equipment, and personal protective equipment.

## 2.0 Safe Operating Guidelines

2.1 The operator must be completely familiar with the controls and proper use of the equipment.

2.2 Workers feeding material into self-feeding wood chippers are at risk of being fed through the chipper if they reach or fall into the infeed hopper or become entangled in braches feeding into the machine.

2.3 Prior to use, make sure all safety devices and controls, such as emergency shut-off devices, are tested and verified to be functioning properly.

2.4 Make sure two workers (buddy system) are in close contact with each other when operating the chipper.

## 3.0 Potential Hazards

3.1 Burns from contact with the hot muffler or engine

3.2 Flying debris

3.3 Noise exposure

3.4 Inhaling exhaust fumes

3.5 Entanglement in limbs and contact with chipper blades

## 4.0 Training Requirements

4.1 Review of Applicable SOPs.

4.2 Demonstrated knowledge on the use of a wood chipper.

4.3 Review of manufacturers operating guidelines.

## 5.0 Personal Protective Equipment (Level D PPE)

5.1 Leather gloves

5.2 Hearing protection

5.3 Debris shield

5.4 Long sleeve shirt (e.g. working near poison ivy, poison oak, etc.)

## 6.0 Other Safety Tips

6.1 Stand to the side of the chipper while inserting limbs into chipper, never stand directly in front.

6.2 Insert trunk portion of tree/limb first. This will prevent the branches from getting entangled with clothing, etc. and pulling you in with the tree/limb.

6.3 Bystanders should be kept at least 25 feet away when in operation.

6.4 Keep the area around the wood chipper free of tripping hazards.

6.5 Never wear loose clothing that may get caught on feed material or moving parts.

6.6 Always set the trigger safety lock when the gun valve is not in use.

6.7 Never fill the fuel tank while the engine is running or if the engine is still hot.

# S3NA-305-WI14 Clearing and Grubbing Equipment Safety Card

In accordance with 29 CFR 1910.266, the following safety precautions will be followed during site clearing and tree felling:

## 1.0 Hand Tools

1.1 All hand tools shall be in safe condition. Tools shall be inspected by the user daily.

1.2 Handles shall be sound, straight and tight-fitting.

1.3 Driven tools shall be dressed to remove any mushrooming.

1.4 Cutting tools shall be kept sharp and properly shaped.

1.5 All clearing activities shall terminate during electrical storms and periods of high winds.

1.6 Dead, broken or rotted limbs or trees (widow makers) shall be felled first.

1.7 Always wear the appropriate Personal Protective Equipment (PPE) when using hand tools, particularly eye and hand protection.

1.8 Use the right tool that is being used for the job to reduce chance of unexpected occurrences. Do not submit or use makeshift tools.

1.9 Defective tools shall not be used. They shall be taken out of service until repaired or replaced.

1.10 Check tools for damage or wear prior to each use to reduce chance of unexpected occurrences.

1.11 Replace cracked or broken handles on files, hammers, screwdrivers, or sledges.

1.12 Replace worn jaws on wrenches, pipe tools, and pliers

1.13 Redress burred or mushroomed heads on striking tools.

1.14 Sharpen cutting tools frequently to reduce chance of unexpected occurrences.

1.15 Store hand tools properly after each use.

1.16 Tools shall be clean and dry to avoid slippage when in use.

1.17 Never leave tools on ladders, scaffolds, or overhead work areas when they are not in use (a high number of injuries occur from objects/tools falling from overhead work areas in construction).

1.18 Always keep tools being used in overhead work areas in containers that will prevent them from falling.

1.19 Carry tools using a heavy belt or apron and hang tools at your sides.

1.20 Never carry tools in your pockets or hanging behind your back.

1.21 Avoid muscle strain and fatigue by doing the following:

- Avoid using hand tools with your wrist bent.
- Choose tools that allow you to keep your wrist straight when using them.
- Always PULL on wrenches and pliers. Never push unless you hold the tool with your palm open.
- Always cut away from yourself when using cutting tools.

1.22 Establish balance and stable footing when using a bar for prying. Pry bars can slip or break without warning.

1.23 Be aware of the presence of other personnel when using any tool, especially picks or axes.

## 2.0 Machete Use

2.1 A machete will only be used for its designated purpose; do not carelessly swing the machete when it is not needed.

2.2 To prevent lacerations, employees will wear Kevlar gloves and Kevlar chain saw chaps.

2.3 Machetes shall not be used when other employees are in the immediate work area.

## 3.0 Use of Weed Whips

3.1 Weed whips may be used to clear vegetation such as grass, light brush, briars and tree seedlings. The L-shaped weed whip cuts grass and weeds but is unstable for use on larger growth; the triangular-frame weed whip cuts briars and woody stems up to a half-inch in diameter. A “Suwannee” sling is a heavy duty weed whip that also has an axe blade. It does the same work as a weed whip, but can also cut through large materials. The heavier weight of this tool allows it to more easily cut off larger material than a weed whip.

3.2 When using weed whips, employees should follow these safety procedures:

3.2.1 Select the correct tool for the types and size of vegetation present across the landfill.

3.2.2 Employees will wear leather gloves when using weed whips.

3.2.3 Weed whips are meant to be swung back and forth with both hands. Avoid using a golf swing. The tool should be swung no higher than an employee’s side.

3.2.4 Strong swings should be made to prevent the blade from bouncing or glancing off springy growth.

3.2.5 Screws hold the serrated double-edge blade in place. These screws can work loose so check them before each use.

3.2.6 At the end of the day, inspect the whips for damage. Clean, sharpen, and oil as necessary and store with a sheath in place.

## 4.0 Chain Saws

4.1 Hand Protection (leather gloves)

4.2 Eye Protection

4.3 Hearing Protection

4.4 Long sleeves and pants; no loose clothing

4.5 Chaps (full protection) or pants with full front protection as well as all around protection below the knee

4.6 As per manufacturer’s instructions

4.7 The chainsaw shall:

4.7.1 Be in safe operating condition;

4.7.2 Have a chain that minimizes the possibility of a kickback; and

4.7.3 Have a device which will effectively stop the chain in the event of a kickback or when the engine is at idle.

4.8 Operate the chainsaw in accordance with manufacturer’s instructions.

4.9 Hold the chainsaw firmly with two hands during operation.

4.10 Hold the chainsaw firmly when starting.

4.11 Have the chain stopped when not actually cutting.

4.12 Be sure that the chain brake is functioning properly and adequately stops the chain.

4.13 Check that the chain is sharp, has the correct tension and is adequately lubricated.

4.14 Start, hold, carry or store and use of the saw as directed by the manufacturer.

4.15 Do not use the chain saw for cutting above shoulder height.

4.16 Add fuel in a well-ventilated area and not while the saw is running or hot.

4.17 Use an approved safety container to contain the fuel used along with a proper spout or funnel for pouring.

4.18 Carry and transport the chain saw with the bar guard in place, the chain bar toward the back and the motor shut off.

4.19 Chain saws shall be inspected daily to assure that all handles and guards are in place and tight, that all controls function properly and that the muffler is operative.

4.20 Start the saw only on the ground or when otherwise firmly supported.

4.21 Clear brush which might interfere with clear footing before starting to cut.

4.22 Shut off the saw when carrying it for a distance greater than from tree to tree or when surface is slippery or heavy with underbrush. The saw shall be at idle speed when carried short distances.

4.23 Do not use the saw to cut directly overhead or a distance at which the operator no longer has a safe grip on the saw. Always use two hands to operate the saw.

4.24 Safety glasses with permanently attached side shields will be worn underneath a steel mesh face shield which will attach to standard hard hats. The brush shield is designed to protect the head and face from debris created by using a chain saw. Employees will wear Kevlar gloves and Kevlar chain saw chaps. Appropriate ear protection shall also be worn.

## 5.0 Felling Trees Manually

5.1 Before cutting begins, survey the work area for dead limbs, the lean of the tree to be cut, wind conditions and the location of other trees.

5.2 Remove lodged trees (tree has not fallen to the ground after being separated from its stump) as soon as possible. Never work under a lodged tree.

5.3 The distance between workers should be maintained at twice the height of the trees being felled.

## 6.0 Chipping Operations

6.1 Access covers and doors shall not be opened until the drum or disk is at a complete stop.

6.2 Infeed and discharge ports shall be designed to prevent employee contact with disc, knives and blower blades.

## 7.0 Cutting Tools

7.1 Wear safety glasses and protective gloves when using cutters.

7.2 Choose the proper cutter for the job. Cutters are designed for a specific type, hardness, and size of material.

7.3 Inspect the tool for proper working condition.

7.4 If tool is designed to have a guard, make sure guards are in place.

7.5 Cut materials straight across - keep the material being cut at right angles to the cutting edges of jaws.

7.6 Warn those in the area to take precautionary measures to avoid possible injury from flying metal pieces.

7.7 Keep cutting tools in good repair.

7.8 Adjust and lubricate cutter and moving parts daily if heavily used.

7.9 Sharpen jaws according to manufacturer’s instructions.

7.10 Do not use a cutting tool until you are trained in its proper and safe use.

7.11 Do not use cushion grip handles for jobs requiring electrically-insulated handles. Cushion grips are for comfort primarily and do not protect against electric shock.

7.12 Do not use cutters which are cracked, broken or loose.

7.13 Do not exceed the recommended capacity of a tool.

7.14 Do not cut diagonally.

7.15 Do not rock cutters from side to side when cutting wire.

7.16 Do not pry or twist with tool when cutting.

7.17 Do not hammer on cutting tools or extend the handle length to achieve greater cutting power.

7.18 Do not expose cutters to excessive heat.

## 8.0 Selection and Use

8.1 Select tools that can be used without bending the wrist. Hand tools should allow the operator to grasp, hold, and use the tool with the wrist held straight.

8.2 Select the tool with the workplace layout and job design in mind. Sometimes a tool is correct for one operation and incorrect for another.

8.3 Use the right tool for the job. Confirm it is the right size and has sufficient power to do the job safely. When there is a choice, select a tool of a low weight.

8.4 Select low-vibrating tools, or choose tools with vibration-absorbing handles, like those covered with cork, rubber, plastic or plastic bonded to steel, to reduce hand-arm vibration.

8.5 Choose hand tools that have the center of gravity within or close to the handle.

8.6 Select tools with rounded and smooth handles that you can grip easily.

8.7 If they are available, choose hand tools with double handles to permit easier holding and better manipulation of the tool.

8.8 Select tools with a trigger strip, rather than a trigger button. This strip will allow you to exert more force over a greater area of the hand that, in turn, will reduce muscle fatigue.

8.9 Confirm that the trigger works easily to reduce the effort needed to operate it.

8.10 Confirm that your tool is well maintained and in good repair.

8.11 Frequently used tools that weigh more than 1 pound should be counter-balanced.

8.12 Hold the tool close to the body. Do not overreach.

8.13 Keep good balance and proper footing at all times. This will help operators to control the tool better, especially in response to unexpected situations.

8.14 Rest your hands by putting the tool down when you are not using it.

8.15 Reduce power to the lowest setting that can complete the job safely. This action reduces tool vibration at the source.

8.16 Confirm that cutting tools, drill bits, etc., are kept sharp, clean, and well maintained.

8.17 Do not wear gloves, loose clothing or jewelry while using revolving power tools. Tie back long hair or wear appropriate hair protection to prevent hair from getting caught in moving parts of equipment (manufacturer’s operating manual for recommended PPE and/or safety issues/concerns).

8.18 Do not use a tool unless you have been trained to use it safely and know its limitations and hazards.

## 9.0 Storage and Handling

9.1 All tools shall be stored in a manner to prevent damage and injury. Store tools in a dry, secure location when they are not being used.

9.2 Tools shall be properly put away after each use.

9.3 Sharp or pointed tools shall be handled only if the sharp/pointed edge is covered, carried in a tool box or other device designed for that purpose, or the sharp/pointed edge is pointed downward, away from the body.

# S3NA-305-WI15 Pneumatic Tools Safety Card

## 1.0 General Requirements

1.1 Wear safety glasses.

1.2 Ensure that the compressed air supplied to the tool is clean and dry. Dust, moisture, and corrosive fumes can damage a tool. An in-line regulator filter and lubricator increases tool life.

1.3 Keep tools clean and lubricated, and maintain them according to the manufacturers' instructions.

1.4 Use only the attachments that the manufacturer recommends for the tools you are using.

1.5 Be careful to prevent hands, feet, or body from injury in case the machine slips or the tool breaks.

1.6 Reduce physical fatigue by supporting heavy tools with a counter-balance wherever possible.

1.7 Use the proper hose and fittings of the correct diameter.

1.8 Use hoses specifically designed to resist abrasion, cutting, crushing and failure from continuous flexing.

1.9 Choose air-supply hoses that have a minimum working pressure rating of 150 psig or 150% of the maximum pressure produced in the system, whichever is higher.

1.10 Check hoses regularly for cuts, bulges and abrasions. Tag and replace, if defective.

1.11 Blow out the air line before connecting a tool. Hold hose firmly and blow away from yourself and others.

1.12 Make sure that hose connections fit properly and are equipped with a mechanical means of securing the connection (e.g., chain, wire, or positive locking device).

1.13 Install quick disconnects of a pressure-release type rather than a disengagement type. Attach the male end of the connector to the tool, NOT the hose.

1.14 Do not operate the tool at a pressure above the manufacturer's rating.

1.15 Turn off the air pressure to the hose when not in use or when changing power tools.

1.16 Do not carry a pneumatic tool by its hose.

1.17 Avoid creating trip hazards caused by hoses laid across walkways or curled underfoot.

1.18 Do not use compressed air to blow debris or to clean dirt from clothes.

## 2.0 Pneumatic Nailing and Stapling Tools

2.1 Permit only experienced and trained persons to operate pneumatic nailing and stapling tools.

2.2 Wear safety glasses or face a shield and, where necessary, use hearing protection.

2.3 Inspect a tool before connecting it to air supply:

2.3.1 Check tool safety mechanisms if applicable.

2.3.2 Tighten securely all screws and cylinder caps.

2.4 Check correct air supply and pressure before connecting a tool.

2.5 Check that the tool is correctly and securely connected to the air supply hose and that it is in good working order, with the safety mechanism operative, before using.

2.6 Always handle a tool as if it loaded with fasteners (nails, staples, etc.).

2.7 Equip tools with a work-contacting element that limits the contact area to one that is as small as practical.

2.8 Make sure that the mechanical linkage between the work-contacting element and trigger is enclosed.

2.9 Disconnect a tool from the air supply when the tool is unattended and during cleaning or adjustment. Before clearing a blockage, be sure that depressing the trigger exhausts all air from the tool.

2.10 Use only fasteners recommended by the manufacturer.

2.11 Permit only properly trained people to carry out tool maintenance.

2.12 Do not depress the trigger unless the nosepiece of tool is directed onto a safe work surface.

2.13 Do not carry a tool with the trigger depressed.

2.14 Do not load a tool with fasteners while the trigger is depressed.

2.15 Do not overreach. Keep proper footing and balance.

# S3NA-305-WI16 Manual Hand Tools Safety Card

## 1.0 Hammers

1.1 Hammers are designed according to the intended purpose. Select a hammer that is comfortable for you and that is the proper size and weight for the job. Misuse can cause the striking face to chip, possibly causing a serious injury.

1.2 Choose a hammer with a striking face diameter approximately ½ inch larger than the face of the tool being struck (e.g., chisels, punches, wedges, etc.).

1.3 Ensure that the head of the hammer is firmly attached to the handle.

1.4 Replace loose, cracked or splintered handles.

1.5 Discard any hammer with mushroomed or chipped face or with cracks in the claw or eye sections.

1.6 Strike a hammer blow squarely with the striking face parallel to the surface being struck. Always avoid glancing blows and over and under strikes. (Hammers with beveled faces are less likely to chip or spall).

1.7 Look behind and above you before swinging the hammer.

1.8 Watch the object you are hitting.

1.9 Hold the hammer with your wrist straight and your hand firmly wrapped around the handle.

1.10 Do not use a hammer with a loose or damaged handle.

1.11 Do not use handles that are rough, cracked, broken, splintered, sharp-edged or loosely attached to the head.

1.12 Do not use any hammer head with dents, cracks, chips, mushrooming, or excessive wear.

1.13 Do not use a hammer for any purpose for which it was not designed or intended.

1.14 Do not use one hammer to strike another hammer, other hard metal objects, stones or concrete.

1.15 Do not redress, grind, weld or reheat-treat a hammer head.

1.16 Do not strike with the side or cheek of the hammer.

1.17 Inspect pipe wrenches periodically for worn or unsafe parts and replace them (e.g., check for worn threads on the adjustment ring and movable jaw).

1.18 Keep pipe wrench teeth clean and sharp.

1.19 Face a pipe wrench forward. Turn wrench so pressure is against heel jaw.

1.20 Pull, rather than push on the pipe wrench handle. Maintain a proper stance with feet firmly placed to hold your balance.

1.21 Do not use a pipe wrench as a hammer, or strike a pipe wrench with a hammer.

1.22 Do not use pipe wrenches on nuts and bolts.

1.23 Do not use a pipe extender for extra leverage. Get a larger pipe wrench.

1.24 Replace pipe cutter wheels which are nicked or otherwise damaged.

1.25 Use a 3- or 4-wheeled cutter, if there is not enough space to swing the single wheel pipe cutter completely around the pipe.

1.26 Choose a cutting wheel suitable for cutting the type of pipe material required:

1.26.1 Thin wheel for cutting ordinary steel pipe.

1.26.2 Stout wheel for cutting cast iron.

1.26.3 Other wheels for cutting stainless steel, plastic and other materials.

1.27 Select the proper hole diameter and correct tap size to tap a hole. The hole should be sized so that the thread cut by the tap will be about 75% as deep as the thread on the tap.

1.28 Use a proper tap wrench (with a “T” handle) for turning a tap.

1.29 Use lubricant or machine cutting fluid with metals other than cast iron.

1.30 Do not permit chips to clog flutes (groves in the tap that allow metal chips to escape from the hole). The chips may prevent the tap from turning – this may result in the tap breaking if you continue to apply pressure.

1.31 Do not use a conventional adjustable wrench for turning a tap – it will cause uneven pressure on the tap that may cause it to break.

1.32 Do not attempt to thread hardened steel. This can chip or damage the die.

1.33 Do not thread any rod or other cylindrical object that is larger in diameter than the major diameter of the die thread.

1.34 Do not use a spiral reamer on a rotating pipe. The reamer may snag and cause serious injury.

## 2.0 Pliers and Wire Cutters

2.1 Pliers are made in various shapes and sizes and for many uses. Use the correct pliers or wire cutters for the job.

2.2 Choose pliers or wire cutters that have a grip span of 2½ – 3½ inches to prevent your palm or fingers from being pinched when the tools are closed.

2.3 Use adjustable pliers that allow you to grip the work piece firmly while maintaining a comfortable handgrip (i.e., hand grasp is not too wide).

2.4 Use tools only if they are in good condition.

2.5 Make sure that the cutting edges are sharp. Dull and worn-down cutting edges require many times more force for cutting.

2.6 Make sure that the toothed jaws are clean and sharp. Greasy or worn-down jaws can result in compromised safety. Such tools also require increased force to hold the work piece which, in turn, increases the risk of muscular fatigue and repetitive strain injuries.

2.7 Oil pliers and wire cutters regularly. A drop of oil on the hinge will make the tools easier to use.

2.8 Pull on the pliers; do not push away from you when applying pressure. If the tool slips unexpectedly, you may lose your balance or injure your hand.

2.9 Cut at right angles. Never rock the cutting tool from side to side or bend wire back and forth against the cutting edges.

2.10 Do not cut hardened wire unless the pliers or wire cutters are specifically manufactured for this purpose.

2.11 Do not expose pliers or wire cutters to excessive heat.

2.12 Do not bend stiff wire with light pliers. Needle-nose pliers can be damaged by using the tips to bend large wire. Use a sturdier tool.

2.13 Do not use pliers as a hammer.

2.14 Do not hammer on pliers or wire cutters to cut wires or bolts.

2.15 Do not extend the length of handles to gain greater leverage. Use a larger pair of pliers for gripping or a bolt cutter for cutting.

2.16 Do not use cushion grip handles for jobs requiring tools with electrically-insulated handles. Cushion grips are for comfort primarily and do not protect against electric shock.

2.17 Do not use pliers on nuts and bolts; use a wrench.

## 3.0 Screwdrivers

3.1 Screwdrivers are made in various shapes and sizes and for many uses. Use the correct screwdriver for the job.

3.2 Choose contoured handles that fit the shank tightly, with a flange to keep the hand from slipping off the tool.

3.3 Use a slot screwdriver with a blade tip width that is the same as the width of the slotted screw head.

3.4 For cross-head screws, use the correct size and type of screwdriver; a Phillips screwdriver may slip out of a screw head designed for use with the slightly flatter-tipped Pozi-driv screwdriver.

3.5 Use a vise or clamp to hold the stock if the piece is small or moves easily.

3.6 Keep the screwdriver handle clean. A greasy handle could cause an injury or damage from unexpected slippage.

3.7 If work must be carried out on “live” electrical equipment, use screwdrivers that have insulated handles designed for electrical work and a non-conducting shaft. Remember, most plastic handles are designed for grip and comfort.

3.8 Use non-magnetic tools when working near strong magnets (e.g., in some laboratories).

3.9 Use a screw-holding screwdriver (with screw-holding clips or magnetic blades) to get screws started in awkward, hard-to-reach areas. Square-tipped screwdrivers (e.g., Robertson) that hold screws with recessed square holes are also useful in such situations.

3.10 Use an offset screwdriver in close quarters where a conventional screwdriver cannot be used.

3.11 Use a screwdriver that incorporates the following features when continuous work is needed:

3.11.1 A pistol grip to provide for a straighter wrist and better leverage.

3.11.2 A "Yankee drill" mechanism (spiral ratchet screwdriver or push screwdriver) which rotates the blade when the tool is pushed forward.

3.11.3 A ratchet device to drive hard-to-move screws efficiently, or use a powered screwdriver.

3.12 File a rounded tip square making sure the edges are straight. A dull or rounded tip can slip out of the slot and cause hand injury or damage to materials.

3.13 Store screwdrivers in a rack or partitioned pouch so that the proper screwdriver can be selected quickly.

3.14 Do not lean or push on a screwdriver with any more force than necessary to keep contact with the screw. A screw properly piloted and fitted will draw itself into the right position when turned. Keep the shank directly over the screw being driven.

3.15 Do not hold the stock in one hand while using the screwdriver with the other. If the screwdriver slips out of the slot you may cut your hand.

3.16 Do not hammer screws that cannot be turned.

3.17 Do not grind the tip to fit another size screw head.

3.18 Do not try to use screwdrivers on screw heads for which they are not designed (e.g., straight blade screwdrivers on Phillips, clutch head, Torx or multi-flutted spline screw heads).

3.19 Do not use defective screwdrivers (e.g., ones with rounded or damaged edges or tips; split or broken handles; or bent shafts).

3.20 Do not use a screwdriver for prying, punching, chiseling, scoring, scraping or stirring paint.

3.21 Do not use pliers on the handle of a screwdriver for extra turning power. A wrench should be used only on the square screwdriver shank designed for that purpose.

3.22 Do not expose a screwdriver blade to excessive heat. Heat can affect the temper of the metal and weaken the tool.

3.23 Do not use a screwdriver to check if an electrical circuit is live. Use a suitable meter or other circuit testing device.

3.24 Do not carry screwdrivers in your pockets.

## 4.0 Snips

4.1 Wear safety glasses and protective gloves when working with snips. Small pieces of metal may go flying in the air and cut edges of metal are sharp.

4.2 Snips are made in various shapes and sizes for various tasks. The handle can be like those on scissors with finger and thumb holes or like plier handles. Models are available for cutting in straight lines and in curves to the left or right.

4.3 Universal snips can cut in both straight and wide curves.

4.4 Straight snips and duckbill snips (flat blade, "perpendicular" to the handle, with pointed tips) are generally designed to cut in straight lines; some duckbill snips are designed for cutting curved lines.

4.5 Hawk's bill snips (with crescent-shaped jaws) are used for cutting tight circles.

4.6 Aviation snips have compound leverage that reduces the effort required for cutting.

4.7 Offset snips have jaws that are set at an angle from the handle.

4.8 Select the right size and type of snips for the job; check the manufacturer's specifications about the intended use of the snips (e.g., type of cut - straight, wide curve, tight curve, right or left, and maximum thickness and kind of metal or other material that can be cut).

4.9 Use only snips that are sharp and in good condition.

4.10 Use snips for cutting soft metal only. Hard or hardened metal should be cut with tools designed for that purpose.

4.11 Use ordinary hand pressure for cutting. If extra force is needed, use a larger tool.

4.12 Cut so that the waste is on the right if you are right-handed or on the left if you are left-handed.

4.13 Avoid springing the blades. This results from trying to cut metal that is too thick or heavy for the snips you are using.

4.14 Keep the nut and the pivot bolt properly adjusted at all times.

4.15 Oil the pivot bolt on the snips occasionally.

4.16 Do not try to cut sharp curves with straight cut snips.

4.17 Do not cut sheet metal thicker than the manufacturer's recommended upper limit (e.g., cuts up to 16-gauge cold, rolled steel or 18-gauge stainless steel). Do not extend the length of handles to gain greater leverage.

4.18 Do not hammer or use your foot to exert extra pressure on the cutting edges.

4.19 Do not use cushion grip handles for tasks requiring insulated handles. They are for comfort primarily and not for protection against electric shocks.

4.20 Do not attempt to re-sharpen snips in a sharpening device designed for scissors, garden tools, or cutlery.

## 5.0 Wood Chisels

5.1 Wear safety glasses.

5.2 Wood chisels are made in various shapes and sizes and for many uses. Use the correct chisel for the job.

5.3 Use the right size of chisel for the job.

5.4 Choose smooth, rectangular handles that have no sharp edges and are attached firmly to the chisel.

5.5 Ensure that the cutting edge is sharp. Dull chisels can be difficult to control and require more effort to do the job.

5.6 Check stock thoroughly for knots, staples, nails, screws, or other foreign objects before chiseling.

5.7 Clamp stock so it cannot move.

5.8 Adjust your stance so that you do not lose your balance if the tool slips.

5.9 Chip or cut away from yourself.

5.10 Keep your hands and body behind the cutting edge.

5.11 Use a wooden or plastic mallet with a large striking face on all chisels. Only heavy-duty or framing chisels are made of a solid or molded handle that can be struck with a steel hammer.

5.12 Make finishing or paring cuts with hand pressure alone.

5.13 Place chisels safely within the plastic protective caps to cover cutting edges when not in use.

5.14 Replace any chisel that is bent or shows dents, cracks, chips, or excessive wear.

5.15 Store chisels in a “storage roll,” a cloth or plastic bag with slots for each chisel, and keep them in a drawer or tray.

5.16 Replace broken or splintered handles.

5.17 Sharpen cutting edges as often as necessary.

5.18 Do not use a wood chisel as a pry or a wedge.

5.19 Do not use a wood chisel on metal.

5.20 Do not use an all-steel chisel with a mushroomed face or a chipped edge. Redress with a file or whetstone.

5.21 Do not use a grinder to redress heat-treated tools. Use a whetstone.

5.22 Do not use a dull chisel.

## 6.0 Wrenches

6.1 Use the correct wrench for the job - pipe wrenches for pipes and plumbing fittings, and general-use wrenches for nuts and bolts.

6.2 Discard any damaged wrenches (e.g., open-ended wrenches with spread jaws or box wrenches with broken or damaged points).

6.3 Select the correct jaw size to avoid slippage.

6.4 Position your body in a way that will prevent you from losing balance and hurting yourself if the wrench slips or something (e.g., a bolt) suddenly breaks.

6.5 Use a box or socket wrench with a straight handle, rather than an off-set handle, when possible.

6.6 Ensure that the jaw of an open-ended wrench is in full contact (fully seated, “flat,” not tilted) with the nut or bolt before applying pressure.

6.7 Face an adjustable wrench “forward,” adjust tightly and turn the wrench so pressure is against the permanent or fixed jaw.

6.8 Ensure that the teeth of a pipe wrench are sharp and free of oil and debris and that the pipe or fitting is clean to prevent unexpected slippage and possible injuries.

6.9 Apply a small amount of pressure to a ratchet wrench initially to ensure that the ratchet wheel (or gear) is engaged with the pawl (a catch fitting in the gear) for the direction you are applying pressure.

6.10 Support the head of the ratchet wrench when socket extensions are used.

6.11 Pull on a wrench using a slow, steady pull; do not use fast, jerky movements.

6.12 Stand aside when work is done with wrenches overhead.

6.13 Make sure adjustable wrenches do not "slide" open during use.

6.14 Keep tools well maintained (cleaned and oiled).

6.15 Clean and place tools and wrenches in a tool box, rack or tool belt after use.

6.16 Do not push on a wrench - losing your balance is more likely if the wrench slips.

6.17 Do not use a wrench that is bent or damaged.

6.18 Do not use worn adjustable wrenches. Inspect the knurl, jaw and pin for wear.

6.19 Do not pull on an adjustable wrench that is loosely adjusted.

6.20 Do not use pipe wrenches on nuts or bolts.

6.21 Do not use pipe wrenches for lifting or bending pipes.

6.22 Do not use a wrench on moving machinery.

6.23 Do not use the wrong tools for the job. For example, never use pliers instead of a wrench or a wrench as a hammer.

6.24 Do not use a makeshift wrench.

6.25 Do not insert a shim in a wrench for better fit.

6.26 Do not strike a wrench (except a "strike face" wrench) with a hammer or similar object to gain more force.

6.27 Do not increase the leverage by adding sleeved additions (e.g., a pipe) to increase tool handle length.

6.28 Do not expose a wrench to excessive heat (like from a blow torch) that could affect the temper of the metal and ruin the tool.

## 7.0 Files/Rasps

7.1 Personnel will not use a file as a pry bar, hammer, screwdriver, or chisel.

7.2 When using a file or a rasp, grasp the handle in one hand and the toe of the file in the other.

7.3 Personnel will not hammer on a file.

## 8.0 Chisels

8.1 Personnel will not use a chisel that has a dull cutting edge.

8.2 Personnel will not use chisels that have "mushroomed" striking heads.

8.3 Hold a chisel by using a tool holder if possible.

8.4 Clamp small work pieces in the vise and chip towards the stationary jaw when working with a chisel.

## 9.0 Vises

9.1 When clamping a long work piece in a vise, support the far end of the work piece by using an adjustable pipe stand, saw horse or box.

9.2 Position the work piece in the vise so that the entire face of the jaw supports the work piece.

9.3 Personnel will not use a vise that has worn or broken jaw inserts, or has cracks or fractures in the body of the vise.

9.4 Personnel will not slip a pipe over the handle of a vise to gain extra leverage.

## 10.0 Clamps

10.1 Personnel will not use the C-clamp for hoisting materials.

10.2 Personnel will not use the C-clamp as a permanent fastening device.

## 11.0 Jacks

11.1 Personnel will not exceed the jack's rated lifting capacity as noted on the label of the jack.

11.2 Clear all tools, equipment and any other obstructions from under the vehicle before lowering the jack.

# S3NA-305-WI17 Small Engine Safety Card

## 1.0 Objective / Overview

1.1 Operate small-engine machines, such as push mowers, weed trimmers, and leaf blowers, in a safe manner.

1.2 You should know how to operate and maintain them in a safe manner.

1.3 If possible, read the operator’s manual. It will contain detailed information on the safe operation and maintenance of the machine. If you do not have a manual, ask if one can be ordered from the manufacturer.

## 2.0 Safe Operating Guidelines

2.1 Do not wear loose or baggy clothing around tools with rotating parts.

2.2 Never run the engine indoors, in poorly ventilated areas, or in a location where the exhaust could be drawn into a building through an opening.

2.3 Never store engine with fuel in fuel tank inside a building with potential sources of ignition such as hot water and space heaters, clothes dryers, electric motors, etc.

2.4 Never remove fuel cap or add fuel when engine is running.

2.5 Never start or operate the engine with the fuel fill cap removed.

2.6 Refuelling: allow engine to cool; fill in well-ventilated area; and do not smoke while re-fuelling.

2.7 Use only properly labelled, CSA approved red gasoline containers to store and dispense fuel.

2.8 Do not pour fuel from engine or siphon fuel by mouth.

2.9 Never leave the engine unattended while it is running.

2.10 Never operate the engine with an unguarded engine shaft.

2.11 Do not modify the engine or tamper with the factory setting of the engine governor.

2.12 Never operate the engine without a muffler guard in place and avoid touching hot areas of the engine.

2.13 Keep all flammable materials away from the muffler and the rest of the engine; do not idle or park the engine in dry grass or ground cover.

2.14 When working on the equipment, avoid accidentelstarts by removing the ignition key, turn off all engine switches, disconnect the battery and disconnect the spark plug, keeping it away from metal part.

2.15 Always wear hearing protection when operating an engine.

## 3.0 Training Requirements

3.1 Review of Applicable SOPs.

3.2 Demonstrated knowledge on the use of small engine equipment.

3.3 Review and follow manufacturers operating guidelines.

## 4.0 Personal Protective Equipment (Level D PPE)

4.1 Always wear safety goggles with shields

4.2 Leather or cotton gloves

4.3 Long pants and long sleeve shirt

4.4 Safety toe work boots

4.5 Hearing protection (earmuffs or earplugs)

## 5.0 Potential Hazards

5.1 Flying debris

5.2 Hearing loss

5.3 Cuts

5.4 Burns

# S3NA-305-WI18 Electric and Battery Hand Tools Safety Card

All electrical tools and equipment must be operated in accordance with the requirements of *S3NA-302-PR Electrical, General.*

## 1.0 Safe Work Practices

1.1 Maintain all electrical tools and cords in good condition and not overloaded.

1.2 Do not wear loose or baggy clothing around tools with rotating parts.

1.3 The switch on the tool must be in the OFF position before connecting it to a power source.

1.4 Verify that the power source is the same voltage and current as indicated on the nameplate of the tool. Using a higher voltage can cause serious injury to the operator as well as burn out the tool.

1.5 The tool must have an approved three-wire cord with a three-prong plug so that it can be used only in a properly grounded three-hole receptacle, unless the tool is double insulated to protect the operator from electrical shock.

1.6 All outdoor receptacles must be protected by means of a ground fault circuit interrupter* (GFCI or GFI) available in portable or fixed models. Do not use any electric power tools outdoors in a receptacle that is not properly protected.

1.7 Report all shocks and/or sparks from electrical tools, no matter how minor. The tool in question should be tagged out and not be used until it has been checked for ground fault.

1.8 Maintain electrical cords and appliances in good working order.

1.8.1 Cords and appliances must be CSA approved.

1.8.2 Never carry an electric tool by the cord or disconnect the plug by pulling or jerking on the cord (can damage, loosen, or separate connections).

1.8.3 Check cords frequently for such damage such as kinks, cuts, and cracked or broken outer jackets (any cord that feels more than comfortably warm to the touch should be checked by an electrician for overloading).

1.9 Store electrical cords in a clean, dry area off the ground to prevent damage to cord.

1.10 Equipment must have proper guards or shields and they must remain in place. If, due to damage or deterioration, the original guard provided on a piece of equipment cannot be put in place, the tool must be removed from service.

1.11 Do not modify, remove, or disable any machine guards.

1.12 Stand to one side when engaging or disengaging an electrical circuit breaker to avoid electrical flash backs.

1.13 It's strongly advisable to use GFCI with all portable electric tools at any time.

1.14 A cord should not be pulled or dragged over nails, hooks, or other sharp objects that may cause cuts in the insulation. In addition, cords should never be placed on radiators, steam pipes, walls, and windows. Particular attention should be placed on connections behind furniture, since files and bookcases may be pushed tightly against electrical outlets, severely bending the cord at the plug.

1.15 Disconnect electrical equipment before cleaning, adjusting, or applying flammable solutions. If a guard is removed to clean or repair parts, replace it before testing the equipment and returning the machine to service.

1.16 Only authorized persons are permitted to activate, de-activate or lockout electrical equipment.

1.17 Where there is or may be a danger to a worker, from the inadvertent operation of electrical equipment, then that equipment must be locked out and tagged prior to commencing work.

1.17.1 Switch off all appropriate devices (MCC, Distribution Panel, Disconnect).

1.17.2 Lock and tag Electrical Supply devices in the “OFF” position.

1.17.3 Test to be sure the equipment cannot be operated at the STOP-START switch.

1.17.4 Test to be sure electrical equipment is de-energized.

1.17.5 After completion of task, remove padlocks and destroy tags.

## 2.0 Inspection

2.1 Inspect tools for any damage prior to each use.

2.2 Ensure that the power tool has the correct guard, shield or other attachment that the manufacturer recommends.

2.3 Ensure that the tools are properly grounded using a 3-prong plug, are double-insulated (and are labeled as such), or are powered by a low-voltage isolation transformer; this will protect users from an electrical shock.

2.4 Check electric tools to ensure that a tool with a 3-prong plug has an approved 3-wire cord and is grounded. The 3-prong plug should be plugged in a properly grounded 3-pole outlet. If an adapter must be used to accommodate a 2-hole receptacle, the adapter wire must be attached to a known, functioning ground. Never remove the third, grounding prong from a plug.

2.5 Check the handle and body casing of the tool for cracks or other damage.

2.6 If the tool has auxiliary or double handles, check to see that they installed securely.

2.7 Inspect cords for defects: check the power cord for cracking, fraying, and other signs of wear or faults in the cord insulation.

2.8 Any tool with a spring-operated trigger switch shall be fully functional.

2.9 Check for damaged switches and ones with faulty trigger locks.

2.10 Inspect the plug for cracks and for missing, loose or faulty prongs.

2.11 If a tool is defective, remove it from service, and tag it clearly “Out of service for repair.” Replace damaged equipment immediately – do not use defective tools “temporarily.” DO NOT ATTEMPT FIELD REPAIRS.

## 3.0 Battery Powered Tools

3.1 Use only the kind of battery that the tool manufacturer specifies for the battery-powered tool that you are using.

3.2 Recharge a battery-powered tool only with a charger that is specifically intended for the battery in that tool.

3.3 Remove the battery from the tool or ensure that the tool is switched off or locked off before changing accessories, making adjustments, or storing the tool.

3.4 Store a battery pack safely so that no metal parts, nails, screws, wrenches and so on can come in contact with the battery terminals; this could result in shorting out the battery and possibly cause sparks, fires or burns.

## 4.0 Using Electric Tools

4.1 Switch off the tools before connecting them to a power supply.

4.2 If a power cord feels more than comfortably warm or if a tool is sparking excessively, have it checked by an electrician or other qualified person.

4.3 Disconnect the power supply before making adjustments or changing accessories.

4.4 Remove any wrenches and adjusting tools before turning on a tool.

4.5 Inspect the cord for fraying or damage before each use. Tag defective tools clearly with an “Out of Service” tag and replace immediately with a tool in good running order.

4.6 During use, keep power cords clear of tools and the path that the tool will take.

4.7 Use clamps, a vice or other devices to hold and support the piece being worked on, when practical to do so. This will allow you to use both hands for better control of the tool and will help prevent injuries if a tool jams or binds in a work piece.

4.8 Use only approved extension cords that have the proper wire size for the length of cord and power requirements of the electric tool that you are using. This will prevent the cord from overheating.

4.9 For outdoor work, use outdoor extension cords marked “W-A” or “W.”

4.10 Suspend power cords over aisles or work areas to eliminate stumbling or tripping hazards.

4.11 Eliminate octopus connections: if more than one receptacle plug is needed, use a power bar or power distribution strip that has an integral power cord and a built-in overcurrent protection.

4.12 Pull the plug not the cord when unplugging a tool. Pulling the cord causes wear and may adversely affect the wiring to the plug - an electrical shock to the operator may result.

4.13 Keep power cords away from heat, water, oil, sharp edges and moving parts. They can damage the insulation and cause a shock.

4.14 Avoid accidental starting by ensuring the tool is turned off before you plug it in. Also do not walk around with a plugged-in tool with your finger touching the switch.

4.15 Do not bypass the ON/OFF switch and operate the tools by connecting and disconnecting the power cord.

4.16 Do not disconnect the power supply of the tool by pulling or jerking the cord from the outlet.

4.17 Do not leave a running tool unattended. Do not leave it until it has been turned off, has stopped running completely, and has been unplugged.

4.18 Do not use electric tools in wet conditions or damp locations unless tool is connected to a ground fault circuit interrupter (GFCI).

4.19 Do not expose electric power tools to rain or wet conditions; wet tools increase the likelihood for getting an electric shock.

4.20 Avoid body contact with grounded surfaces like refrigerators, pipes and radiators when using electric powered tools; this will reduce the likelihood of shock if the operator's body is grounded.

4.21 Do not plug several power cords into one outlet by using single-to-multiple outlet adapters or converters (“cube taps”).

4.22 Do not use light duty power cords.

4.23 Do not connect or splice extension cords together to make a longer connection: the resulting extension cord may not be able to provide sufficient current or power safely.

4.24 Do not carry electrical tools by the power cord.

4.25 Do not tie power cords in knots. Knots can cause short circuits and shocks. Loop the cords or use a twist lock plug.

4.26 Never break off the third prong on a plug: replace broken 3-prong plugs and make sure the third prong is properly grounded.

4.27 Never use extension cords as permanent wiring; use extension cords only as a temporary power supply to an area that does not have a power outlet.

4.28 Do not walk on or allow vehicles or other moving equipment to pass over unprotected power cords. Cords should be put in conduits or protected by placing planks on each side of them.

4.29 Do not brush away sawdust, shavings or turnings while the tool is running. Never use compressed air for cleaning surfaces or removing sawdust, metal turnings, etc.

4.30 Do not operate tools in an area containing explosive vapors or gases.

4.31 Do not clean tools with flammable or toxic solvents.

4.32 Do not surprise or touch anyone who is operating a tool. Startling a tool operator could end up causing an accident or injury.

## 5.0 Belt Sanders

5.1 Wear safety glasses.

5.2 Make sure the sander is switched “OFF” before connecting the power supply.

5.3 Disconnect power supply before changing a sanding belt, making adjustments, or emptying dust collector.

5.4 Inspect sanding belts before using them. Replace those belts that are worn or frayed.

5.5 Install sanding belts that are the same widths as the pulley drum.

5.6 Adjust sanding belt tension to keep the belt running true and at the same speed as pulley drum.

5.7 Secure the sanding belt in the direction shown on the belt and the machine.

5.8 Keep hands away from a sanding belt.

5.9 Use two hands to operate sanders – one on a trigger switch and the other on a front handle knob.

5.10 Keep all cords clear of sanding area during use.

5.11 Clean dust from a motor and vents at regular intervals.

5.12 Do not use a sander without an exhaust system or a dust collector present that is in good working order. Empty the collector when 1/4 full. The dust created when sanding can be a fire and explosion hazard. Proper ventilation is essential.

5.13 Do not exert excessive pressure on a moving sander. The weight of the sander supplies adequate pressure for the job.

5.14 Do not work on unsecured stock unless it is heavy enough to stay in place. Clamp the stock into place or use a “stop block” to prevent movement.

5.15 Do not overreach. Always keep proper footing and balance.

5.16 Do not cover the air vents of the sander.

## 6.0 Drills

6.1 Wear safety glasses.

6.2 Keep drill air vents clear to maintain adequate ventilation.

6.3 Always keep drill bits sharp.

6.4 Keep all cords clear of the cutting area during use. Inspect for frays or damage before each use.

6.5 Disconnect power supply before changing or adjusting bit or attachments.

6.6 Tighten the chuck securely. Remove chuck key before starting drill.

6.7 Secure workpiece being drilled to prevent movement.

6.8 Slow the rate of feed just before breaking through the surface.

6.9 Drill a small “pilot” hole before drilling large holes.

6.10 For small pieces, clamp stock so work will not twist or spin. Do not drill with one hand while holding the material with the other.

6.11 Do not use a bent drill bit.

6.12 Do not exceed the manufacturer’s recommended maximum drilling capacities.

6.13 Do not use a hole saw cutter without the pilot drill.

6.14 Do not use high speed steel (HSS) bits without cooling or using lubrication.

6.15 Do not attempt to free a jammed bit by starting and stopping the drill. Unplug the drill and then remove the bit from the work piece.

6.16 Do not reach under or around stock being drilled.

6.17 Do not overreach. Always keep proper footing and balance.

6.18 Do not raise or lower the drill by its power cord.

## 7.0 Planers

7.1 Wear safety glasses.

7.2 Disconnect the planer from the power supply before making any adjustments to the cutter head or blades.

7.3 Use blades of the same weight and set at the same height.

7.4 Ensure that the blade-locking screws are tight.

7.5 Remove adjusting keys and wrenches before turning on power.

7.6 Support the material (stock) in a comfortable position that will allow the job to be done safely and accurately.

7.7 Check stock thoroughly for staples, nails, screws, or other foreign objects before using a planer.

7.8 Start a cut with the infeed table (front shoe) resting firmly on the stock and with the cutter head slightly behind the edge of the stock.

7.9 Use two hands to operate a planer - one hand on the trigger switch and the other on a front handle.

7.10 Do not put your finger or any object in a deflector to clean out chips while a planer is running.

7.11 Disconnect the power supply when stopping to dump out chips.

7.12 Do not set a planer down until blades have stopped turning.

7.13 Keep all cords clear of cutting area.

## 8.0 Routers

8.1 Wear safety glasses.

8.2 Disconnect the power supply before making any adjustments or changing bits.

8.3 Ensure that the bit is securely mounted in the chuck and the base is tight.

8.4 Put the base of the router on the work, template or guide. Make sure that the bit can rotate freely before switching on the motor.

8.5 Secure stock. Never rely on yourself or a second person to support or hold the material. Sudden torque or kickback from the router can cause damage and injury.

8.6 Before using a router, check stock thoroughly for staples, nails, screws or other foreign objects.

8.7 Keep all cords clear of cutting area.

8.8 Always hold both hands on router handles, until a motor has stopped. Do not set the router down until the exposed router bit has stopped turning.

8.9 Do not overreach. Keep proper footing and balance.

8.10 When inside routing, start the motor with the bit above the stock. When the router reaches full power, lower the bit to two times the required depth.

8.11 When routing outside edges, guide the router counter clockwise around the work.

8.12 When routing bevels, moldings and other edge work, make sure the router bit is in contact with the stock to the left of a starting point and is pointed in the correct cutting direction.

8.13 Feed the router bit into the material at a firm, controlled speed.

8.14 With softwood, you can sometimes move the router as fast as it can go. With hardwood, knotty and twisted wood, or with larger bits, cutting may be very slow.

8.15 The sound of the motor can indicate safe cutting speeds. When the router is fed into the material too slowly, the motor makes a high-pitched whine. When the router is pushed too hard, the motor makes a low growling noise.

8.16 When the type of wood or size of the bit requires going slow, make two or more passes to prevent the router from burning out or kicking back.

8.17 To decide the depth of cut and how many passes to make, test the router on scrap lumber similar to the work.

## 9.0 Circular Saws

9.1 Wear safety glasses and hearing protection.

9.2 Check the retracting lower blade guard to make certain it works freely.

9.3 Ensure that the blade that you have selected is sharp enough to do the job. Sharp blades work better and are safer.

9.4 Check the saw for proper blade rotation.

9.5 Set the depth of the blade, while the saw is unplugged, and lock it at a depth so that the lowest tooth does not extend more than about 1/8 inch beneath the wood.

9.6 Keep all cords clear of cutting area.

9.7 Circular saws are designed for right-hand operation; left-handed operation will demand more care to operate safely.

9.8 Check the retracting lower blade guard frequently to make certain it works freely. It should enclose the teeth as completely as possible, and cover the unused portion of the blade when cutting.

9.9 Check that the retracting lower blade guard has returned to its starting position before laying down the saw.

9.10 Keep upper and retracting lower blade guard clean and free of sawdust.

9.11 Disconnect power supply before adjusting or changing the blade.

9.12 Allow the saw to reach full power before starting to cut.

9.13 Use two hands to operate saws - one on a trigger switch and the other on a front knob handle.

9.14 Keep the motor free from accumulation of dust and chips.

9.15 Select the correct blade for stock being cut and allow it to cut steadily. Do not force it.

9.16 Secure work being cut to avoid movement.

9.17 Do not hold or force the retracting lower guard in the open position.

9.18 Do not place your hand under the shoe or guard of the saw.

9.19 Do not over tighten the blade-locking nut.

9.20 Do not twist the saw to change, cut or check alignment.

9.21 Do not use a saw that vibrates or appears unsafe in any way.

9.22 Do not force the saw during cutting.

9.23 Do not cut materials without first checking for obstructions or other objects such as nails and screws.

9.24 Do not carry the saw with a finger on the trigger switch.

9.25 Do not overreach. Keep proper footing and balance.

9.26 Do not rip stock without using a wedge or guide clamped or nailed to the stock.

## 10.0 Other Saws

10.1 Wear safety glasses.

10.2 Disconnect power supply before changing or adjusting blades.

10.3 Use lubricants when cutting metals.

10.4 Keep all cords clear of cutting area.

10.5 Position the saw beside the material before cutting and avoid entering the cut with a moving blade.

10.6 Make sure guards, if present, are installed and are working properly.

10.7 Remember sabre saws cut on the upstroke.

10.8 Secure and support stock as close as possible to the cutting line to avoid vibration.

10.9 Keeps the base or shoe of the saw in firm contact with the stock being cut.

10.10 Select the correct blade for the material being cut and allow it to cut steadily. Do not force it. Clean and sharp blades operate best.

10.11 Set the blade to go no further than 1/8 to 1/4 inch deeper than the material being cut.

10.12 Do not start cutting until the saw reaches its full power.

10.13 Do not force a saw along or around a curve. Allow the machine to turn with ease.

10.14 Do not insert a blade into or withdraw a blade from a cut or lead hole while the blade is moving.

10.15 Do not put down a saw until the motor has stopped.

10.16 Do not reach under or around the stock being cut.

10.17 Maintain control of the saw always. Avoid cutting above shoulder height.

10.18 **External Cuts**

10.18.1 Make sure that the blade is not in contact with the material or the saw will stall when the motor starts.

10.18.2 Hold the saw firmly down against the material and switch the saw on.

10.18.3 Feed the blade slowly into the stock, maintaining an even forward pressure.

10.19 **Internal Cuts**

10.19.1 Drill a lead hole slightly larger than the saw blade. With the saw switched off, insert the blade in the hole until the shoe rests firmly on the stock.

10.19.2 Do not let the blade touch the stock until the saw has been switched on.

# S3NA-306-PR Highway and Road Work

## 1.0 Purpose and Scope

1.1 To address potential hazards that may occur during highway construction and during work within the right of way of a public or private roadway.

1.2 This procedure applies to all AECOM North America-based employees and operations.

## 2.0 Terms and Definitions

2.1 **Personal Protective Equipment (PPE)**: Safety clothing and equipment worn by workers in traffic areas to provide protection and heightened visibility from physical hazards including moving vehicles and construction equipment.

2.2 **Traffic areas**: Any work area where workers are located within 20 feet of moving traffic, existing or anticipated.

2.3 **Traffic Control Plan**: A written document containing drawings and text that describes the physical controls to be established to isolate workers from moving vehicles.

2.4 **WOF:** Workers on foot.

## 3.0 Attachments

3.1 S3NA-306-FM Equipment Checklist

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Project/Lead Manager or Resident Engineer** is responsible for administering the procedure and for determining the measures and configuration of the temporary traffic control zone in accordance with specifications for workers, motorists, and pedestrians and the protection of AECOM employees within the contract. The Lead Manager will also see that employees assigned to work in traffic areas are trained in the use of traffic control systems and PPE.

4.1.2 **Site Safety Coordinator** is responsible to the lead manager for the implementation of safety and the internal traffic control plan within a highway construction/demolition worksite. The Site Safety Coordinator will

- Be responsible for traffic safety coordination on office projects.
- Be appointed by each office that has any field work involving AECOM staff working in or near traffic. This is not a dedicated role and may be a committee member.
- Receive training in the requirements of the governing transportation authority and the applicable OH&S legislation through training sanctioned by the respective authorities.
- Be involved in conducting hazard assessments, developing the mitigating strategies and Safe Job Procedures, and reviewing their implementation for any project where traffic is identified as a hazard to our team members.

### 4.2 Personal Protective Equipment

4.2.1 High visibility safety vest /apparel

4.2.2 Retro-reflective stripes (for night work)

4.2.3 Protective headwear (hard hat)

4.2.4 Two-way radio or other means of effective communication

4.2.5 Traffic Accommodation equipment, as required by the traffic protection plan:

- A rooftop beacon light for the vehicle, where required
- Pylons, Glo-posts, flags, barricades and/or flagging tape, warning lights, flashing light boards
- Signage
- Flagging equipment, as required:
  - Daytime:
    - Flag person's "Stop and Slow" paddle
    - A blaze orange flag person's vest over white coveralls
    - Safety head protection (hard hat)
    - Drinking water
    - Bug repellent and/or sun screen as conditions warrant
    - Optional radio communication (if required)
  - Night time (additional requirements):
    - A retro-reflective "Stop and Slow" paddle
    - A flashlight fitted with a red signaling baton
    - Flashing yellow beacons set up in advance of the flag person

### 4.3 Restrictions

4.3.1 Applicable legislated requirements governing all aspects of traffic safety, including directing traffic, signage, PPE, traffic control devices in temporary construction, maintenance and utility work zones, will be reviewed in preparation for the site-specific traffic accommodation.

4.3.2 No personnel will be allowed onto the site without first reviewing the project-specific traffic protection plan.

### 4.4 Training

4.4.1 All staff will receive on-site orientation to the hazards and controls.

4.4.2 Only staff with appropriate flag person training will act as a flag person.

### 4.5 Traffic Control Plan

4.5.1 Transportation incidents and workers struck by vehicles or mobile equipment account for many fatal construction work injuries. Workers in highway construction activities including flagging, demolition, surveying, utility, clean-up, emergency responders, and others in areas where traffic exists are exposed to being struck by moving vehicles. Work zones are used to move traffic in an approved direction and are typically identified by signs, cones, barrels, and barriers.

4.5.2 The procedures appropriate for work in traffic areas will vary depending on the work environment. Very simple procedures are needed in an inactive parking lot, and more complex procedures are needed when working in a construction zone on a highway. Each AECOM project team shall prepare a project HASP or SWP addressing traffic controls and worker protection appropriate for the team's project and exposures. Plans shall address the following if applicable:

- Attenuator vehicles
- Closures within a closure
- Communications
- Driving: seatbelts and rollover protection should be used on equipment and vehicles as stated by the manufacturer
- Night operations and work within traffic controls
- PPE
- Sanitation

- Traffic control plans and permits
- Training
- Work zone protections: various styles of concrete, water, sand, collapsible barriers, crash cushions, and truck mounted attenuators are available to limit motorist intrusions into the construction work zone
- Worker: heavy equipment interface

4.5.3 A Traffic Control Plan will be completed for the movement of vehicles in areas where workers are conducting other tasks.

4.5.4 Drivers, workers on foot (WOF), and pedestrians will be able to see and understand the routes they are to follow.

4.5.5 Where there are several projects, coordinated vehicle routes and communication between contractors will reduce vehicular struck-by incidents.

4.5.6 Hazard identification and plan development shall be performed in accordance with this procedure. The plans shall include the identification of the responsibility for personnel and implementation of the safety program under highway construction activities.

4.5.7 Other requirements for supporting activities such as excavations, heavy equipment usage, personal protective equipment, etc. shall be applicable and addressed in accordance with other Standard Operating Procedures.

- A traffic protection plan will be an integral part of the Health and Safety Plan (HASP) or Safe Work Plan (SWP) whenever staff will be exposed to the hazards of vehicular traffic during project work (this may include surveys, drilling and soils inspections, bridge or overpass inspections, inspection of roadway construction projects).
- Work duration, road width, and traffic volume are some of the key considerations to be contemplated when designing a traffic protection plan. The traffic protection plan will address the specific vehicular hazards and describe the measures that will be implemented to protect employees.
- Traffic accommodation plans will be developed in consultation with a qualified supervisor or manager experienced in traffic control. In addition, a supervisor will be designated to oversee the implementation of the protection plan until work is completed.
- OH&S regulations and associated standards or guidebooks provide instruction on the use of traffic control devices in temporary construction, maintenance, and utility work zones for worker and motorist safety and to minimize the disruption of traffic flow.
- Schedule work to avoid periods of heavy traffic.
- Alert traffic of work ahead, by placing signs or cones well ahead of the work area.
- If the work area is being managed under a Traffic Control Plan or Traffic Accommodation Plan, obtain copies of these plans before commencing work.
- Traffic accommodation that is adequate in good weather conditions and daylight may not be adequate under adverse weather conditions and/or hours of darkness. Reassess the accommodation based on conditions.
- Traffic accommodation will be planned to provide safe conditions for the protection and safe passage of motorists, pedestrians, and employees at all work sites. It will include all areas located within the traveled portion of a roadway including shoulders, ditches, and boulevards.

### 4.6 Short-Term Traffic Protection

4.6.1 Always wear the appropriate PPE to maintain your visibility to vehicular traffic. Wear a tear-away fluorescent reflective vest (and retro-reflective stripes on the arms and legs for night work or during periods of limited visibility) at all times.

4.6.2 Pull your vehicles off as far to the right of the traveled portion of the road as possible. Confirm that the shoulder of the highway or street where you will park your vehicle is wide enough to allow for safe access to and egress from the vehicle.

4.6.3 Always park your vehicle at least 30 metres from the flag person station. The vehicle should be positioned between the flag person and the work crew.

4.6.4 Activate the four-way flashers for your vehicle prior to exiting the vehicle.

4.6.5 Plan an escape route prior to exiting the vehicle.

4.6.6 Load and unload materials or equipment from the passenger side of the vehicle.

4.6.7 Avoid turning your back to oncoming traffic.

4.6.8 Be aware of mobile equipment that may be operating in the work area.

4.6.9 Do not enter onto the traveled portion of the road except to cross the road. Road crossings should be made at a 90 degree angle to the direction of the road.

## 4.7 Long-Term Traffic Protection

4.7.1 Traffic accommodation will be provided BEFORE the work starts and will be maintained until the work is completed. This may mean 24 hours a day, 7 days a week.

4.7.2 Generally, for long-term duration work activities that are performed at construction projects, the Constructor for the project is required to develop a traffic protection plan.

4.7.3 If AECOM has assumed the role of Constructor for the project, the traffic protection plan will be developed and implemented prior to the commencement of work activities at the project.

4.7.4 If AECOM is not the Constructor for the project, the traffic protection plan for the project will be developed by our Client or a Constructor designated by the Client.

4.7.5 The traffic protection plan should be reviewed with AECOM employees during orientation to the Project. If the traffic protection plan is not discussed at the project-specific orientation, employees should discuss the issue with the Site Supervisor or Client contact for the Project.

## 4.8 Signage

4.8.1 Standard highway signs for information, speed limits, and work zones will assist drivers in identifying designated traffic paths.

4.8.2 Provide appropriate instructional signage such as: EVACUATION ROUTE; DO NOT ENTER; REDUCED SPEED AHEAD; ROAD CLOSED; and NO OUTLET.

4.8.3 Using standard highway signs for internal construction worksite traffic control will assist workers in recognizing the route they are to use at the construction site.

4.8.4 Traffic Signs

- Signage will be of acceptable standards, in good condition, clean, legible, and suited to the purpose.
- Signage will be secured or weighted.
- Routinely inspect signage for placement, cleanliness, and physical damage.
- Cover road traffic control signage when no activity is present.

## 4.9 Traffic Control Devices

4.9.1 Standard traffic control devices, signals, and message boards will instruct drivers to follow a path away from where work is being done.

4.9.2 The authority in charge will determine the approved traffic control devices such as cones, barrels, barricades, and delineator posts that will be used as part of the traffic control plan.

4.9.3 These standard devices should also be used inside the work zone.

## 4.10 Work Zone Protections

4.10.1 Various styles of concrete, water, sand, collapsible barriers, crash cushions, and truck-mounted attenuators shall be used to limit motorist intrusions into the construction work zone, as appropriate.

4.10.2 All AECOM staff shall be made aware of controls established by the Contractor.

4.10.3 AECOM staff shall wear the required safety equipment at all times including a hard hat, work boots, eye protection, and a high-visibility safety vest as a minimum and shall observe all project rules and requirements.

4.10.4 In the absence of a contractor, when AECOM staff are in the field alone—e.g., investigations, surveys—all appropriate DOT traffic control standards and devices shall be observed and placed in position.

4.10.5 The work zone shall be made safe by its separation from traffic.

### 4.11 Flagging

4.11.1 Flaggers and others providing temporary traffic control will wear high visibility clothing with a background of fluorescent yellow-green or orange-red and white, silver, yellow-green, orange, or yellow retro-reflective material.

4.11.2 In areas of traffic movement, PPE will make the worker visible for at least 1,000 feet so that the worker can be seen from any direction and will make the worker stand out from the background. Check the label or packaging to confirm that the garments are performance Class 2 or 3 (class requirement may be project-specific).

4.11.3 Drivers should be warned in advance with signs that there will be a flagger ahead.

4.11.4 Flaggers should use STOP/SLOW paddles, paddles with lights, or flags (flags should be used only in emergencies.). The STOP sign should be octagonal with a red background and white letters and border. The SLOW sign should be octagonal with an orange background and black letters and a border.

4.11.5 Flag Persons

- A traffic control person (flag person) will stand in a safe position, preferably on the driver's side of the lane under control, be clearly visible, have an unobstructed view of approaching traffic, and be positioned at least 25 m (80 ft) away from the work area unless circumstances or space requirements, such as working at or near an intersection, dictate otherwise.
- Flag persons will be trained and competent and will use appropriate PPE.
- Flag persons will be instructed in traffic control and flagging procedures, will be provided with sufficient breaks, and will not be permitted to work alone for extended periods as per local regulations.
- Flag persons will not get involved in needless conversation and will stay alert at their points of duty until relieved.
- Except for brief flagging operations, or in an emergency, "Flag Person Ahead" signs will be posted in advance of each flag person's station. Such signs will be removed promptly when the flagging operation terminates.

### 4.12 Lighting

4.12.1 Flagger stations should be illuminated. Lighting for workers on foot and equipment operators is to be at least 5 foot-candles or greater.

4.12.2 Where available lighting is not sufficient, flares or chemical lighting should be used.

4.12.3 Glare affecting workers and motorists should be controlled or eliminated.

### 4.13 Training

4.13.1 Flaggers should be trained/certified and will use the signaling methods required by the authority in charge.

4.13.2 WOF, equipment operators, and drivers in internal work zones need to know the routes that construction vehicles will use.

4.13.3 Equipment operators and signal persons need to know the hand signals used on the worksite.

4.13.4 Operators and WOF need to know the visibility limits and the "blind spots" for each vehicle on site.

4.13.5 WOF should wear high visibility safety garments designated as Class 1, 2 or 3.

4.13.6 Workers should be made aware of the ways in which shift work and night work may affect their performance.

4.14 **Driving**

4.14.1 Seatbelts and rollover protection will be used on equipment and vehicles as stated by the manufacturer.

4.14.2 When pulling off to the side of the road, AECOM personnel will park their vehicles at minimum of 20 feet or the width of two traffic lanes from moving traffic.

4.15 **Night Operations and Work Within Traffic Controls**

4.15.1 Night work on roadways should not be done unless absolutely necessary and unless the work area is adequately lit.

4.15.2 Operations with night activities will have a written plan that addresses the safety issues of working at night. The plan will address, but is not limited to:

- Reflectivity
  - All equipment used in the work zone shall have DOT-approved reflective material placed to increase the visibility of the equipment.
  - All reflective surfaces shall be cleaned as required so that the reflectivity of the material is not degraded. Any areas of reflective surface that is damaged or obscured will be replaced.
  - Personnel working at night will have reflective tape on their hardhats and will wear retro-reflective vests at a minimum. The reflective bands on vests will be vertical and horizontal around the entire upper body.
  - Additional measures such as white disposable coveralls, reflective bands, and personal battery-operated strobe lights may be used when practical.
- Illumination
  - Whenever feasible and practical, light plants will be used to illuminate the work area.
  - On mobile operations, additional lighting on equipment may be used to illuminate the work area.
  - All equipment shall, at a minimum, have working strobe or warning beacon lights.
  - All equipment shall have working lights confirmed through daily visuals.
  - All flag persons will be placed in illuminated areas only.
  - All lighting is to be checked after setup to confirm that it is not blinding approaching traffic or other equipment in the work zone.
- Hazard Analysis and Communication
  - Prior to the start of any night operation, a detailed Hazard Analysis will be made addressing the possible hazards of night work. The Hazard Analysis will be reviewed with the crews and updated as needed. At the start of each shift, the Daily Safety Reminder will be used to reaffirm the provisions of the night work requirements as found in the hazard analysis and this policy.
  - The hazard analysis should also provide for:
    - The selection of a competent person responsible for maintaining surveillance on the work area to alert other workers of vehicles encroaching on the work zone.
    - A method to signal workers when vehicles encroach on the work zone.
    - A system to account for workers at all times, which may include a buddy system.
    - Emergency communication or warning signals used by a worker such as a radio, signal horn, or whistle, which will be used to call for help.

4.16 **Attenuator Vehicles**

4.16.1 Although not required, it is good construction practice to place an attenuator truck or pick-up truck (minimum) immediately ahead of workers in a work zone.

4.16.2 The vehicle of choice should be placed to provide the best protection for workers.

4.16.3 The tires should be placed so that when struck the vehicle will turn away from workers.

4.17 **Closures within a Closure**

4.17.1 On occasion, satellite operations may be performed under full freeway traffic closures. For this type of work, special precautions referred to as a "closure within a closure" is to be implemented in accordance with the following:

- Posted speed limits within closures should be set at 15 miles per hour.
- Signs are to be installed approximately 250 feet in advance of and behind the work zone to alert drivers who may approach from either direction of the upcoming work zone.
- The work area is to be completely delineated with Type 1 barricades (candlesticks).
- Any vehicle used for AECOM field work shall be equipped with a functioning rotating beacon placed on the roof of the vehicle.

## 5.0 Records

5.1 Traffic Protection Plans and completed Equipment Checklists will be maintained in project files.

## 6.0 References

6.1 The following standards apply to traffic accommodation equipment.

| Association | Standard |
|---|---|
| **Transportation Association of Canada** | Manual of Uniform Traffic Control Devices for Canada (1998) |

# S3NA-306-FM Equipment Checklist

Name of Contractor:

Location: Project #:

Date: Time: Weather:

Person Conducting Inspection: Title:

*Note: As you conduct your inspection you should be able to answer each question with a **YES**. If the answer to any question is **NO,** this deficiency should be corrected as soon as possible.*

| | YES | NO | Deficiency Corrected? OK | N/A |
|---|---|---|---|---|
| Are accident prevention signs, tags clearly visible? | ☐ | ☐ | ☐ | ☐ |
| Are danger signs used where immediate hazards exist? | ☐ | ☐ | ☐ | ☐ |
| Are caution signs used to warn against potential hazards or to caution against unsafe practices? | ☐ | ☐ | ☐ | ☐ |
| Are exit signs posted at all exit locations? | ☐ | ☐ | ☐ | ☐ |
| Are proper visual warning signs posted prior to (in advance of) the work area? | ☐ | ☐ | ☐ | ☐ |
| Are flaggers provided with signs, signals, and barricades to provide the necessary protection? | ☐ | ☐ | ☐ | ☐ |
| Are flaggers using red lights when signaling during periods of darkness? | ☐ | ☐ | ☐ | ☐ |
| Are flaggers wearing highly visible warning garments? | ☐ | ☐ | ☐ | ☐ |
| Are the flaggers trained in proper flagging procedures? | ☐ | ☐ | ☐ | ☐ |
| Are warning garments worn at night reflectorized? | ☐ | ☐ | ☐ | ☐ |
| Are highly visible flags used by the flaggers at least 18 inches square? | ☐ | ☐ | ☐ | ☐ |
| Are barricades used to totally obstruct the passage of people and vehicles to protect the work area? | ☐ | ☐ | ☐ | ☐ |
| Do barricades meet the requirements set forth in the Manual of Uniform Traffic Control Devices? (MUTCD) | ☐ | ☐ | ☐ | ☐ |

**COMMENTS:**

# S3NA-307-PR Housekeeping, Worksite

## 1.0 Purpose and Scope

1.1 This procedure provides AECOM's work practices as well as personal hygiene and work site sanitation standards for housekeeping.

1.2 Applies to all AECOM North America-based staff and field worksites.

## 2.0 Terms and Definitions

2.1 None

## 3.0 Attachments

3.1 None

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Project Manager (Field Task Manager, Supervisor)** is responsible for the procedure's implementation and the details of addressing housekeeping policy within the construction/demolition worksite.

4.1.2 **SH&E Department** personnel will monitor, assess, and report on project housekeeping when visiting locations.

4.1.3 **Employees** are responsible for reporting any areas of concern to the Site Supervisor for prompt resolution as well as for maintaining worksites that are free from debris, clutter, and slipping or tripping hazards.

### 4.2 Smoking, Eating, and Drinking

4.2.1 Eating and drinking will be permitted in designated areas at AECOM project sites and as specified on client sites. Smoking will be permitted only in areas designated in compliance with applicable local laws, regulations, legislation, and ordinances, by the Field Supervisior and situated in locations that are not in the immediate vicinity of activities associated with work site activities. Additionally, Field Supervisior will designate each smoking area giving primary consideration to those personnel who do not smoke.

4.2.2 Personnel involved in the performance of certain activities will not be permitted to smoke, eat, drink, or use smokeless tobacco, except during breaks (e.g., HAZWOPER-controlled work areas).

4.2.3 Site personnel will first wash hands and face after completing work activities and prior to eating or drinking.

### 4.3 Water Supply

4.3.1 Water supplies will be available for use on site and will comply with the following requirements:

4.3.2 Potable Water: An adequate supply of drinking water will be available for site personnel consumption. Potable water can be provided in the form of approved well or city water, bottled water, or drinking fountains. Where drinking fountains are not available, individual use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified in order to distinguish them from nonpotable water sources.

4.3.3 Nonpotable Water: Nonpotable water will not be used for drinking purposes. Nonpotable water may not be used for hand washing or other personal hygiene activities but may be used for other types of cleaning activities. All containers/supplies of nonpotable water used will be properly identified and labeled as such.

### 4.4 Toilet Facilities

4.4.1 Toilet facilities will be available for site personnel and visitors. Should subcontractor personnel be located on-site for extended periods, it may become necessary to obtain temporary toilet facilities.

Exceptions to this requirement will apply to mobile crews where work activities and locations permit transportation to nearby toilet facilities.

4.4.2 A minimum of one toilet will be provided for every 20 site personnel, with separate toilets maintained for each sex, except where there are less than five total personnel on site. For mobile crews where work activities and locations permit use of nearby toilet facilities (e.g., gas station, or rest stop), on-site facilities are not required.

4.4.3 Washing Facilities

4.4.4 Hand and Face: Site personnel will wash hands and face after completing work activities and prior to breaks, lunch, or completion of workday.

4.4.5 Personal Cleaning Supplies: Cleaning supplies at AECOM project sites will consist of soap, water, and disposable paper towels or items of equal use/application (e.g., anti-bacterial gels, wipes, etc.).

## 4.5 Clothing and Personal Protective Equipment (PPE)

4.5.1 All PPE will be kept clean at all times and maintained in accordance with the manufacturer's, AECOM's. and applicable regulatory, legislative, or provincial requirements.

4.5.2 General Work Areas

4.5.3 At all times work areas will be kept free of dirt and debris that may impact the safety of site personnel and visitors. All trash receptacles will be emptied regularly.

4.5.4 Break Areas and Lunchrooms

Site personnel will observe the following requirements when using break areas and lunchrooms at AECOM project sites:

4.5.5 All food and drink items will be properly stored when not in use.

4.5.6 Food items will not be stored in personal lockers for extended periods in order to prevent the potential for vermin infestation.

4.5.7 Perishable foods will be refrigerated whenever possible.

4.5.8 All waste food containers will be discarded in trash receptacles.

4.5.9 All tables, chairs, counters, sinks, and similar surfaces will be kept clean and free of dirt, waste food, and food containers at all times.

4.5.10 Refrigerators used to store food items will be maintained at 45 degrees Fahrenheit and emptied of all unclaimed food items weekly. Refrigerators used to store food will be labeled as such so that only food and drinks are stored within the refrigerator.

4.5.11 Routine cleaning of refrigerators will also be performed on a regular basis.

## 4.6 Vermin Control

4.6.1 Every enclosed workplace shall be constructed, equipped, and maintained, so far as reasonably practicable, to prevent the entrance or harborage of rodents, insects, and other vermin.

4.6.2 A continuing and effective extermination program shall be instituted where the presence of rodents, insects, or other vermin is detected.

## 4.7 General Housekeeping

4.7.1 All work areas shall be kept clean to the extent that the nature of the work allows.

4.7.2 Every work area shall be maintained, so far as practicable, in a dry condition. Where wet processes are used, drainage shall be maintained and platforms, mats, or other dry standing places shall be provided, where practicable, or appropriate waterproof footgear shall be provided.

4.7.3 Protruding objects or placement of materials on paths or foot traffic areas present a problem with regard to slips, trips, falls, and puncture wounds. Personnel will use a reasonable amount of effort to keep slip, trip, and fall hazards to a minimum.

4.7.4 Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal.

4.7.5 At no time will debris or trash be intermingled with waste PPE or contaminated materials.

4.7.6 Material and equipment must be placed, stacked, or stored in a stable and secure manner. Stacked material or containers must be stabilized as necessary by interlocking, strapping, or other effective means of restraint to protect the safety of workers.

4.7.7 An area in which material may be dropped, dumped, or spilled must be guarded to prevent inadvertent entry by workers or protected by adequate covers and guarding.

4.7.8 Floors, platforms, ramps, stairs, and walkways available for use by workers must be maintained in a state of good repair and kept free of slipping and tripping hazards. If such areas are taken out of service, the employer must take reasonable means for preventing entry or use.

4.7.9 Hazardous areas not intended to be accessible to workers must be secured by locked doors or equivalent means of security and must not be entered unless safe work procedures are developed and followed.

### 4.8 Worksite Offices and Trailers

Worksite offices and trailers will be maintained in accordance with *S3NA-103-PR Housekeeping, Office.*

## 5.0 Records

5.1 None

## 6.0 References

6.1 None

# S3NA-308-PR Manual Lifting, Field

## 1.0 Purpose and Scope

1.1 This procedure provides the requirements for use when performing manual materials handling activities (e.g., lifting/handling of items or materials).

1.2 This procedure applies to all field staff for AECOM North America-based operations.

## 2.0 Terms and Definitions

2.1 **Manual Materials Handling:** Moving or handling things by lifting, lowering, pushing, pulling, carrying, holding, or restraining.

2.2 **Team Handling:** Team handling occurs when more than one person is involved during the lift.

## 3.0 Attachments

3.1 S3NA-308-WI Manual Lifting Safe Work Practices

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 The **Project Manager** will effectively implement the procedure, providing resources as required, and providing direction on proper lifting/handling techniques.

4.1.2 The **Region SH&E Manager** will assist in identifying activities with a high potential for lifting/handling strains/injuries as well as the associated mitigation strategies and training on proper lifting/manual materials handling techniques.

4.1.3 **Employees** are responsible for reviewing and following *S3NA-308-WI Manual Lifting Safe Work Practices*.

### 4.2 Mechanical Controls

4.2.1 Mechanical equipment or assistance such as dollies, carts, come-alongs, or rollers are preferable to be used whenever possible rather than the employee physically moving materials.

4.2.2 Mechanical assistance will be of proper size, have wheels sized for the terrain, and be designed to prevent pinching or undue stress on wrists.

4.2.3 Objects to be moved will be secured to prevent falling and properly balanced to prevent tipping.

### 4.3 Administrative Controls

4.4 When significant, sustained lifting work is required, it is desirable to rotate employees to spread the work load among several people and thereby avoid fatigue.

4.5 Rotation is not simply performing a different job but instead is performing a job that utilizes a completely different muscle group from the ones that have been overexerted.

## 5.0 Records

5.1 None

## 6.0 References

6.1 OSHA Technical Manual: http://www.osha.gov/dts/osta/otm/otm_vii/otm_vii_1.html

6.2 National Safety Council: www.nsc.org

# S3NA-308-WI Manual Lifting Safe Work Practices

## 1.0 General

### 1.1 Before Performing a Lift:

1.1.1 Check to see if mechanical aids such as hoists, lift trucks/dollies, or wheelbarrows are available.

1.1.2 Do not lift if you are not sure that you can handle the load safely.

1.1.3 Confirm that, based on your own physical capabilities and medical limitations, you can lift the load without overexertion. Get help with heavy or awkward loads.

1.1.4 Confirm that the load is “free” to move.

1.1.5 Check that the planned destination of the load is free of obstacles and debris.

1.1.6 Confirm that the path to the planned destination of the load is clear. Grease, oil, water, litter, and debris can cause slips and falls.

1.1.7 Particular handling and lifting techniques are needed for different kinds of loads or materials being handled (for example, compact loads, small bags, large sacks, drums, barrels, cylinders, and sheet materials like metal or glass). See Section 2.0 for additional guidance.

### 1.2 General Tips for Lifting

1.2.1 Prepare for the lift by warming up the muscles.

1.2.2 Make certain that your balance is good. Feet should be shoulder width apart, with one foot beside and the other foot behind the object that is to be lifted.

1.2.3 Bend the knees; do not stoop. Keep the back straight, but not vertical. There is a difference. Tucking in the chin straightens the back.

1.2.4 Grip the load with the palms of your hands and your fingers. The palm grip is much more secure. Tuck in the chin again to make certain your back is straight before starting to lift.

1.2.5 Use your body weight to start the load moving, then lift by pushing up with the legs. This makes full use of the strongest set of muscles.

1.2.6 Keep the arms and elbows close to the body while lifting.

1.2.7 Carry the load close to the body. Do not twist your body while carrying the load. To change direction, shift your foot position and turn your whole body.

1.2.8 Watch where you are going!

1.2.9 To lower the object, bend the knees. Do not stoop. To deposit the load on a bench or shelf, place it on the edge and push it into position. Confirm that your hands and feet are clear when placing the load.

### 1.3 Engineering Controls:

1.3.1 Material handling tasks should be designed to minimize the weight, range of motion, and frequency of the activity.

1.3.2 Alter the task to eliminate the hazardous motion and/or change the position of the object in relation to the employee's body—such as adjusting the height of a pallet or shelf.

1.3.3 Work methods and stations should be designed to minimize the distance between the person and the object being handled.

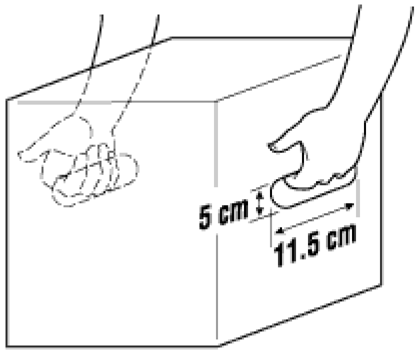
1.3.4 High-strength push-pull requirements are undesirable, but pushing is better than pulling. Material handling equipment should be easy to move, with handles that can be easily grasped in an upright posture.

1.3.5 Workbench or workstation configurations can force people to bend over. Corrections should emphasize adjustments necessary for the employee to remain in a relaxed upright stance or fully supported seated posture. Bending the upper body and spine to reach into a bin or container is highly undesirable. The bins should be elevated, tilted, or equipped with collapsible sides to improve access.

1.3.6 Repetitive or sustained twisting, stretching, or leaning to one side are undesirable. Corrections could include repositioning bins and moving employees closer to parts and conveyors.

1.3.7 Store heavy objects at waist level.

**1.4 Whenever possible, utilize hand holds or other lifting attachments on objects being handled:**



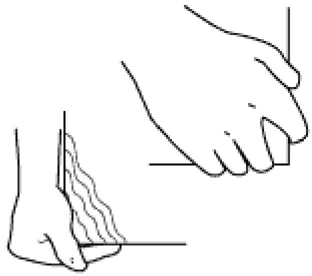

1.4.1 Use the “hook grip” on loads with cut-out handholds.

1.4.2 Curl your fingers around the edge.

1.4.3 Do not hold the load with your fingertips.

1.4.4 Use containers with handles located more than halfway up the side of the container.

1.4.5 Use the “ledge grip” to handle regularly shaped objects without handles.



1.4.6 Use vacuum lifters to handle sheet materials or plates.

1.4.7 Hold the object with hands placed diagonally.

1.4.8 Wear gloves where practical.

## 2.0 Specific Handling Techniques

The following guidance will be used when performing manual materials handling for various types of materials.

### 2.1 Square or Rectangular Objects

2.1.1 Place one foot slightly in front of the other.

2.1.2 Squat as close to the object as possible.

2.1.3 Grasp one of the top corners away from the body and the opposite bottom corner closest to the body.

2.1.4 Tilt the object slightly away from the body, tilt forward at the hips, keep the back straight, and tuck in the chin.

2.1.5 Test to confirm that the object is loose from floor and will lift without snagging.

2.1.6 Straighten the legs, keeping the backbone straight, pull the object into the body, and stand up slowly and evenly without jerking or twisting.

2.1.7 If turning or change of direction is required, turn with feet without twisting the torso and step in the direction of travel.

2.1.8 To set an object down, reverse the sequence, being sure not to trap the bottom hand between the object and the surface on which the object is set.

## 2.2 Cylindrical Objects

2.2.1 When lifting/moving round or cylindrical objects, the objects should be rolled wherever possible. Rolling must be controlled by chute, tagline, or other means of limiting acceleration. Workers must not be positioned downhill from rolled objects. Use of the legs for pushing and tagline control of rolled objects must be stressed.

2.2.2 Cylindrical objects, such as drums that must remain upright, are to be handled manually by slightly tilting the object, using the legs for control, and balancing the object on the bottom edge. The handler then walks besides the object, with the object tilted toward the body, positioning the hands on the top edge away from the body and moving so they do not cross, thus maintaining balance and a steady, controlled, forward motion. Motion must be controlled so that ceasing to walk and moving the hands will stop forward motion.

2.2.3 Use carts or tracks to transport cylinders. Make sure that two people transport a cylinder if carts cannot be used, use lifting straps to improve grip.

- Technique for one person lifting a cylinder onto a platform:
  - Roll the cylinder to within 3 feet of the platform.
  - Position the forward foot around the cylinder, the back foot about 1 foot behind the cylinder.
  - Bend knees slightly.
  - Place one hand on the valve protective cap, the other hand underneath the cylinder about 1 foot from the ground.
  - Tilt the cylinder onto the thigh of the back leg.
  - Balance the cylinder on the thigh by pressing down with the back hand while lifting the cylinder with the forward hand.
  - Extend both knees to initiate forward movement of the cylinder and continue by pushing up and forward with the arms until the cylinder is located on the platform.
  - Climb on the platform.
  - Straddle the cylinder at the valve end.
  - Grasp the valve protective cap of the cylinder with both hands between the thighs.
  - Lean forward and straighten the knees to set the cylinder upright.

## 2.3 Bags and Sacks

2.3.1 The best way to handle a bag depends on its size, weight, and how far it is to be carried. When lifting, remember to

- Straddle the end of the bag.
- Bend the hips and knees.
- Keep the back straight.
- Grasp the bag with both hands under the closer end. Keep elbows inside the thighs.
- Lean forward, straightening the knees to set the bag upright.
- Readjust the straddle position moving feet closer to the bag.
- Readjust the grasp, with one hand clasping the bag against the body and the other under it.
- Stand up by thrusting off with the back leg and continuing in an upward and forward direction.
- Thrust the bag up with the knee while straightening the body.
- Put the bag on the shoulder opposite the knee used to thrust the bag up.
- Stabilize the bag on the shoulder.

- Move off without bending sideways.

2.3.2 Avoid unloading a bag from the shoulder directly to floor level. Use an intermediate platform or get help from a coworker.

- Stand close to the platform.
- Place one foot in front of the platform.
- Bend hips and knees.
- Keep the back straight.
- Ease the bag off the shoulder and put it upright on the platform.
- Pull the bag slightly over the edge of the platform.
- Stand close to the platform with the bag touching the chest.
- Clasp the bag against the body with one hand, the other hand holding bottom of the bag.
- Step back.
- Bend hips and knees, keeping back straight.
- Ease the bag onto the floor.

2.3.3 Bulkier sacks are easier to carry on your back. Lift the sack onto your back from a platform:

- Move the sack to the edge of the platform.
- Put your back against the sack.
- Grasp with both hands on the upper corners of the sack.
- Ease the sack onto the back, bending hips and knees before taking the weight.
- Keep the back straight.
- Stand up and straighten the hips and knees.
- Stabilize the sack.
- Move away without bending sideways.

2.3.4 Two-person handling of a sack:

- Position one person on either side of the sack.
- Squat with one foot balancing behind the sack.
- Keep back straight.
- Grasp with the outer hand on the upper corner, the other hand holding the bottom of the sack.
- On one person's command:
  - Stand up and straighten the hips and knees.
  - Move toward the stack.
  - Put the sack on the stack.

## 2.4 Sheet Materials

2.4.1 When lifting sheet materials:

- Stand close to the pile of sheets in a walking stance.
- Grasp sheet firmly at the midpoint of its long side with the closer hand.
- Pull sheet up and toward the body.
- Change grip using your other hand and put your fingers on top of the sheet.
- Pull sheet up to the vertical position and to the side until one half is off the pile.
- Grasp the lower edge of the sheet with the free hand and support the hand by placing it on your knee.
- Stand up without bending or twisting body.

- Whenever moving sheet materials, be cognizant of wind conditions.

2.4.2 To carry sheets:

- Use drywall carts to carry sheet materials.
- Get help from another person where carts are not available.
- Apply carrying handles for manual carrying.
- Always use gloves and carrying handle for glass and other materials with sharp edges.

2.4.3 Use team lifting and carrying where other solutions are inappropriate.

- Remember that the combined strength of the team is less than the sum of individual strength.
- Select team members of similar height and strength.
- Assign a leader to the team.
- Determine a set of commands to be used such as "lift," "walk," "stop," and "down." Make sure that everyone knows what to do when they hear the command.
- Follow the commands given by the team leader.
- Practice team lifting and carrying together before attempting the task.

## 2.5 Material Storage

2.5.1 When storing materials on site:

- Store materials at a convenient height.
- Leave the lowest shelf unused if necessary.
- Use vertically mobile shelves to avoid bending and overhead reaching.
- Use bin racks for storing small items.
- Store heavy and frequently used materials at waist height.
- Do not store materials at floor level.
- Use hand trucks with elevating devices in storage and loading areas.
- Use trucks with a tilting device to avoid bending.
- Use elevating platforms to avoid overhead reaching.

# S3NA-309-PR Mobile or Heavy Equipment

## 1.0 Purpose and Scope

1.1 Outline the safe working requirements for working with and near mobile equipment and heavy equipment operation.

1.2 This procedure applies to all AECOM North America based employees and operations.

## 2.0 Terms and Definitions

2.1 **Heavy equipment:** All excavating equipment include scrapers, loaders, crawler or wheel tractors, excavators, backhoes, bulldozers, off-highway trucks, graders, agricultural and industrial tractors, and similar equipment.

2.2 **Operator:** Any person who operates the controls while the heavy equipment in is motion or the engine is running.

2.3 **Ground personnel/workers:** Personnel performing work on the ground around heavy equipment (note: operators are considered ground personnel when outside of the equipment cab).

## 3.0 Attachments

3.1 S3NA-309-FM1 Certification of Machinery and Mechanized Equipment

3.2 S3NA-309-FM2 Heavy Machinery Pre-Operation Checklist

3.3 S3NA-309-WI Brokk180 Safety Card

## 4.0 Procedure

4.1 For work under AECOM's control, Project Managers are responsible for ensuring all equipment is in good working order and all equipment operators are qualified on the piece of machinery they are assigned.

4.2 Staff will confirm that all rented equipment arrives in proper working order with the manufacturer's operating manual before acceptance from the supplier.

4.3 The operator of mobile equipment is the only worker permitted to ride the equipment unless the equipment is a worker transportation vehicle.

4.4 A person will not operate mobile equipment unless the person has received adequate instruction and training in the safe use of the equipment, has demonstrated to a qualified supervisor or instructor competency in operating the equipment.

4.5 The operator of mobile equipment will operate the equipment safely, maintain full control of the equipment, and comply with the laws governing the operation of the equipment

### 4.6 Communication

4.6.1 Communication between site supervisors/managers, heavy equipment operators, and other site personnel is a key method of preventing serious injury or death during heavy equipment operations.

4.6.2 The following outline the communication requirements during heavy equipment operations:

- Site supervisors/managers shall confirm that all operators are notified/informed of when, where, and how many ground personnel will be working on site.
- Site supervisors/managers shall inform all ground personnel before changes are made in the locations of designated work areas.
- Prior to work initiating onsite the site supervisor/manager is to confirm all operators and ground personnel are trained on the hand signals that will be used to communicate between operators and ground personnel.
- Personnel working around heavy equipment operations are to maintain eye contact with operators to the greatest extent possible (always face equipment). Never approach equipment from a blind spot or angle.

- All heavy equipment whose backup view can be obstructed shall be equipped with reverse warning devices (i.e., backup alarms) that can be significantly heard over equipment and other background noise. Reverse signaling lights shall be in working order.
- When feasible, two-way radios shall be used to verify the location of nearby ground personnel.
- When an operator cannot adequately survey the working or traveling zone, a guide shall use a standard set of hand signals to provide directions. Flags or other high visibility devices may be used to highlight these signals.

## 4.7 Ground Personnel

4.7.1 Ground clearance around heavy equipment may significantly reduce hazards posed during heavy equipment operations.

4.7.2 The following outline the clearance requirements during heavy equipment operations:

- Ground personnel shall always yield to heavy equipment.
- Ground personnel shall maintain a suitable “buffer” area of clearance from all active heavy equipment.
- A job-specific hazard analysis that identifies any special precautions shall be completed and communicated to all AECOM personnel.
- Site supervisors/managers shall designate areas of heavy equipment operation and confirm that all ground personnel are aware of designated areas. Designated areas shall include boundaries and travel routes for heavy equipment. Travel routes shall be set up to reduce crossing of heavy equipment paths and to keep heavy equipment away from ground personnel.
- When feasible, site supervisors/managers shall set up physical barriers (e.g., caution tape, orange cones, concrete jersey barriers) around designated areas and confirm that unauthorized ground personnel do not enter such areas.
- Operators shall stop work whenever unauthorized personnel or equipment enter the designated area and only resume when the area has been cleared.
- Operators shall only move equipment when aware of the location of all workers and when the travel path is clear.
- Ground personnel shall never stand between two pieces of heavy equipment or other objects (i.e., steel support beams, trees, buildings, etc.).
- Ground personnel shall never stand directly below heavy equipment located on higher ground.
- If working near heavy equipment, ground personnel shall stay out of the travel and swing areas (excavators, all-terrain forklifts, hoists, etc.) of all heavy equipment.
- Ground personnel shall never work near heavy equipment.
- Personnel shall keep all extremities, hair, tools, and loose clothing away from pinch points and other moving parts on heavy equipment.
- Personnel shall not talk on a cell phone while standing or walking on a roadway or other mobile equipment path.

4.7.3 At a minimum, all ground personnel and operators outside of heavy equipment shall wear the following:

- High visibility, reflective (Class 2) safety vest that is visible from all angles and made of fluorescent material and orange, white, or yellow reflective material (confirm that vest is not faded or covered with outer garments, dirt, etc.).
- Retro-reflective striping for arms and legs (night work)
- ANSI-CSA approved hard hat
- ANSI-CSA approved safety glasses with side shields
- ANSI-CSA approved work boots (unless project requirements are more stringent)
- ANSI-CSA approved hearing protection as needed
- Appropriate work clothes (i.e., full length jeans/trousers and a sleeved shirt; no tank, crew tops or other loose clothing permitted).

## 4.8 Prior to work commencing

4.8.1 All mobile equipment will be regularly inspected pre-shift and then regularly as required with the details of the inspection recorded in a log book.

4.8.2 The operator will report defects and conditions affecting the safe operation of the equipment to the supervisor or employer. Any repair or adjustment necessary for the safe operation of the equipment will be made before the equipment is used.

4.8.3 Exposed moving parts on mobile equipment which are a hazard to the operator or to other workers will be guarded and if a part will be exposed for proper function it will be guarded as much as is practicable consistent with the intended function of the component.

4.8.4 An approved Underwriter's Laboratories (UL) 4A40BC fire extinguisher should be present on all mobile equipment.

4.8.5 Inform the operators of the equipment that AECOM employees are in the area and inquire if there are any restricted areas or specific rules or requirements. In some industrial facilities, mobile equipment has the 'right of way'.

4.8.6 Where the operator will not have a full view of the path of travel, a signal person will be used on the ground that has a full view of the load, the operator, and the path.

4.8.7 Mobile equipment in which the operator cannot directly or by mirror or other effective device see immediately behind the machine will have an automatic audible warning device which activates whenever the equipment controls are positioned to move the equipment in reverse, and if practicable, is audible above the ambient noise level.

## 4.9 Operation

4.9.1 The operator of mobile equipment will operate the equipment safely, maintain full control of the equipment, and comply with the laws governing the operation of the equipment.

4.9.2 A supervisor will not knowingly operate or permit a worker to operate mobile equipment which is, or could create, an undue hazard to the health or safety of any person.

4.9.3 The operator of mobile equipment will not leave the controls unattended unless the equipment has been secured against inadvertent movement such as by setting the parking brake, placing the transmission in the manufacturer's specified park position, and by chocking wheels where necessary.

4.9.4 The operator will maintain the cab, floor and deck of mobile equipment free of material, tools or other objects which could create a tripping hazard, interfere with the operation of controls, or be a hazard to the operator or other occupants in the event of an accident.

4.9.5 If mobile equipment has seat belts required by law or manufacturer's specifications, the operator and passengers will use the belts whenever the equipment is in motion, or engaged in an operation which could cause the equipment to become unstable.

4.9.6 When approaching or crossing the intended path of travel of mobile equipment, establish eye contact with the operator of the mobile equipment and confirm that it is safe to proceed.

4.9.7 Have vehicle headlights on at all times when driving in the area.

4.9.8 Park motor vehicles off the haul roads, or away from the work areas.

4.9.9 Do not wear loose clothing where there is a danger of entanglement in rotating equipment.

4.9.10 Do not enter the swing area of machines such as cranes, mobile drill rigs, or excavators, without first making eye contact with the operator, and receiving permission to do so.

4.9.11 Stay out of the blind areas around mobile equipment and never assume that the equipment operators have seen them or are aware of their presence.

4.9.12 Maintain a distance of 60 cm (2 ft.) between the counterweight of swing machines and the nearest obstacle. If this distance cannot be maintained, the area will be barricaded or guarded to prevent access.

4.9.13 Vibration from moving traffic or mobile equipment can cause excavations or spoil piles to become unstable. Be aware of the risk and keep clear.

4.9.14 All heavy equipment shall be operated in a safe manner that will not endanger persons or property.

4.9.15 All heavy equipment shall be operated at safe speeds.

4.9.16 Always move heavy equipment up and down the face of a slope. Never move equipment across the face of a slope.

4.9.17 Slow down and stay as far away as possible while operating near steep slopes, shoulders, ditches, cuts, or excavations.

4.9.18 When feasible, operators shall travel with the “load trailing”, if the load obstructs the forward view of the operator.

4.9.19 Slow down and sound horn when approaching a blind curve or intersection. Flagmen equipped with 2-way radio communications may be required to adequately control traffic.

4.9.20 Operators shall remain in cab while heavy equipment is being loaded.

4.9.21 Equipment shall be shut down prior to and during fueling. Do not smoke or use electrical devices while fueling. Fuel shall not be carried in or on heavy equipment, except in permanent fuel tanks or approved safety cans.

4.9.22 Turn off heavy equipment, place gear in neutral and set parking brake prior to leaving vehicle unattended. Buckets and blades are to be placed on the ground and with hydraulic gears in neutral. Heavy equipment parked on slopes shall have the wheels chocked.

4.9.23 Never jump on to or off of a piece of heavy equipment, always maintain 3-points of contact at a minimum.

4.9.24 Never exit heavy equipment while it is in motion.

4.9.25 Passengers shall only ride in heavy equipment designed for occupancy of passengers.

4.9.26 Never ride on the outside of a piece of heavy equipment (e.g., tailgates, buckets, steps, etc.).

4.9.27 Site vehicles will be parked in a designated parking location away from heavy equipment.

4.9.28 Operators shall never push/pull “stuck” or “broken-down” equipment unless a spotter determines that the area is cleared of all personnel around and underneath the equipment.

4.9.29 If designated for work in contaminated areas/zones, equipment shall be kept in the exclusion zone until work or the shift has been completed. Equipment will be decontaminated within designated decontamination areas.

4.9.30 Equipment left unattended at night adjacent to traveled roadways shall have appropriate lights or reflectors, or barricades equipped with appropriate lights or reflectors, to identify the location of that equipment, and shall not be closer than 6 feet (or the regulatory requirement for the work location) to the active roadway.

4.9.31 Pneumatic-tired earthmoving haulage equipment, with a maximum speed exceeding 15 miles per hour, shall be equipped with fenders on all wheels.

4.9.32 Lift trucks shall have the rated capacity clearly posted on the vehicle, and the ratings are not exceeded.

4.9.33 Steering or spinner knobs shall not be attached to steering wheels.

4.9.34 High lift rider industrial trucks shall be equipped with overhead guards.

4.9.35 When ascending or descending grades in excess of 5%, loaded trucks shall be driven with the load upgrade.

4.9.36 All belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating or moving parts of equipment shall be guarded when exposed to contact by persons or when they otherwise create a hazard.

4.9.37 All hot surfaces of equipment, including exhaust pipes or other lines, shall be guarded or insulated to prevent injury and fire.

4.9.38 All equipment having a charging skip shall be provided with guards on both sides and open end of the skip area to prevent persons from walking under the skip while it is elevated.

4.9.39 Platforms, foot walks, steps, handholds, guardrails, and toeboards shall be designed, constructed, and installed on machinery and equipment to provide safe footing and access ways.

4.9.40 Substantial overhead protection shall be provided for the operators of fork lifts and similar equipment.

### 4.10 Utilities

4.10.1 When contacted by heavy equipment, aboveground and underground utilities may cause severe injuries or death as a result of electrocution, explosion, etc.

4.10.2 The following outline the requirements while performing heavy equipment operations that may lead to contact with aboveground or underground utilities:

- Always be aware of surrounding utilities.
- Confirm all equipment (i.e., dump trailers, loaders, excavators, etc.) is lowered prior to moving underneath of aboveground utilities.
- Confirm utilities are cleared and identified prior to beginning any earthmoving operation. Contact the local utility service providers for clearance prior to performing work. Confirm documentation of the contact is made; date, number; contact name, organization, etc.

### 4.11 Training

4.11.1 The operator or other qualified supervisor will provide all on-site personnel with an orientation to the mobile equipment and its associated hazards and controls.

4.11.2 Only designated, qualified personnel shall operate heavy equipment.

4.11.3 Operators shall have all appropriate local, state, or federal licenses or training to operate a designated piece of heavy equipment.

4.11.4 Operators shall be evaluated through documented experience and routine monitoring of activities unless the equipment is operated by an AECOM operator in which case a practical evaluation is needed. Operators shall be knowledgeable and competent in the operation of a designated piece of heavy equipment.

### 4.12 Inspection and Maintenance

4.12.1 Maintenance records for any service, repair or modification which affects the safe performance of the equipment will be maintained and be reasonably available to the operator and maintenance personnel during work hours.

4.12.2 Maintenance records will be maintained on the site or project for mobile equipment.

4.12.3 Servicing, maintenance and repair of mobile equipment will not be done when the equipment is operating, unless continued operation is essential to the process and a safe means is provided.

4.12.4 All heavy equipment shall have a documented inspection and if necessary, repaired prior to use. Operators shall not operate heavy equipment that has not been cleared for use. All machinery and mechanized equipment will be certified to be in safe operating condition (certification form attached) by a competent individual seven days prior to on-site operation, and is valid for one year.

4.12.5 All heavy equipment shall be inspected at a minimum to the manufacturer’s recommendations prior to each work shift. All defects shall be reported to the site supervisor/manager immediately. Inspection records shall be maintained at the site. If a manufacturer’s or company-specific inspection checklist is not provided, use the Heavy Equipment Pre-Operation Inspection Checklist (attached).

4.12.6 Defective heavy equipment shall be immediately taken out of service until repaired.

### 4.13 Fueling and batteries

4.13.1 A well-ventilated area shall be used for refueling.

4.13.2 Only the type and quality of fuel recommended by the engine manufacturer shall be used.

4.13.3 Fuel tanks shall not be filled while the engine is running. All electrical switches shall be turned off.

4.13.4 No one shall spill fuel on hot surfaces. Any spillage should be cleaned before starting an engine.

4.13.5 Spilled fuel shall be cleaned with cotton rags or cloths; do not use wool or metallic cloth.

4.13.6 Open flames, lighted smoking materials, or sparking equipment shall remain well away from the fueling area.

4.13.7 Heaters in carrier cabs shall be turned off when refueling the carrier or the drill rig.

4.13.8 Portable fuel containers shall not be filled completely to allow expansion of the fuel during temperature changes.

4.13.9 The fuel nozzle shall be kept in contact with the tank being filled to prevent static sparks from igniting the fuel.

4.13.10 Portable fuel containers shall not travel in the vehicle or carrier cab with personnel.

4.13.11 Fuel containers and transfer hoses shall be kept in contact with a metal surface during travel to prevent buildup of a static charge.

4.13.12 Batteries shall be serviced in a ventilated area while wearing appropriate PPE.

4.13.13 When a battery is removed from a vehicle or service unit, the battery shall be disconnected ground post first.

4.13.14 When installing a battery, the battery shall be connected ground post last.

4.13.15 When charging a battery, cell caps shall be loosened prior to charging to permit gas to escape.

4.13.16 When charging a battery, the power source shall be turned off to the battery before either connecting or disconnecting charger loads to the battery posts.

4.13.17 Spilled battery acid shall be immediately flushed off the skin with a continuous supply of water.

4.13.18 Should battery acid get into the eyes, the eyes shall be flushed immediately with copious amounts of water and medical attention sought immediately.

4.13.19 To avoid battery explosions, the cells shall be filled with electrolytes. A flashlight (not an open flame) shall be used to check water electrolyte levels. Avoid creating sparks around battery by shorting across a battery terminal. Lighted smoking materials and flames shall be kept at least 25 feet away from battery-charging stations.

## 5.0 Records

5.1 Inspection records shall be maintained with the equipment.

## 6.0 References

6.1 S3NA-205-PR Equipment Inspections & Maintenance

# S3NA-309-FM1 Certification of Machinery and Mechanized Equipment

## 1.0 General Guidelines

1.1 Subcontractor equipment shall comply with all applicable requirements for motor vehicles and material handling heavy equipment contained in 29 CFR 1926 Subpart O. Heavy equipment includes, but is not limited to, drill rigs, front end loaders, backhoes, trackhoes, bulldozers, forklifts, and similar equipment used for the implementation of the project Statement of Work.

## 2.0 Equipment Safety Inspections

2.1 The following presents general guidelines for certifying equipment is in safe operating condition before activities commence at the site and during site operations. The following guidelines are not meant to be all-inclusive.

2.1.1 All machinery and mechanized equipment will be certified to be in safe operating condition (using the attached form) by a competent individual seven days prior to onsite operation. This certification is valid for one year.

2.1.2 Equipment will be inspected on a daily basis by the owner/operator and daily logs will be maintained. All discrepancies shall be corrected prior to placing the equipment in service.

2.1.3 Inspections shall include, but are not limited to, all hydraulic lines and fittings for wear and damage, all cable systems and pull ropes for damage and proper installation, exhaust systems, brake systems, and drill controls, etc.

2.1.4 Drill rigs and related support equipment and vehicles shall be inspected by the driller in charge on a daily basis. These inspections shall be recorded on the Daily Drill Rig Checklist or on equivalent subcontractor forms.

2.1.5 Exhaustive preventive maintenance shall be conducted for all equipment according to manufacturer recommendations and/or the subcontractor's internal policies, schedules, and equipment SOPs.

2.1.6 Only designated qualified persons shall operate machinery and mechanized equipment.

2.1.7 The contractor shall maintain records of tests and inspections at the site and shall make the records available upon request of the designated authority; the records shall become part of the official project file.

2.1.8 Equipment found to not be in safe operating condition or to have a deficiency that affects the safe operation of the equipment shall immediately be taken out of service and its use shall be prohibited until safe conditions have been corrected.

2.1.9 All equipment shall be kept in the exclusion zone until work or the shift has been completed. Equipment will be decontaminated within designated decontamination areas.

2.1.10 Equipment with an obstructed rear view must have an audible alarm that sounds when equipment is moving in reverse.

TO: AECOM

DATE:

FROM:

Project Name:

Project Location:

1. This form provides certification of machinery and mechanized equipment to be used on the referenced project for the following work:

| | |
|---|---|
| Description of equipment work: | |
| Project site: | |
| Subcontractor providing equipment:<br>Address: | |
| Dates (duration) of equipment work: | |

2. Inspection and certification of machinery and mechanized equipment, as required by AECOM, has been made prior to but within seven calendar days in advance of use on the project site. Recertification will be required for equipment that is used on the project site for more than one year.

| Identification of equipment (make, model, serial no.) | | Date of Certification |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |

3. The above listed equipment has been inspected and tested as indicated above, and is <u>CERTIFIED TO BE IN SAFE OPERATING CONDITION BY THE FOLLOWING COMPETENT INDIVIDUAL</u>:

| | | | |
|---|---|---|---|
| Name | | Title | |
| Company | | | |
| Signature | | Date | |

4. If there are any questions regarding this certification, please contact the following AECOM representative:

# S3NA-309- FM2 Heavy Equipment Pre-Operation Checklist

| **Project Name/Location:** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Number/Name:** | | | | | | | **Make/Model:** | | | | | | | | |
| **Hour meter reading:** | | | | | | | | | | | | | | | |
| **Check the following as appropriate** | **Operator Name/Date** | | | **Operator Name/Date** | | | **Operator Name/Date** | | | **Operator Name/Date** | | | **Operator Name/Date** | | |
| | | | | | | | | | | | | | | | |
| | **SAT** | **UNSAT** | **N/A** | **SAT** | **UNSAT** | **N/A** | **SAT** | **UNSAT** | **N/A** | **SAT** | **UNSAT** | **N/A** | **SAT** | **UNSAT** | **N/A** |
| 1. Operator qualified | | | | | | | | | | | | | | | |
| 2. Overhead guard (ROPS) | | | | | | | | | | | | | | | |
| 3. Horn | | | | | | | | | | | | | | | |
| 4. Lights | | | | | | | | | | | | | | | |
| 5. Parking brake | | | | | | | | | | | | | | | |
| 6. Service brakes | | | | | | | | | | | | | | | |
| 7. Steering | | | | | | | | | | | | | | | |
| 8. Oil level | | | | | | | | | | | | | | | |
| 9. Hydraulic oil level | | | | | | | | | | | | | | | |
| 10. Radiator fluid level | | | | | | | | | | | | | | | |
| 11. Major fluid leaks | | | | | | | | | | | | | | | |
| 12. Windows | | | | | | | | | | | | | | | |
| 13. Backup alarm | | | | | | | | | | | | | | | |
| 14. Tires (visual) | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15. Seat belts | | | | | | | | | | | | | | | |
| 16. Fuel leaks | | | | | | | | | | | | | | | |
| 17. Fire extinguisher | | | | | | | | | | | | | | | |
| 18. Fuel lines secure | | | | | | | | | | | | | | | |
| 19. Electrical lines | | | | | | | | | | | | | | | |
| 20. Exhaust components | | | | | | | | | | | | | | | |

**Comments/Remarks:**

# S3NA-309-WI Brokk180 Safety Card


## 1.0 Objective/Overview

The Brokk 180 is an electric-powered hydraulic device used for demolishing concrete structures and refractory linings as well as excavating. This machine includes attachments designed exclusively for demolishing work (e.g., grapple, bucket, hydraulic hammer, etc.). By using the remote control unit, an operator can move the machine and attachments in different directions and speeds from afar.

## 2.0 Safe Operating Guidelines

2.1 Prior to use, complete a pre-operation inspection to determine if the unit is in safe working condition.

2.2 Position the unit to safely perform the intended task, then deploy the outriggers to stabilize the unit.

2.3 Confirm that the operator knows what the lifting capacity is; do not exceed the lifting capacity.

2.4 Complete a subsurface utility clearance prior to excavating.

2.5 Establish a minimum 15-foot clearance around the unit.

2.6 Do not allow debris to build-up around the unit. Maintain good housekeeping practices.

2.7 Prior to removing debris from under the boom, stop, disengage the unit, and position the boom so that the attachment is at rest on the ground.

2.8 Personnel operating the unit with the remote control device will be properly trained and certified by a competent person.

2.9 The operator will be able to maintain line of sight visual contact with the unit at all times to assess hazards and site security.

2.10 Maintenance in excess of preventive maintenance activities (e.g., lubrication, replenishing fluids, etc.) will be performed by manufacturer personnel ONLY.

2.11 All operations will comply with the manufacturer's recommended policies.

## 3.0 Potential Hazards

3.1 Flying debris.

3.2 Crush/impact/pinch from extendable boom, tracks, and tipping over.

3.3 Electrocution from subsurface utilities (when excavating).

3.4 Hearing loss.

## 4.0 Training Requirements

4.1 Review of applicable SOPs.

4.2 Complete knowledge and understanding of remote control functions.

4.3 Review and follow manufacturers' recommended policies and practices**.**

## 5.0 Personal Protective Equipment (Level D ensemble)

5.1 Reflective traffic safety vest.

5.2 Hearing protection (ear plugs and/or ear muffs).

5.3 Leather gloves.

## 6.0 Other Safety Tips

6.1 Never stand under a raised boom.

6.2 Maintain a clearance of 15 feet around the unit while operating.

6.3 Pay close attention to power cords for potential tripping hazard and equipment entanglement.

6.4 Maintain line of sight visual contact with unit at al times (especially when operating from a distance).

# S3NA-313-PR Wildlife, Plants and Insects

## 1.0 Purpose and Scope

1.1 Communicates the requirements and precautions to be taken by AECOM employees to protect against the biological hazards associated with insects, arachnids, snakes, poisonous plants, and other animals referred to herein collectively as “biological hazards”.

1.2 This procedure applies to all AECOM North America (NA) based employees and operations.

## 2.0 Terms and Definitions

2.1 **Field Work**: Field work is defined as any activity conducted at a site that contains brush, overgrown grass, leaf litter, poisonous plants, or is located near mosquito breeding areas and includes work in structures where animals might exist that harbor fleas or ticks or where spiders and mites could be present. Field work includes, but is not limited to, Phase I, Phase II, Operations Monitoring & Maintenance (OM&M), biological surveys, and other work that meets the definition of field work.

2.2 **Poisonous:** Capable of harming or killing by or as if by poison; toxic or venomous.

2.3 **Phase I Environmental Site Assessment:** Investigation of real property to determine the possibility of contamination, based on visual observation and property history, but no physical testing. Under new Environmental Protection Agency regulations that went into effect on November 1, 2006, a Phase I, as it is called for short, will be mandatory for all investors who wish to take advantage of CERCLA defenses that will shield them from liability for future cleanup, should that prove necessary. The new Phase I rules, called “All Appropriate Inquiry” or AAI, also require more investigation than previously mandated. Investors can expect to see dramatic price increases over prior experiences.

2.4 **Phase II Environmental Site Assessment:** Investigation of real property through physical samplings and analyses to determine the nature and extent of contamination and, if indicated, a description of the recommended remediation method.

## 3.0 Attachments

3.1 S3NA-313-FM Tick Test Request Form

3.2 S3NA-313-WI1 Biological Hazard Assessment Decision Flow Chart

3.3 S3NA-313-WI2 Ticks

3.4 S3NA-313-WI3 Poisonous Spider Identification

3.5 S3NA-313-WI4 Mosquito Borne Diseases

3.6 S3NA-313-WI5 Plants of Concern

3.7 S3NA-313-WI6 Wild Parsnip Identification

3.8 S3NA-313-WI7 Configuration Clothing for Protection against ticks and insects

3.9 S3NA-313-WI8 Insect Repellent Active Ingredient Product Information

3.10 S3NA-313-WI9 New York Department of Health Recommendations for Permethrin Application

3.11 S3NA-313-WI10 Bird Droppings Safe Work Practices

3.12 S3NA-313-WI11 Large Carnivores

3.13 S3NA-313-WI12 Bear Safety

3.14 S3NA-313-WI13 Small Mammals

3.15 S3NA-313-WI14 Snakes

3.16 S3NA-313-WI15 Alligators

# 4.0 Procedure

## 4.1 Roles and Responsibilities

### 4.1.1 Project Managers and Supervisors

- **Project Managers** and **Supervisors** responsible for managing field work will work with employees conducting the work to see that a Task Hazard Analysis (THA) for the work to be conducted has been performed prior to the beginning of the field work and that it includes an assessment of potential biological hazards.
- If biological hazards are identified as an exposure risk in the workplace, control measures that may be applied at the project site will be implemented to reduce the potential for employees to be exposed to injuries and illnesses while working.
- If the exposures cannot be eliminated or managed with engineering controls, the **Project Manager** or **Supervisor** will approve the use of PPE and protective repellents and lotions and ensure that exposed employees have and use these products.

### 4.1.2 District Operations Manager

- Approve the costs associated with the PPE and materials necessary to protect employees from the biological hazards covered by this Procedure.
- During the performance of project site visits, managers will assess the precautions being taken against the requirements of this Procedure.

### 4.1.3 Region SH&E Manager

- Participate in incident reporting and investigations when appropriate.
- Work with office SH&E Department and project Safety Professionals, provide training and guidance to employees consistent with this procedure.
- Assist project teams in identifying hazards and selecting appropriate control measures.

### 4.1.4 Operational Managers

- Assure implementation of this procedure in their regions and offices.
- Participate in incident reporting and investigations when appropriate.

### 4.1.5 Employees

- Participate in required training on this procedure.
- Participate in the development of THAs for the project, identify control measures to limit exposure and request PPE, repellents, and protective lotions required by this Procedure.
- Obtain approval from **Project Managers** and/or **Supervisors** to purchase selected PPE prior to purchasing.
- Implement the precautions appropriate to prevent exposure to the hazardous wildlife, insects and plants.
- Observe requirements for reporting as detailed within the Procedure.
- Participate in incident reporting and investigations when appropriate.

## 4.2 Overview

4.2.1 The procedures discussed below are detailed because these hazards have historically posed the most significant risk to AECOM **employees**. Note that this discussion is not a fully encompassing list of hazards and as part of the Task Hazard Analysis conducted by the project team, additional consideration must be given to other biological hazards.

4.2.2 Departments of Public Health local to the worksite, as well as the Centers for Disease Control (CDC) can serve as a resource for identifying biological hazards not discussed in this Procedure.

4.2.3 If additional biological hazards are identified, the project team should contact the **Region SH&E Manager** to discuss the hazards and identify effective control measures that can be implemented at the project site.

4.3 **Planning and Hazard Assessment**

4.3.1 The AECOM project team shall ensure that the potential for exposure to specific biological hazards are assessed prior to the commencement of work and that the procedures specified by this SOP are integrated into the project planning process and conveyed to AECOM employees conducting the field work. This information shall be communicated in the site specific Safe Work Plan (SWP), Health and Safety Plan (HASP), the THA, pre-project kickoff meetings, and tailgate meetings at the project site.

*4.3.2* It is important to note that the precautions to be taken by AECOM **employees** to decrease the risk of exposure to biological hazards can directly increase the risk of heat-related illness due to thermal stresses. Therefore, heat stress monitoring and precautions shall be included as a critical component of the project-specific hazard assessments in accordance with *S3NA-511-PR Heat Stress.*

4.3.3 During the preparation of the project specific Safe Work Plan (SWP), HASP and project specific THA, **Project Managers**, **Supervisors**, and the project staff will determine what biological hazards might be encountered during the project and will prescribe the precautions to be taken to reduce the potential for exposure and the severity of resulting illnesses. Consideration will be given to conditions such as weather, proximity to breeding areas, host animals, and published information discussing the presence of the hazards.

4.3.4 It should be assumed that at least one of the biological hazards exists whenever working on undeveloped property. This can include insect activity any time that local temperatures exceed 40°F for a period of more than 24 hours. The stubble and roots of poisonous plants can be a hazard any time of year, including when some plants are dormant or mown.

4.3.5 The hazard assessments must also consider the additional hazards posed by vegetative clearing such as the increased risk of coming in contact with poison ivy, oak or sumac and hazards associated with the use of tools and equipment to remove vegetation.

4.3.6 **Employees** in the field where biological hazards exist will not enter the hazard areas unless they are wearing the appropriate protective clothing, repellents, and barrier creams specified below. If the hazard is recognized in the field but was not adequately assessed during the THA, the affected employees shall stop work and not proceed until the THA has been amended and protective measures implemented.

4.3.7 A decision flow chart and table for determining the potential for biological hazards in US states has been provided in *S3NA-313-WI1 Biological Hazard Assessment Decision Flow Chart Hazard Assessment (US States).*

4.4 **Restrictions**

4.4.1 Staff with life-threatening reactions shall not undertake work in areas infested with the allergen (e.g., wasps, poison ivy), unless precautions are met which satisfy a medical practitioner's requirements.

4.5 **Employee Sensitivity**

4.5.1 Sensitivity to toxins generated by plants, insects and animals varies according to dosage and the ability of the victim to process the toxin, therefore it is difficult to predict whether a reaction will occur, or how severe the reaction will be. Staff should be aware that there are a large number of organisms capable of causing serious irritations and allergic reactions. Some reactions will only erupt if a secondary exposure to sunlight occurs. Depending on the severity of the reaction, the result can be severe scarring, blindness or even death.

4.5.2 **Employees** also need to consider whether they are sensitive to the use of insect repellents.

4.6 **Personal Protective Equipment**

4.6.1 The selection of Personal Protective Equipment is dependent on the hazard present and a PPE Hazard Analysis should be conducted to determine situation specific PPE required. (refer to SOP *S3NA-208 Personal Protective Equipment Program*)

4.6.2 At a minimum, in addition to any project specific PPE, long sleeves and pants should be worn on field projects where the risk of biological encounter exists.

4.6.3 PPE for insects should include sunscreen, bug nets, bug jackets, or insect repellent. Socks should be pulled over pant legs and rubber boots should be worn where the threat of exposure is anticipated.

4.6.4 Epi-pens[1] or other personal medication should be carried by those staff that are aware that anaphylactic shock is a possibility for them.

## 4.7 Remedies

4.7.1 If you suspect exposure to an irritant, identify the cause including obtaining a specimen if possible. Document the occurrence as a safety precaution if the exposure should lead to complications.

4.7.2 Go to a doctor or call WorkCare for advice if necessary.

## 4.8 Training

4.8.1 Field staff must learn to recognize organisms that represent a threat in the regions in which they work – experienced field staff must provide on the job training to assist staff with hazard recognition.

4.8.2 Staff who have severe allergic reactions are strongly recommended to notify their project manager, field supervisor, and co-workers of the potential for a reaction and demonstrate what medication they might need and how it is administered.

## 4.9 Insects

4.9.1 Insects for which precautionary measures should be taken include but are not limited to: mosquitoes (potential carriers of disease aside from dermatitis), black flies, wasps, bees, ticks, Fire Ants and European Fire Ants.

4.9.2 Wasps and bees will cause a painful sting to anyone if they are harassed. They are of most concern for individuals with allergic reactions who can go into anaphylactic shock. Also, instances where an individual is exposed to multiple stings can cause a serious health concern for anyone. These insects are most likely to sting when their hive or nest is threatened.

4.9.3 Ticks can be encountered when walking in tall grass or shrubs. They crawl up clothing searching for exposed skin where they will insert mouthparts to drink blood. The most serious concern is a possibility of contracting Lyme disease which is spread by the Black-legged or Deer Tick. The larger Wood Ticks are widespread in the west but these rarely carry diseases. Occasionally a tick can cause Tick Paralysis if it is able to remain feeding for several days. Full recovery usually occurs shortly after the tick is removed.

4.9.4 The Fire Ant (southern and western US) and the European Fire Ant (northeastern US and eastern Canada) is often very abundant where it is established. It is very aggressive and commonly climbs up clothing and stings unprovoked when it comes into contact with skin. Painful irritations will persist for an hour or more.

## 4.10 Ticks

4.10.1 Data from the CDC indicates that tick-borne diseases have become increasingly prevalent. At the same time, tick repellents have become both safe and effective so it is possible to prevent the vast majority of bites and therefore most related illnesses.

4.10.2 The most common and severe tick-borne illnesses in the U.S. are Lyme disease, Ehrlichiosis, and Rocky Mountain spotted fever. A summary table listing CDC informational resources for these diseases is provided in *S3NA-313-WI2 Ticks* along with a listing of CDC information resources and maps showing the distribution of common tick-borne diseases in the U.S.

4.10.3 When working in areas where ticks may occur, it is recommended that clothes are turned inside out and shaken at the end of day; do not wear the same clothes two days in a row.

4.10.4 To remove ticks that are embedded in skin, use tweezers or fingers to carefully grasp the tick as close to the skin as possible and pull slowly upward, avoiding twisting or crushing the tick. Do not try to burn or smother the tick. Cleanse the bite area with soap and water, alcohol, or household antiseptic. Note the date and location of the bite and save the tick in a secure container such as an empty pill vial or film canister. A bit of moistened paper towel placed inside the container will keep ticks from drying out.

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[1] *Epi-pens must be prescribed by a personal physician. Renew epi-pens on a regular schedule to ensure effectiveness and make sure your field companions know where it is and how to use it if you cannot self administer the dose.*

4.10.5 Familiarize yourself with the characteristic bulls-eye pattern of Lyme disease infection surrounding the bite. If noted, report to medical help for inoculation.

4.10.6 If possible, submit any ticks found or captured to the following laboratories for species identification.

- Canada – National Microbiology Laboratory (NML) (Phone: (204) 789-2000; email: ticks@phac-aspc.gc.ca). The NML will conduct diagnostic testing for the Lyme disease agent as well as several other disease-causing agents. The NML results will not only benefit anyone bit by the tick, but will also assist the NML in their goal to accurately map the distribution of the tick species and associated diseases in Canada.
- US – IGeneX, Inc. (Phone: (800) 832-3200; www.igenex.com). IGeneX will test the tick for the presence of the Lyme bacteria. They also test ticks for *Babesia microti* and/or *Babesia duncani* (formerly WA-1), Ehrlichia, Bartonella henselae and Rickettsia (Rocky Mountain Spotted Fever). These diseases are also carried by ticks. The testing request form is attached as *S3NA-313-FM Tick Test Request Form*.

4.10.7 If you experience symptoms such as fever, headache, fatigue, and a skin rash, you should immediately visit a medical practitioner as Lyme disease is treated easily with antibiotics in the early stages, but can spread to the heart, joints, and nervous system if left untreated.

### 4.11 Chiggers

4.11.1 Chiggers are mite larvae, approximately ½ mm in size, and typically invisible to the naked eye. While chiggers are not known to carry infectious diseases, their bites and resulting rashes and itching can lead to dermatitis and a secondary infection.

4.11.2 Chiggers are typically active from the last hard freeze in the winter or spring to the first hard freeze. They are active all year in the Gulf Coast and tropical areas.

### 4.12 Spiders

4.12.1 Spiders can be found in derelict buildings, sheltered areas, basements, storage areas, well heads and even on open ground. Spiders can be found year round in sheltered areas and are often present in well heads and valve boxes.

4.12.2 Most spider bites produce wounds with localized inflammation and swelling. The Black Widow and Brown Recluse spiders in the US and others outside the US inject a toxin that causes extensive tissue damage and intense pain.

4.12.3 Additional information on spider identification can be found in attachment *S3NA-313-WI3 Poisonous Spider Identification*.

### 4.13 Mosquitoes

4.13.1 Mosquitoes can transmit the West Nile Virus and other forms of encephalitis after becoming infected by feeding on the blood of birds which carry the virus. Positive cases of West Nile Virus have been confirmed throughout North America since 2007.

4.13.2 Most people infected with the virus experience no symptoms or they have flu-like symptoms. Sometimes though, the virus can cause severe illness, resulting in hospitalization and even death ,so proper precautions should be taken. Consult a medical practitioner if you suspect you have West Nile Virus.

4.13.3 When a mosquito bites, it injects an enzyme that breaks down blood capillaries and acts as an anticoagulant. The enzymes induce an immune response in the host that results in itching and local inflammation. The tendency to scratch the bite sites can lead to secondary infections.

4.13.4 CDC data indicates that mosquito-borne illnesses, including the strains of encephalitis, are a health risk to employees working in outdoor environments. At least one of the Encephalitis strains listed below is known to exist in every area of the U.S. and in many other countries as well:

- Eastern Equine encephalitis (EEE)
- Western Equine encephalitis (WEE)
- West Nile Virus
- St. Louis encephalitis (SLE)
- La Crosse (LAC) encephalitis

4.13.5 Other diseases including Dengue Fever and Malaria are spread by mosquitoes in the sub-tropic and tropical parts of the world. See *S3NA-313-WI4 Mosquito Borne Diseases* for information on the locations where mosquito borne diseases are known to be present.

## 4.14 Bees and Hornets

4.14.1 Bees, hornets, and wasps may be found in derelict buildings, sheltered areas, and even on open ground. The flying/stinging insects are not specifically included in the scope of this procedure and the PPE and other protective measures are not normally effective against aggressive, flying insects. Avoid reaching into areas where visibility is limited.

4.14.2 If stung by a wasp or bee or hornet, notify a co-worker or someone who can help should you have an allergic reaction. Stay calm and treat the area with ice or cold water. Seek medical attention if you have any reactions to the sting such as developing a rash, excessive swelling or pain at the site of the bite or sting, or any swelling or numbness beyond the site of the bite or sting.

4.14.3 Employees with known allergies to insect stings should consult their personal physician for advice on any immediate medications that they should carry with them. AECOM highly recommends that employees with known allergies inform their co-workers of the allergy and the location of the medications they might carry for the allergy.

## 4.15 Poisonous Plants

4.15.1 Poisonous plants including poison ivy, oak and sumac, which contain the oil urushiol that produces a rash, can lead to dermatitis and infections. Exposure to urushiol produces a rash that can be irritating and cause the exposed employee to scratch the affected area, increasing susceptibility for an infection. It should be noted that each time an employee is exposed to urushiol the severity of the reaction increases. In cases that involve severe rashes, medical treatment may be necessary to control the rash.

4.15.2 Wild parsnip is found throughout the U.S. and contains a poison that produces a rash similar to poison oak and ivy. Unlike poison oak and ivy, the active oil will not be present on unbroken leaves. See *S3NA-313-WI6 Wild Parsnip Identification* for additional information and photos of wild parsnip.

4.15.3 Plants that field staff should recognize and take precautions to avoid include: Poison Sumac, Poison Ivy (terrestrial and climbing), Poison Oak, Giant Hogweed[2] (or Giant Cow Parsnip), Wild Parsnip, Devil's Club and Stinging Nettle. Many others are extremely poisonous to eat (e.g., Poison Hemlock; Water Parsnip) – do not eat anything that has not been identified.

4.15.4 See *S3NA-313-WI5 Plants of Concern* for information on locations where some of these poisonous plants are found in the US.

4.15.5 Of the toxic plants in the cashew family, Poison Ivy (*Rhus radicans*) is most widespread occurring across southern Canada. It is usually a low sprawling shrub or ground cover but in southwestern Ontario it also grows as a thick woody vine that grows high into the tree canopy. Poison Oak (*Rhus diversiloba*) is a low shrub that grows only in southwestern British Columbia and Poison Sumac (*Rhus vernix*) is a tall shrub that grows in southern Ontario but is quite rare. All of these plants possess urushiol oils in nearly all parts of the plant. Touching the plant causes an itchy skin rash that shows up several days following contact. People have a wide range of reactions which in severe cases can lead to oozing blisters on large parts of the body. Some people apparently never react and others may develop an allergy after no reaction after years of frequent contact.

4.15.6 Several plants in the carrot family contain toxic sap that causes severe dermatitis if it comes into contact with skin that is then exposed to sunlight. The most serious reaction is caused by the Giant Hogweed (*Heracleum mantegazzianum*), a garden that is spreading in southern Ontario and is also present in southwestern British Columbia. The plant is enormous, attaining up to 5 m in height, which it does in one growing season. Contact causes painful blistering that can cause permanent disfigurement. It is to be avoided. Similar but less serious reactions can be caused by Meadow Parsnip (*Pastinaca sativa*) and Cow Parsnip (*Heracleum lanatum*). Meadow Parsnip can be very abundant on disturbed sites.

4.15.7 Nettles, particularly Stinging Nettle (*Urtica dioica*) and Wood Nettle (*Laportea canadensis*) contain urticating hairs on the leaves and stems that cause sharp pain or itchiness on contact with skin. The irritation is immediate and normally lasts no more than an hour and there are no lasting consequences.

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[2] *Phytodermatisi producer: keep skin covered and wash well after exposure*

4.15.8 Some plants contain abundant stiff spines that can present a safety hazard, particularly if one is to fall into them. Fragile Prickly Pear cactus (*Opuntia fragilis*) is common in semi arid areas of the southern Prairie Provinces and interior British Columbia. Pieces will break off and imbed into one's ankle by scarcely brushing them. Devils Club (*Oplopanax horridum*) can form dominant understorey in humid forests among the western mountains. It contains semi-soft spines on the stems that will break off in the skin causing considerable irritation for days. In some areas of Ontario, Prickly-ash (*Zanthoxylon americanum*) a tall shrub with sturdy spines, sometimes forms dense single stands that are nearly impenetrable.

4.15.9 A large number of plants are not harmful to touch but may contain poisonous berries or foliage that could cause serious complications or death if they are ingested. It goes without saying not to eat any berries or plants if you are not absolutely sure of their identity.

4.15.10 Of all the plants, Giant Hogweed presents the most serious health risk. Field staff should learn to recognize and avoid it if encountered.

4.15.11 Employees who develop a rash as a result of exposure to poisonous plants shall report the exposure immediately to their **Supervisor** or **Project Manager** who will then forward the report to the **Regional SH&E Manager**.

## 4.16 Additional Biological Hazards

4.16.1 Additional Work Instructions are provided for protection and prevention from the following:

- *S3NA-313-WI11 Large Carnivores*
- *S3NA-313-WI12 Bear Safety*
- *S3NA-313-WI13 Small Mammals*
- *S3NA-313-WI14 Snakes*
- *S3NA-313-WI15 Alligators*

## 4.17 Habitat Avoidance, Elimination, and/or Control

4.17.1 Ticks, Spiders and Insects

- The most effective method to manage worker safety and health is to eliminate, avoid and/or control hazards. Clearing the project site of brush, high grass and foliage reduces the potential for exposure to biological hazards. Clearing will not eliminate the exposure to flying insects and there might be an increased exposure to ticks, spiders, and poisonous plants during the clearing process.
- AECOM projects such as subsurface environmental assessment or remediation are often candidates for brush and overgrown grass to be cleared. In these instances, the AECOM **project manager** shall either request that the client eliminate vegetation, or request approval from the client to have vegetation clearing added to the scope of work.
- When projects must be conducted in areas that cannot or may not be cleared of foliage, personal precautions and protective measures outlined in this SOP shall be prescribed.
- Mosquitoes breed in stagnant water and typically only travel a quarter mile from their breeding site. Whenever possible, stagnant water should be drained to eliminate breeding areas. **Project Managers** and client site managers should be contacted to determine whether water can be drained and the most appropriate method for draining containers, containment areas, and other objects of standing water.
- If water cannot be drained, products similar to Mosquito Dunks® can be placed in the water to control mosquitoes. Once wet, the Mosquito Dunks® kill the immature, aquatic stage of the mosquito. The active ingredient is a beneficial organism that is lethal to mosquito larvae, but harmless to fish, humans, and other animals. Mosquito Dunks® provide long-term protection for 30 days or more.

4.17.2 Poisonous Plants

- If poisonous plants are identified in the work area, **employees** will mark the plants using either flags or marking paint, and discuss what the specific indicator will be to signal to other **employees** to avoid the designated area. If **employees** decide to use ground-marking paint to identify poisonous plants, they should discuss this tactic with the **Project Manager** and/or Client to gain approval.

- If removal of the plants is considered, it should be subcontracted to a professional landscaping service that is capable and experienced in removing the plant. If herbicides are considered for use, a discussion will need to occur with the **Project Manager** and Client to determine whether it is acceptable to apply herbicides at the work site. Application of herbicides may require a license.
- AECOM **employees** shall not attempt to physically remove poisonous plants from the work area unless a clearing procedure including PPE is prepared in advance and approved by the **Region SH&E Manager**. If a SWP or HASP is prepared for the project, the clearing procedure should be included and the required PPE specified.

4.17.3 Bird Droppings

- Bird excrement may be encountered due to the nesting of pigeons and other birds and winged animals (e.g., bats) on or in structures. Substantial accumulations of droppings can pose physical and health risks as slippery surfaces (if wet) and if the material is disturbed and becomes airborne, it can be inhaled or ingested if personal hygiene practices are not implemented. Inhalation of airborne droppings can cause diseases such as histoplasmosis. Exposure to surfaces with bird droppings shall be safeguarded by implementing proper work practices, training employees for awareness and using PPE. See *S3NA-313-WI10 Bird Droppings Safe Work Practices*.

## 4.18 Personal Precautions and Personal Protective Measures

4.18.1 Precautions

- Be aware of the potential irritants in your area and know how to recognize them.
- Modify activities to avoid encounters (diurnal rhythms, seasonal rhythms).
- Wear protective clothing.
- When working in areas where there may be small insects that “hitchhike” (e.g., ticks, spiders, scorpions), it is recommended that clothes are turned inside out and shaken at the end of day; do not wear same clothes two days in a row.
- Staff should always be aware of where they are placing their hands, or where they are sitting in order to avoid contact with potential toxins.

4.18.2 PPE

- The following recommendations may be considered by the project team to determine if the use of PPE is necessary for the type of work planned: Disposable gloves may be cotton, leather, or synthetic materials and must not be reused after removing.
- Clearing activities present the greatest risk of employee exposure but reduce the risks once completed. Recommendation – AECOM employees actively participating in clearing will use full protection from ticks and insects during the clearing activities including insect repellents, Tyvek® coveralls, and gloves.
- If the foliage being cleared includes poisonous plants, exposed skin will be treated with a dermal barrier cream such as Tecnu®’s Oak ‘n Ivy Armor or Enviroderm’s Ivy Block and either a full face respirator or a half face respirator (with goggles) fitted with a P-100 (HEPA) dust filter.
- Work in habitats with direct exposure to ticks, mosquitoes, and poisonous plants is likely and the scope of work does not allow for worksite control measures like vegetative clearing: Recommendation – Full protection from biological hazards including insect repellents, Tyvek® coveralls or full length clothing, poisonous plant barrier creams and wipes, and gloves.
- Work in habitats with direct exposure to ticks and mosquitoes and no exposure to poisonous plants is likely and the scope of work typically does allow for worksite control measures like vegetative clearing: Recommendation – Protection including insect repellents and Tyvek® coveralls or full length clothing.
- Work in habitats with direct exposure to poisonous plants and no exposure to ticks or insects is likely and the scope of work does not allow for worksite control measures like vegetative clearing: Recommendation – Full protection from poisonous plants including insect repellents, Tyvek® coveralls or full length clothing, poisonous plant barrier creams and wipes, and gloves.
- Industrial/Commercial/Office Facilities – Direct contact with biological hazards is considered unlikely or low risk: Recommendation – PPE for biological hazards are not required; however, Tyvek coveralls and insect repellentrepellent should be available if exposure to spiders, flying insects, or other biological hazards is encountered.
- Work in areas where no biological hazards are expected because of the local environment, winter weather, or property development: Recommendation – PPE for biological hazards is not required;

however, Tyvek® coveralls and insect repellentrepellent should be available if exposures to spiders, flying insects, or other biological hazards are encountered.

- The following precautions and protective measures shall be implemented by AECOM **employees** conducting field work where the biological hazards covered by this SOP exist:

4.18.3 Insects, Spiders, and Ticks

- Chemically-treated field clothing, full-length clothing, or Tyvek® coveralls.
- Application of insect repellent to clothing and/or exposed skin.
- Routine personal checks.
- Exercise care when collecting samples and avoid reaching into areas where visibility is limited. If stung by an insect or bitten by a spider or tick, attempt to identify the attacker and notify a co-worker or someone who can help should the bite site become painful, discolored, or swollen. Stay calm and treat the area with ice or cold water. Seek medical attention if you have any reactions to the sting such as developing a rash, excessive swelling or pain at the site of the bite, or any swelling or numbness beyond the site of the bite.
- Oil of lemon eucalyptus, DEET, and Permethrin have been recommended by the Centers for Disease Control and Prevention for effective protection against mosquitoes that may carry the West Nile virus and related diseases.
- Note that DEET will reduce the effectiveness of Fire Resistance Clothing (FRC) and should not be applied to this clothing. If working in FRC, **employees** can apply DEET to their skin and let dry prior to putting FRC on, or use Permethrin as it has been shown not to reduce the effectiveness of FRC. Permethrin will need to be applied to FRC well in advance of the planned work.

4.18.4 Poisonous Plants

- **Employees** working in areas where poisonous plants exist shall wear either long sleeve clothing or Tyvek® coveralls, and disposable cotton, leather or synthetic gloves. **Employees** must not touch exposed skin (neck and face) with potentially contaminated gloves. Tyvek® and gloves worn to protect from exposure to poisonous plants will be treated as contaminated, removed from the body in a manner that the contamination is not spread, and placed in plastic bags for disposal.
- Personal clothing that has been exposed to poisonous plants shall be decontaminated with a poisonous plant cleanser such as Tecnu® or removed in a careful manner, bagged and washed separately from other clothing to remove urushiol.
- Work boots will be decontaminated with either soap and water or a cleansing agent such as Tecnu® cleanser.
- Remember that in the fall and winter the hazard still exists in the form of stubble and roots.
- Employees who develop a rash as a result of exposure to poisonous plants shall report the exposure immediately to their **Supervisor** or **Project Manager** who will forward the report to the RSHEM.
- For dermatitis caused by Poison Ivy, Poison Oak, or Poison Sumac, calamine lotion is effective.

## 4.19 Selection and Configuration of Field Clothing

4.19.1 At a minimum, **employees** will wear long legged pants and long sleeve shirts or Tyvek® coveralls to reduce the amount of exposed skin when biological hazards are identified at the work site. Gloves will also be worn consistent with the recommendations of the site-specific SWP, HASP and/or THA to minimize hand exposure.

4.19.2 Where ticks, chiggers, and spiders are presumed to exist, the Tyvek® or chemically-treated clothing will be taped to the work boots.

4.19.3 See *S3NA-313-WI7 Configuration Clothing for Protection* against ticks and insects for illustrations and instructions for configuring, taping, and tucking clothing.

4.19.4 Chemical Treatment of Field Clothing

- Oil of lemon eucalyptus, DEET, and Permethrin have been recommended by the Centers for Disease Control and Prevention for effective protection against mosquitoes that may carry the West Nile virus and related diseases.
- Note that DEET will reduce the effectiveness of Fire Resistance Clothing (FRC) and should not be applied to this clothing. If working in FRC, **employees** can apply DEET to their skin prior to putting FRC on, or use Permethrin as it has been shown not to reduce the effectiveness of FRC. Permethrin will need to be applied to FRC well in advance of the planned work.

4.19.5 Permethrin

- When selected as part of a project's PPE requirements, the AECOM **Project Manager** shall ensure that field teams wear clothing treated with the chemical Permethrin, which is an insecticide with repellent properties registered with the U.S. Environmental Protection Agency (EPA), and recommended by the CDC. Information regarding the toxicity and product safety of Permethrin is provided in *S3NA-313-WI8 Insect Repellent Active Ingredient Product Information*. Permethrin is highly effective in preventing tick bites when applied to clothing, but is not effective when applied directly to the skin. Two options are available for Permethrin treatment of clothing worn during field work: 1) pre-treatment of fabric by the clothing manufacturer; or 2) employee treatment of their personal clothing using 0.5% Permethrin spray. AECOM strongly recommends the first option (employees obtaining pre-treated clothing) to avoid the time required, potential risk, and housekeeping issues involved with manually treating the clothing with spray. Purchase pre-treated clothing in accordance with *S3NA-208-PR Personal Protective Equipment Program* and with the approval of your **Supervisor**. For more information visit the AECOM NA SH&E website.
- The Permethrin pre-treatment is odorless and retains its effectiveness for approximately 25 washings. After 25 washings, the pre-treated clothing will be considered no longer effective and removed from service. Clothing that has been manually treated by employees will be considered effective for 5 wash cycles.
- Also, use of clothing that has been pre-treated with Permethrin offers a reduction in the use and application of other insect repellents that must be applied directly to the skin.. Costs for clothing shall be charged to projects as a consumable item. If charging to the project is not possible, the charges should be managed as a department expense. **Supervisor** or **Department Manager** approval is required prior to purchase.
- If an employee opts not to utilize chemically pre-treated clothing while potentially exposed to insects, spiders and/or ticks, they must either: 1) wear Tyvek® coveralls taped to the boots, 2) full length clothing consisting of long legged pants and long sleeved shirts treated with an insect repellent containing Permethrin, DEET, or an organic alternative to their work clothing.

4.19.6 Manual Treatment of Field Clothing

- If clothing pre-treated with Permethrin is not available or not purchased prior to field work, employees may manually treat their clothing with Permethrin spray. The outer surfaces of all external clothing to be worn during field work should be treated with 0.5% Permethrin spray a minimum of 2 to 4 hours prior to field work (boots, trousers, shirt, jackets, rain gear; refer to Section 4.16 for selection of field clothing) in accordance with recommendations provided by the New York State Department of Health presented in *S3NA-313-WI9 New York Department of Health Recommendations for Permethrin Application*. This will likely require treatment at home or the office prior to field mobilization. Caution should be used when applying Permethrin as it is highly toxic to fish and house cats. Clothing treatment will last for approximately 5 wash cycles (check the specific instructions for the product used.)

4.19.7 Lemon Eucalyptus

- Lemon Eucalyptus is a plant-based insect repellent on the market as Repel Lemon Eucalyptus. The products have been proven to be effective against mosquitoes, deer ticks, and no-see-ums for up to six hours. Derived from Oil of Lemon Eucalyptus, this non-greasy lotion or spray has a pleasant scent and is not known to be toxic to humans. The spray or lotions will be effective for approximately two to six hours and should be reapplied every two hours to sustain protection. Lemon Eucalyptus products cannot be applied to fire retardant clothing.

4.19.8 Purchase of PPE and Repellents and Lotions

- Costs for clothing, repellents, lotions, and other PPE shall be charged to projects as a consumable item. If charging to the project is not possible, the charges should be managed as a department expense. **Supervisor** or **Department Manager** approval is required prior to purchase.
- Material Safety Data Sheets (MSDS) for the repellents, lotions, and cleansers discussed in this Procedure are not required because the repellents, lotion, and clothing are consumer products used in the manner intended for the general public. Although not required, a MSDS should be obtained for the products used and placed into the office MSDS library and site-specific health and safety plans. Selected MSDSs are available on the AECOM NA SH&E web site.

4.20 **Personal Hygiene and Body Checks**

4.20.1 Tick-borne diseases typically require that the tick be imbedded for four hours to begin disease transfer. The oils from poisonous plants can take up to 4 hours after exposure to penetrate the skin and react with the live proteins under the skin.

4.20.2 It is recommended that exposed skin be checked frequently for the presence of ticks, insects, rashes, or discolorations. External clothing should also be checked for the presence of ticks and insects; these should be retained for identification and to determine if medical treatment is needed.

4.20.3 **Employees** will shower as soon as practical after working in the field and examine their bodies for the presence of ticks, insect bites, rashes, or swollen areas. If imbedded ticks are found, they should be removed using the technique described in *S3NA-313-WI2 Ticks*, the tick should be preserved with the date and location of the bite noted, and retained for identification if medical treatment is needed as described in Section 4.13.1 of this Procedure.

4.20.4 The presence of an imbedded tick, rash, or abnormal reactions will be reported as an SH&E Incident to the **Project Manager** or **Supervisor** who will forward the report to the **RSHEM** for follow up.

## 5.0 Records

5.1 None

## 6.0 References


6.1 Public Health Agency of Canada (http://www.phac-aspc.gc.ca/id-mi/tickinfo-eng.php) on Ticks and Lyme Disease in Canada

6.2 Public Health Agency of Canada (http://www.phac-aspc.gc.ca/wn-no/index-eng.php) on West Nile Virus

6.3 United States Center for Disease Control (CDC) (http://www.cdc.gov/ncidod/dvbid/lyme/index.htm) on Lyme Disease

6.4 New York State Department of Health, 2007. Health Advisory, Tick and Insect Repellents. http://www.health.state.ny.us/nysdoh/westnile/pdf/2737.pdf

6.5 Spectrum Brands, 2007. Personal Insect Repellent Products. http://www.spectrumbrandshomeandgarden.com/CorpNav/AboutSpectrum/ProductCategories/insect_repellent.htm

6.6 U.S. Centers for Disease Control and Prevention, 2004. Tick Management Handbook. http://www.cdc.gov/ncidod/dvbid/lyme/resources/handbook.pdf

6.7 U.S. Environmental Protection Agency, 2006. Permethrin Facts: Preregistration Eligibility Decision Fact Sheet. http://www.epa.gov/oppsrrd1/reregistration/REDs/factsheets/permethrin_fs.htm

6.8 U.S. National Pesticide Information Center, 1997, National Pesticide Telecommunications Network Fact Sheet for Permethrin. http://npic.orst.edu/factsheets/permethrin.pdf

6.9 U.S. Environmental Protection Agency, 2005. New Pesticide Fact Sheet, Picaridin http://www.epa.gov/opprd001/factsheets/picaridin.pdf

# S3NA-313-FM Tick Test Request Form

IGeneX, Inc.
795 San Antonio Road
Palo Alto, CA 94303
800/832-3200
www.igenex.com

## TICK TEST REQUEST FORM

Revised: JUNE 2008

**TO SEND A TICK:**

- Place ticks (up to 20) in a small tube or plastic baggy with a small piece of moist cotton.
- Place container in a sealed plastic bag.
- Fill out lower portion of this form.
- Place form, check and sealed plastic bag in padded envelope or box.
- Send to IGeneX, Inc. and mark front of envelope or box with "TT".
- IGeneX does not "TYPE" or determine the species of the ticks. If you want to "TYPE" your tick, please contact your local Vector Control Center.
- Once your tick(s) have been processed, the tick can not be returned to you.
- For Multiple Ticks: up to 20 ticks will be tested together at one time unless indicated otherwise.
  If ticks are tested separately, the charge is per tick. Please test my ticks separately. Yes ☐

---

**Please test the tick by PCR for:**

| | | | |
|---|---|---|---|
| ☐ | Test 140 | Lyme Disease (B. burgdorferi) | $65.00 |
| ☐ | Test 689 | Babesiosis (B microti and/or B duncani) | $65.00 |
| ☐ | Test 148 | Ehrlichiosis (Ehrlichia) | $65.00 |
| ☐ | Test 290 | Bartonella henselae | $65.00 |
| ☐ | Test 975 | Rickettsia | $65.00 |

---

**Name and Address of Sender:**

____________________________________

____________________________________

____________________________________

**Phone:** (______) ______________________

**If you would like results faxed or called, please indicate below. Otherwise, results will be mailed by USPS.**

_______**Please fax my completed results to:**
(_______)______-_________

______**Please call me with my results at:**
(_______)______-_________

---

☐ **Check enclosed payable to IGeneX, Inc.**

☐ **Please charge my credit card for the above tests:**

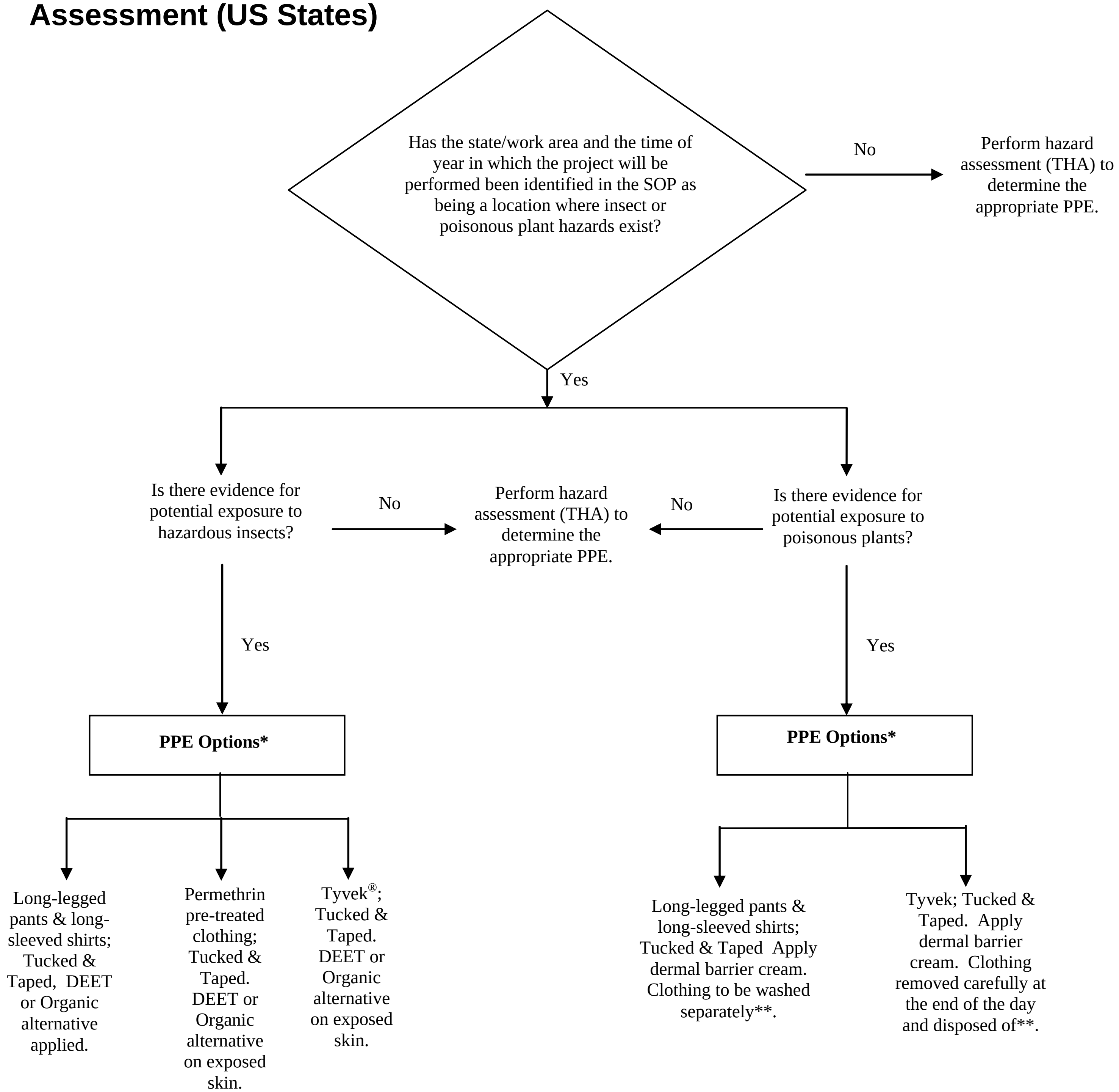
☐ Visa ☐ Mastercard ☐ Discover

**Card Number:** ______________________________________________

**Exp. Date**_________________________________

**Signature**___________________________________________________

# S3NA-313-WI1 Biological Hazard Assessment Decision Flow Chart Hazard Assessment (US States)




* indicates that when both insect and poisonous plant hazards are recognized hazards at a project site, the most conservative combination of the available PPE choices will be selected.

** indicates that clothing that has been known or suspected to have come in contact with poisonous plants must be washed before it can be worn again. Similarly, Tyvek® that has been known or suspected to have come in contact with poisonous plants will be disposed of rather than reused during a subsequent day or project.

**State by State Guideline for Exposure**

| States | Tick-Borne Diseases | Mosquito-Borne Diseases | Poisonous Plants |
|---|---|---|---|
| Alabama | Year Round<br>Low Risk | Year Round | Year round |
| Alaska | No Risk | No Risk | No Risk |
| Arizona | No Risk | March - July | March - November |
| Arkansas | March - November | March - November | March - November |
| California | Low Risk | March - November | Year Round |
| Colorado | Low Risk | March - November | No Risk |
| Connecticut | March - November | Low Risk<br>March - November | March - November |
| Delaware | March - November | Low Risk<br>March - November | March - November |
| Florida | Year Round<br>Low Risk | Year Round | Year round |
| Georgia | Year Round<br>Low Risk | Year Round | Year round |
| Hawaii | No Risk | No Risk | No Risk |
| Idaho | No Risk | Low Risk<br>March - November | No Risk |
| Illinois | March - November | March - November | March - November |
| Indiana | March - November | March - November | March - November |
| Iowa | March - November | March - November | March - November |
| Kansas | Low Risk | March - November | March - November |
| Kentucky | March - November | March - November | March - November |
| Louisiana | Year Round<br>Low Risk | Year Round | Year round |
| Maine | March - November | March - November | March - November |
| Maryland | March - November | Low Risk | March - November |
| Massachusetts | March - November | March - November | March - November |
| Michigan | March - November | March - November | March - November |
| Minnesota | March - November | March - November | March - November |
| Mississippi | Year Round | Year Round | Year round |
| Missouri | March - November | March - November | March - November |
| Montana | Low Risk<br>March - July | Low Risk<br>March - July | No Risk |
| Nebraska | Low Risk | Low Risk | Low Risk |
| Nevada | Low Risk<br>March - July | Low Risk<br>March - July | Low Risk<br>March - November |
| New Hampshire | March - November | March - November | March - November |
| New Jersey | March - November | March - November | March - November |
| New Mexico | No Risk | Low Risk<br>March - July | No Risk |
| New York | March - November | March - November | March - November |
| North Carolina | March - November | March - November | March - November |
| North Dakota | No Risk | March - November | No Risk |
| Ohio | Low Risk<br>March - November | March - November | March - November |
| Oklahoma | March - November | Low Risk<br>March - November | March - November |
| Oregon | Low Risk<br>March - November | Low Risk<br>March - November | March - November |
| Pennsylvania | March - November | March - November | March - November |
| Puerto Rico | ??? | Low Risk<br>March - November | Year round |
| Rhode Island | March - November | Low Risk<br>March - November | March - November |
| South Carolina | March - November | Low Risk<br>March - November | March - November |

| States | Tick-Borne Diseases | Mosquito-Borne Diseases | Poisonous Plants |
|---|---|---|---|
| South Dakota | Low Risk<br>March - November | March - November | March - November |
| Tennessee | March - November | March - November | March - November |
| Texas | Year Round<br>Low Risk | Year Round | Year round |
| Utah | Low Risk<br>March - July | Low Risk<br>March - July | No Risk |
| Vermont | March - November | Low Risk<br>March - November | March - November |
| Virginia | Low Risk<br>March - November | March - November | March - November |
| Washington | Low Risk<br>March - November | Low Risk<br>March - November | March - November |
| West Virginia | Low Risk<br>March - November | March - November | March - November |
| Wisconsin | March - November | March - November | March – November |
| Wyoming | No Risk<br>March - July | Low Risk<br>March - July | No Risk |

# S3NA-313-WI2 Ticks

## 1.0 Background

1.1 The Public Health Agency of Canada (PHAC) works with the provinces, health authorities and other experts on research to define and monitor the occurrence of the ticks that carry *Borrelia burgdorferi*, the bacterium that causes Lyme disease. In Canada, the blacklegged tick (*Ixodes scapularis*; often referred to as a deer tick) and the western blacklegged tick (*Ixodes pacificus*) are the species known to transmit this disease-causing agent, as well as other less common agents.

1.2 In Quebec, blacklegged tick populations are becoming established in parts of the Monteregie and Estrie regions in the southeast of the province. In Ontario, populations can be found in Long Point; Point Pelee National Park; Rondeau Provincial Park; Turkey Point; Prince Edward Point National Wildlife Area and St. Lawrence Islands National Park in the Thousand Islands region of eastern Ontario. In Nova Scotia, blacklegged tick populations are found in the Lunenburg, Bedford and Shelburne areas. An established population has also been found in the southeastern corner of Manitoba. Western blacklegged ticks, on the other hand, are found in British Columbia; they are fairly widely distributed but populations are largest in the lower mainland, on Vancouver Island, and in the Fraser Valley.

**1.3** Although the distribution of blacklegged ticks in Canada appears to be limited, surveillance indicates that some of the established populations are spreading within certain areas of southern Canada. The potential expansion of localized tick populations makes it difficult to precisely define the geographic limits of any given population; however, people living in or visiting areas adjacent to established tick populations may have a greater chance of contact with blacklegged ticks. Although current evidence does not suggest a widespread distribution of blacklegged tick populations in Canada, the establishment of new populations appears to be an ongoing process. Hence, it is desirable to continue surveillance and to take precautions to reduce tick contact.

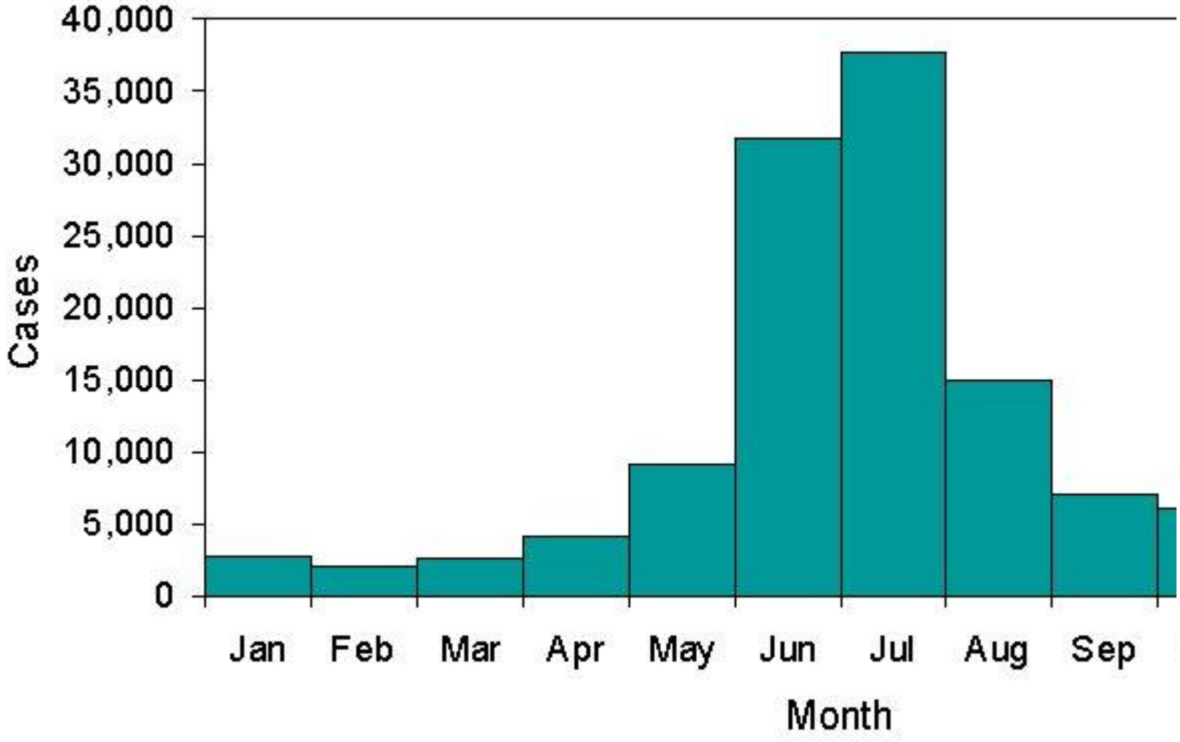
1.4 The rate of infection of ticks with the bacterium that causes Lyme disease varies. Infection rates are typically higher in adult ticks compared to the other stages (nymphs and larvae). Despite the lower rates of infection, people are most likely to acquire Lyme disease from a nymph because this stage is so small (see Figure 2) and thus more likely to go unnoticed and feed for a sufficient amount of time for the Lyme disease bacterium to be transmitted (24-36 hours). Infection rates are often greater in tick populations that have been established for long periods of time (such as Long Point) compared to newly established ones. As many as 60 percent of the adult ticks at Long Point are infected; however, infection rates in adults are more often between 10 and 25 percent at the other localities where ticks are established. Partly because of differences in the types of hosts that they feed upon, infection rates of the Lyme disease agent in *Ixodes pacificus* are much lower (1-3 percent) than *Ixodes scapularis*.

**1.5** While there is a higher risk of coming in contact with infected blacklegged ticks in areas where populations are established, there is also a low risk of Lyme disease being contracted almost anywhere in Canada because migratory birds transport infected ticks over large geographic distances. Surveillance data indicates that about 12 percent of the ticks detected outside of areas where tick populations are established, and likely transported there on migratory birds, are infected with the agent of Lyme disease.

**1.6** Source: http://www.phac-aspc.gc.ca/id-mi/tickinfo-eng.php

**Figure 1**

**Reported Cases of Lyme Disease by Month of Illness Onset United States, 1992-2004**




Lyme disease patients are most likely to have illness onset in June, July, or August and less likely to have illness onset from December through March.

Lyme disease likelihood = April through November http://www.cdc.gov/ncidod/dvbid/lyme/ld_rptmthofill.htm

## 2.0 Tick removal tips from CDC

http://www.cdc.gov/ncidod/dvrd/ehrlichia/Q&A/Q&A.htm

## 3.0 To Remove Attached Ticks

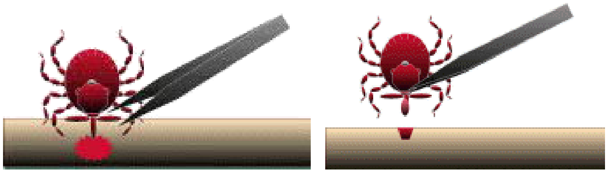
3.1 Use fine-tipped tweezers or notched tick extractor, and protect your fingers with a tissue, paper towel, or latex gloves (see figure). Persons should avoid removing ticks with bare hands.

3.2 Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. (If this happens, remove mouthparts with tweezers. Consult your health care provider if illness occurs.)

3.3 After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.

3.4 Do not squeeze, crush, or puncture the body of the tick because its fluids may contain infectious organisms. Skin accidentally exposed to tick fluids can be disinfected with iodine scrub, rubbing alcohol, or water containing detergents.

3.5 Save the tick for identification in case you become ill. This may help your doctor make an accurate diagnosis of potential diseases by determining what type of tick it is. Place the tick in a sealable plastic bag and put it in your freezer. Write the date of the bite on a piece of paper with a pencil and place it in the bag.



## 4.0 Devices Designed for Removing Ticks

**4.1** **The Tick Tool - http://www.ticktool.com/index.html**

## 5.0 Folklore Remedies Don't Work

**5.1** Folklore remedies, such as the use of petroleum jelly or hot matches, do little to encourage a tick to detach from skin. In fact, they may make matters worse by irritating the tick and stimulating it to release additional saliva or regurgitate gut contents, increasing the chances of transmitting the pathogen. These methods of tick removal should be avoided.

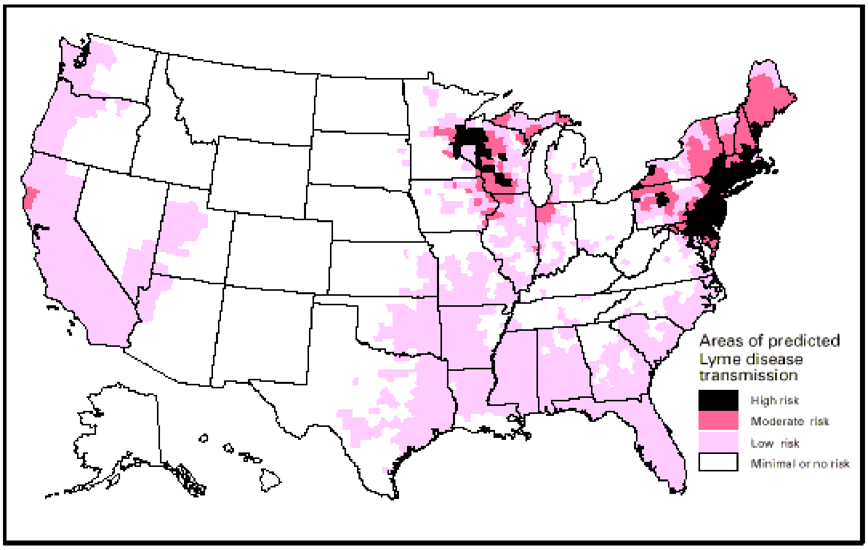
**Information Regarding Common Tick-Borne Diseases and Tick Removal Procedures**

**Table 1**
**Common Tick-Borne Diseases in the U.S. and Information Resources**

| Disease | Tick Species | CDC Informational Web Pages |
|---|---|---|
| Lyme disease | • Black-legged or deer tick<br>• Western black legged tick | http://www.cdc.gov/ncidod/dvbid/lyme/ |
| Ehrlichiosis | • Lone star tick<br>• Black-legged or deer tick<br>• Western black legged tick | http://www.cdc.gov/Ncidod/dvrd/ehrlichia/Index.htm |
| Rocky Mountain spotted fever | • American dog tick<br>• Rocky Mountain wood tick<br>• Brown dog tick | http://www.cdc.gov/ncidod/dvrd/rmsf/index.htm |

## 6.0 Distribution

**Figure 2**
**Distribution Map for Lyme Disease Risk, U.S.**

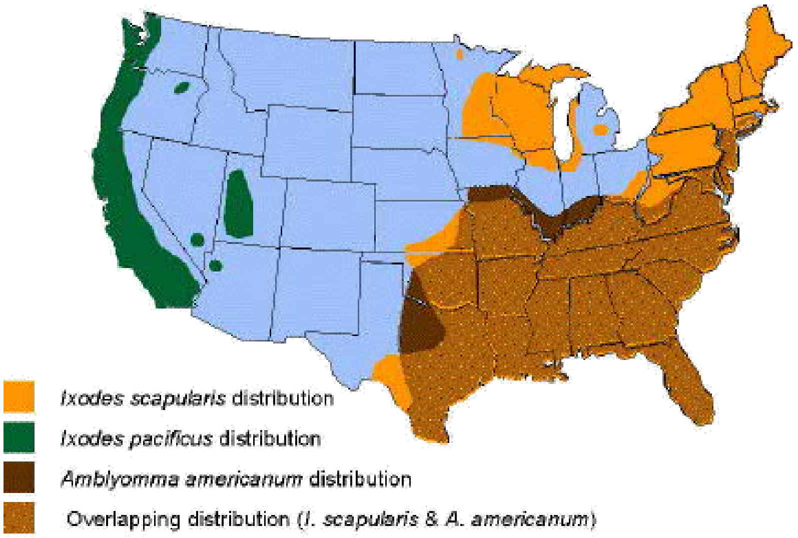



Note: This map demonstrates an approximate distribution of predicted Lyme disease risk in the United States. The true relative risk in any given county compared with other counties might differ from that shown here and might change from year to year. Risk categories are defined in the accompanying text. Information on risk distribution within states and counties is best obtained from state and local public health authorities.

Source: CDC, http://www.cdc.gov/ncidod/dvbid/lyme/riskmap.htm

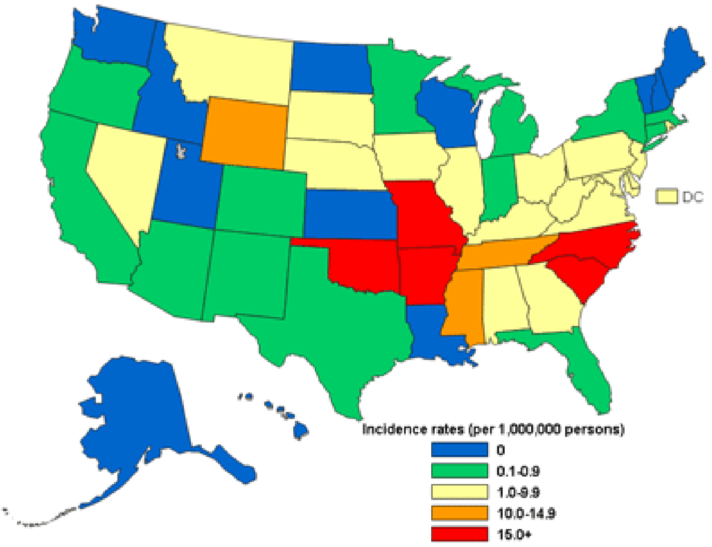
**Figure 3**
**Distribution Map of Vector**

**Tick Species for Human Ehrlichiosis, U.S.**




Source: CDC, http://www.cdc.gov/ncidod/dvrd/ehrlichia/Q&A/Q&A.htm

**Figure 4**
**Distribution Map of Annual Incidence**
**of Rocky Mountain Spotted Fever, U.S**




Data for calendar year 2002

Source: CDC, http://www.cdc.gov/ncidod/dvrd/rmsf/Epidemiology.htm

# S3NA-313-WI3 Poisonous Spider Identification

**Black Widow Spider**

- Abdomen usually shows hourglass marking.
- The female is 3-4 centimeters in diameter.
- Have been found in well casings and flush-mount covers.
- Not aggressive, but more likely to bite if guarding eggs.
- Light, local swelling and reddening of the bite are early signs of a bite, followed by intense muscular pain, rigidity of the abdomen and legs, difficulty breathing, and nausea.
- If bitten, see physician as soon as possible.


**Brown Spiders (Recluse)**

- Central and South U.S., although in some other areas, as well.
- ¼-to-½-inch-long body and the size of silver dollar.
- Hides in decaying wood, baseboards, ceilings, cracks, and undisturbed piles of material.
- Bite either may go unnoticed or may be followed by a severe localized reaction, including scabbing, necrosis of affected tissue, and very slow healing.
- If bitten, see physician as soon as possible.



Exercise care when collecting samples and avoid reaching into areas where visibility is limited. If bitten by a spider, attempt to identify the spider, notify a co-worker or someone who can help should the bite site become painful, discolored, or swollen. Stay calm and treat the area with ice or cold water. Seek medical attention if you have any reactions to the sting such as developing a rash, excessive swelling or pain at the site of the bite or any swelling or numbness beyond the site of the bite.

Additional USA Spider Identification charts are available at http://www.termite.com/spider-identification.html

# S3NA-313-WI4 Mosquito-Borne Diseases

## 1.0 Background

1.1 CDC data indicates that mosquito-borne illnesses, including encephalitis, are a health risk to employees working in outdoor environments.

1.2 Mosquitoes pose a risk of causing infection with various forms of encephalitis and other diseases in AECOM employees. This section will focus on the transmission of encephalitis. West Nile encephalitis is an infection of the brain that is caused by a virus known as the West Nile virus.

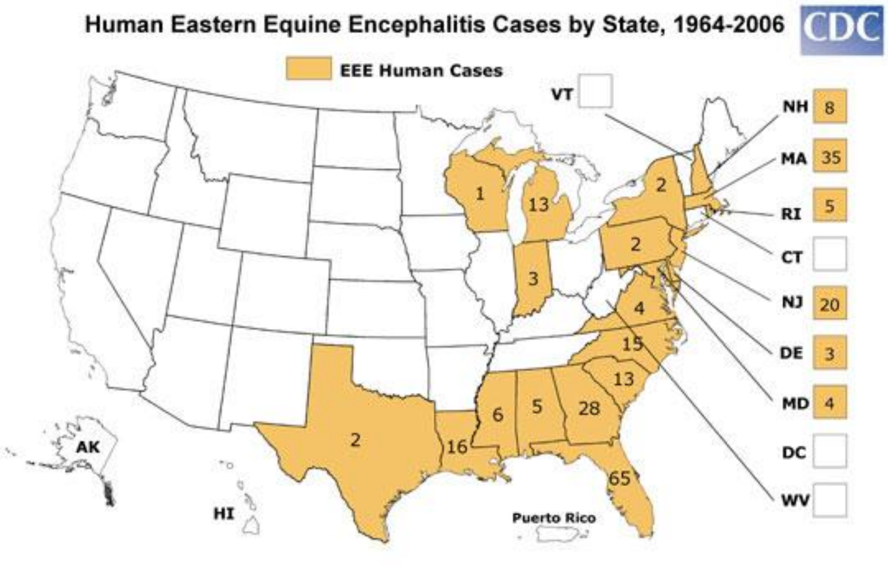
1.3 If other mosquito-borne diseases are identified in the project area, the local Public Health Department and CDC should be consulted to determine what diseases are present and exposure prevention recommendation.

1.4 According to the CDC, arboviral encephalitis is a virus that is “maintained in nature through biological transmission between susceptible vertebrate hosts by blood feeding arthropods”, e.g., mosquitoes. It exists in various forms in global distribution, and in four primary forms in the U.S.: 1) eastern equine encephalitis (EEE), 2) western equine encephalitis (WEE), 3) St. Louis encephalitis (SLE), and 4) La Crosse (LAC) encephalitis; all of which are transmitted by mosquitoes.

1.5 Mosquitoes are known to breed in standing water; therefore, when standing water is found at a job site, actions should be taken to drain the water. Typically, mosquitoes will fly only a quarter of a mile (400 meters) from their breeding location.

## 2.0 Distribution

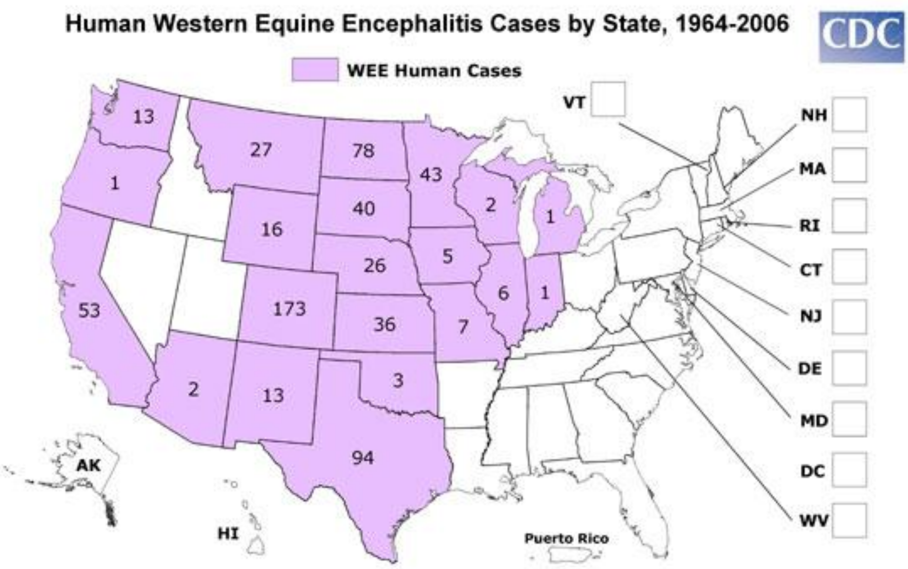
**Figure 1**
**Distribution Map for EEE Cases**




Source: http://www.cdc.gov/ncidod/dvbid/arbor/images/EEE_Map.jpg

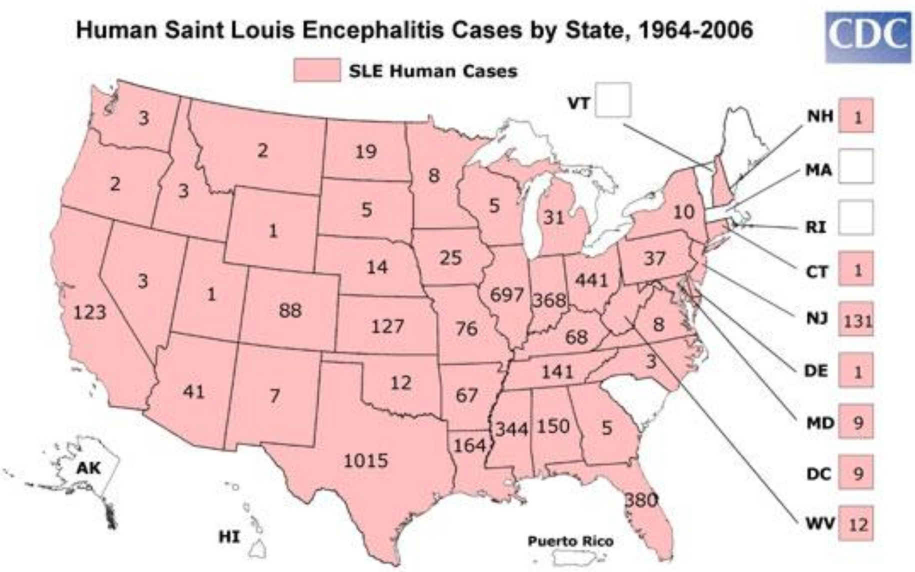
**Figure 2**

**Distribution Map for WEE Cases**



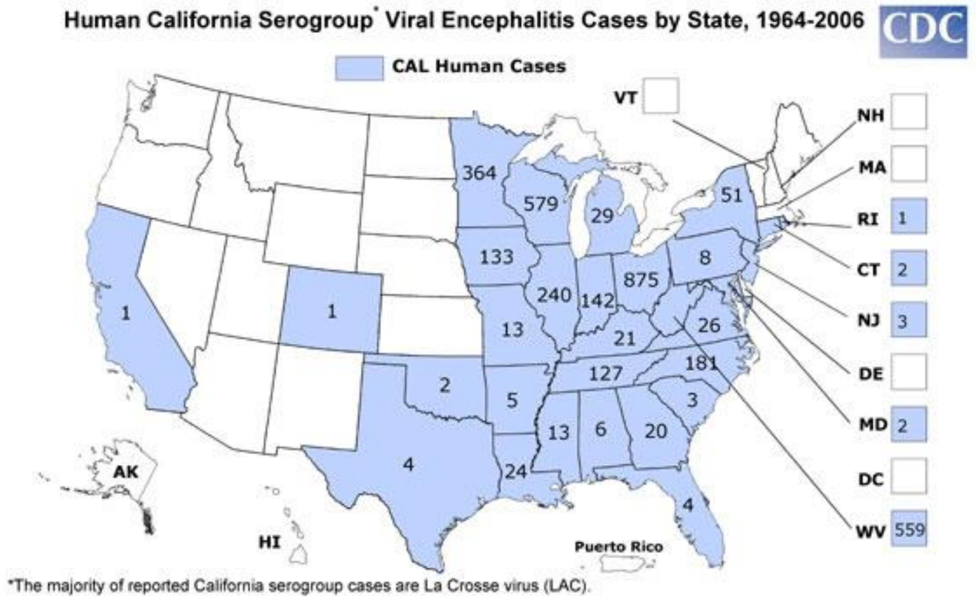

Source: http://www.cdc.gov/ncidod/dvbid/arbor/images/WEE_Map.jpg

**Figure 3**
**Distribution Map for SLE Cases**



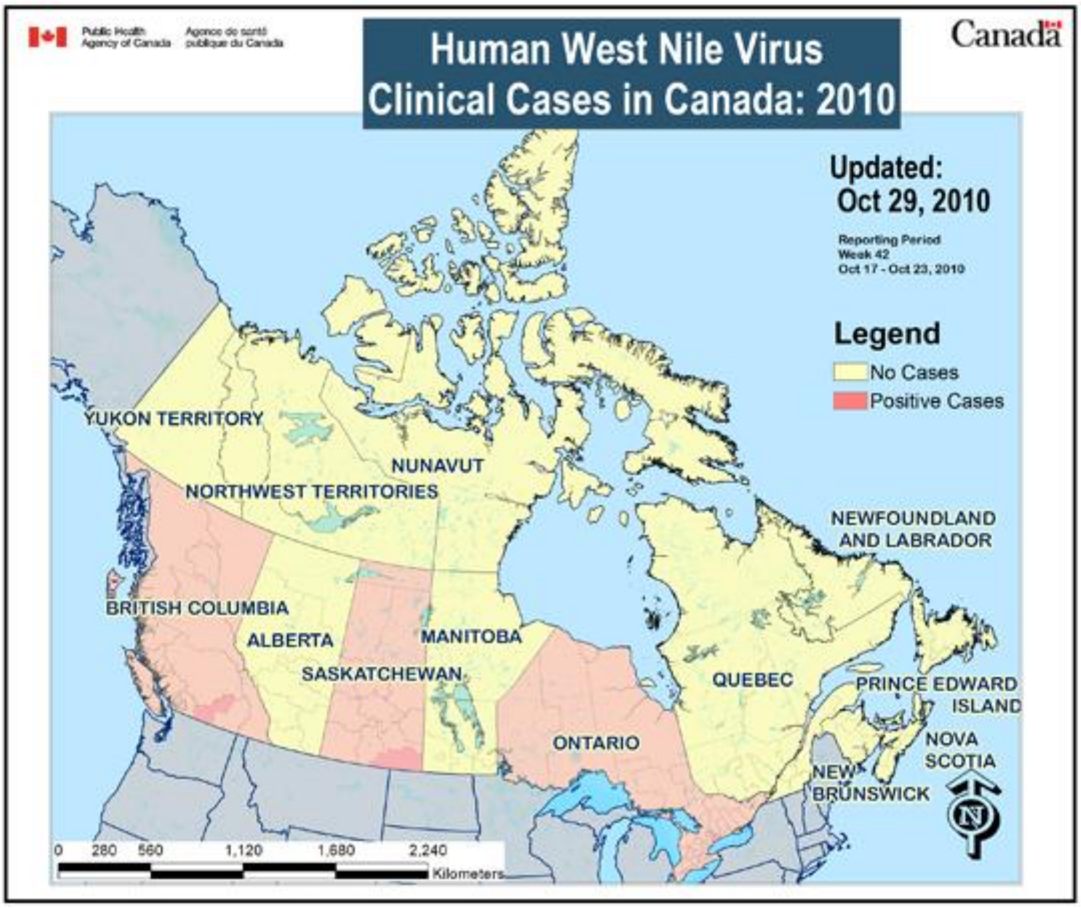

Source: http://www.cdc.gov/ncidod/dvbid/arbor/images/SLE_Map.jpg

**Figure 4**
**Distribution Map for LAC Cases**




Source: http://www.cdc.gov/ncidod/dvbid/arbor/images/LAC_Map.jpg

**Canadian Mosquito Borne Diseases**




**Source: http://www.eidgis.com/wnvmonitorca/**

| **Disease** | **Distribution** |
|---|---|
| California encephalitis | Canada-wide |
| Western equine encephalitis | Western Canada |
| Eastern equine encephalitis | Quebec, Ontario |
| St Louis encephalitis | Ontario, Quebec, Manitoba, Saskatchewan |
| Cache Valley | Ontario, Manitoba, Saskatchewan, Alberta |

Source: Paediatr Child Health. 2000 May–Jun; 5(4): 206–212.

# S3NA-313-WI5 Plants of Concern

## 1.0 Background

1.1 Poison ivy, oak and sumac (poisonous plants) pose a significant threat to AECOM employees due to the dermatitis that results from exposure to the oil on these plants, called urushiol.

1.2 Exposure to urushiol produces a rash that can be irritating and cause the exposed employee to scratch the infected area, increasing susceptibility for an infection to result from the rash.

1.3 It should be noted that each time an employee is exposed to urushiol, it increases the severity of the reaction they will have in subsequent exposures.

## 2.0 Treatment

2.1 In cases that involve severe rashes, medical treatment may be necessary to control the rash.

2.2 Employees that develop a rash as a result of exposure to poison ivy, oak or sumac should report the exposure immediately to their Supervisor, Project Manager and RSHEM.

**Figure 1**

**Distribution Map for Poison Ivy**

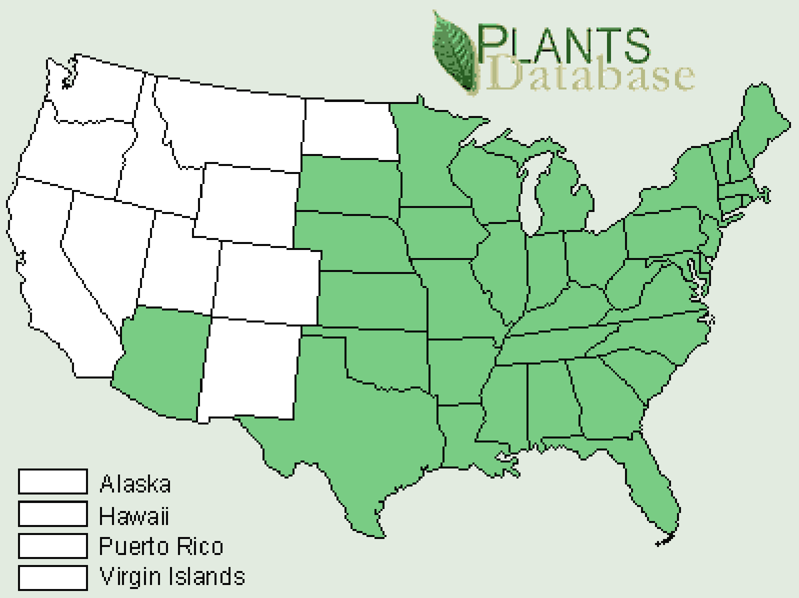


**Figure 2**
**Distribution Map for Poison Oak**

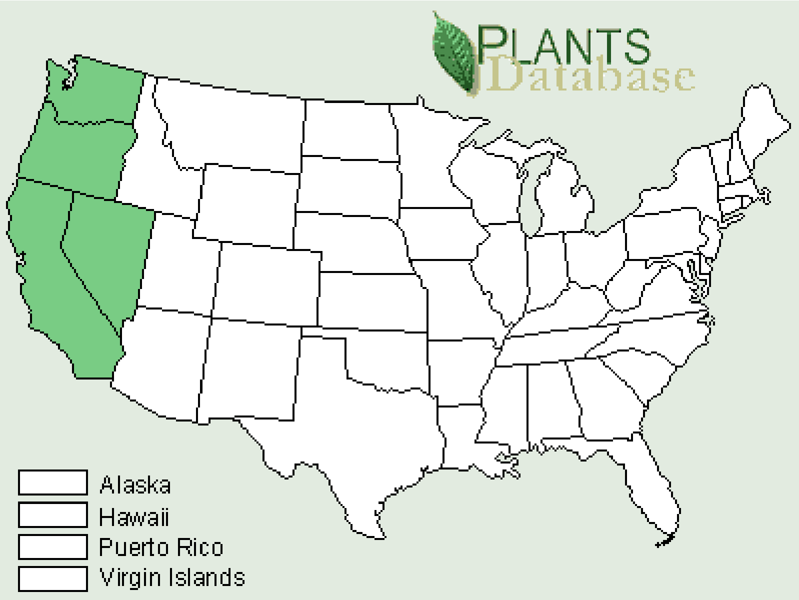
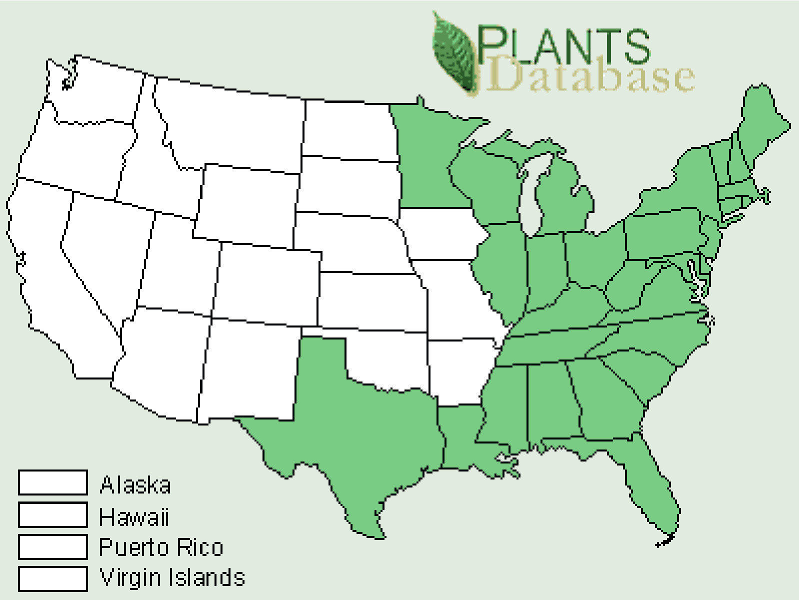



**Figure 3**
**Distribution Map for Poison Sumac**




Source for Figures 1, 2, and 3: http://www.tecnuextreme.com/plant-map.htm

# S3NA-313-WI6 Wild Parsnip Identification

## 1.0 Background

1.1 Wild Parsnip (also known as Poison Parsnip) looks similar to a large carrot plant and is found in open places along roadsides and in waste places throughout the United States and Canada.

1.2 This plant produces a compound that causes severe blistering and discoloration after being exposed to sunlight—a condition known as photodermatitis. That is, when the skin comes in contact with this plant's juice and then is exposed to UV light, a severe burn develops.

## 2.0 Hazard

2.1 Everyone can get burned by wild parsnip. Unlike poison ivy, you don't need to be sensitized by a prior exposure. However, wild parsnip is only dangerous when the juice from broken leaves or stems gets on your skin—therefore, you can touch and brush against the undamaged plant without any danger.

2.2 If one gets some of the sap of Hogweed (or Meadow Parsnip or Cow Parsnip) in contact with skin, it is critical that they stay out of the sun for 8 hours. If one needs to remove the plant they should be completely covered with overalls, gloves, hat and safety glasses.

More information can be found at www.co.becker.mn.us/dept/soil_water/wild_parsnip.aspx

# S3NA-313-WI7 Configuration Clothing for Protection Against Ticks and Insects

## 1.0 Configuration of Clothing

1.1 Loose-cuff trousers must be tucked into socks, wrapped with duct tape (or equivalent) completely around the cuff of the sock up on to the surface of the pant leg to prevent entry of insects between the sock and pants, and preferably reverse-wrapped with "sticky" side out (see figure below).

# S3NA-313-WI8 Insect Repellent Active Ingredient Product Information

## 1.0 Application of Insect Repellent

1.1 Immediately prior to the commencement of work in the field, an AECOM-approved insect repellent shall be applied to exposed skin, and to the outer surface of pant leg cuffs tucked into socks, shirt tails tucked into pants at the waist, and shirt cuffs.

1.2 Table 1 provides a list of AECOM-approved insect repellent active ingredients; employees may utilize any brand containing the minimum concentration of active ingredients as listed.

1.3 All products are registered with the EPA and recommended by the CDC.

1.4 Employees should select the AECOM approved repellent which is best for them based on skin sensitivity/allergies, and personal preference, but be aware that reapplication frequency will be greater for Picaridin and lemon eucalyptus products.

1.5 Employees shall carefully read and comply with manufacturer recommendations and instructions on product labels prior to application. Repellent shall not be applied beneath clothing to minimize the potential for irritation and/or allergic reaction.

1.6 The chemical N,N-diethyl-*m*-toluamide (DEET) shall not be applied to Nomex™ fire retardant clothing as it reduces the effectiveness of the fabric.

**Table 1**
**Approved Insect Repellents**

| Active ingredient and minimum concentration | Products Available | Approximate Duration of Effectiveness | Notes and Web Link to Product Safety Information |
|---|---|---|---|
| Permethrin (0.5%) | -Repel® Permanone<br>-Coulston's Duranon™ | 2 weeks[1] | -Application to clothing and equipment only |
| DEET (23.8%) | -Deep Woods Off! ®<br>-Repel® Sportsmen Formula® | 5 hours[2] | -Cannot be applied to Nomex™ fabric |
| Picaridin (7%) | -Cutter Advanced™ | 4 hours[3] | -Protection equivalent to approximately 10% DEET |
| Oil of Lemon Eucalyptus (30%) | -Repel® Lemon Eucalyptus | 2 hours[2] | -Protection equivalent to approximately 7% DEET<br>-Natural, plant based product |

[1] – New York State Department of Health, 2007
[2] – Fradin and Day, 2002
[3] – Spectrum Brands, 2007

1.7 Repellent shall be reapplied multiple times daily over the course of the day at a frequency identified during the hazard assessment based on manufacturers' recommendations, the approximate effective period provided in Table 1, and other factors such as perspiration, precipitation, etc.

1.8 All approved repellents are available at most department or sporting goods stores.

## Product Safety Information

Facts about the repellants recommended by AECOM are available by clicking on the embedded link.

**National Pesticide Telecommunications Network Fact Sheet: Permethrin and Picaridin**

| Picaridin | Permethrin |
|---|---|
| Picaridin Fact Sheet.pdf | Permethrin Fact Sheet.pdf |

| DEET | Lemon Eucalyptus |
|---|---|
| DEET Fact Sheet.pdf | Lemon Eucalyptus fact sheet.pdf |

# S3NA-313-WI9 New York Department of Health Recommendations for Permethrin Application

## 1.0 Application Recommendations

1.1 Source: New York State Department of Health, 2007. Health Advisory, Tick and Insect Repellents. **http://www.health.state.ny.us/nysdoh/westnile/pdf/2737.pdf**

1.2 Products containing permethrin are for use on clothing only—not on skin. Permethrin kills ticks and insects that come in contact with treated clothes. It is effective for two weeks or more if the clothing is not laundered.

## 2.0 Treat Clothing Only– DO NOT APPLY TO SKIN.

2.1 Read carefully and follow manufacturer's recommendations for application.

2.2 If you accidentally get the product on your skin, immediately wash with soap and water.

2.3 Apply to clothing in a well-ventilated outdoor area, protected from wind.

2.4 Only spray Permethrin products on the outer surface of clothing and shoes before you put them on - do not apply to clothing while it is being worn. Only spray enough product to lightly moisten the outer surface of the fabric causing a slight color change or darkening; do not saturate clothing. Do not exceed recommended spraying times. Pay special attention while treating socks, trouser cuffs and shirt cuffs to ensure proper coverage. Hang the treated clothing outdoors and allow clothing to dry for at least two hours (four hours under humid conditions) before wearing.

2.5 Do not treat clothing more than once every two weeks. Launder treated clothing separately from other clothing at least once before retreating.

2.6 Keep treated clothes in a separate bag. Those who frequent tick or mosquito habitats should consider having a set of clothes, preferably long-sleeved shirt, pants and socks that are used only in such settings. These clothes can be treated with a Permethrin-containing product according to the label directions, worn only when needed, and then placed in a separate bag when not in use. In hot weather, when long-sleeved shirt and pants may be uncomfortable, pants and jackets made of insect netting (either untreated or treated with repellent) can be worn. Such clothes are available in some sporting good stores and through outdoor equipment catalogs.

1. U. S. Environmental Protection Agency. 1999. Office of Pesticide Programs List of Chemicals Evaluated for Carcinogenic Potential-August 25, 1999. Office of Pesticide Programs. Washington, DC.

# S3NA-313-WI10 Bird Droppings Safe Work Practices

## 1.0 Background

1.1 According to the National Institute for Occupational Safety and Health (NIOSH), histoplasmosis is an infectious disease caused by inhaling spores of a fungus called *Histoplasma capsulatum (*abbreviated *H. capsulatum)* that may inhabit accumulated masses of pigeon droppings and excrement of other birds and flying animals. Its symptoms vary greatly, but the disease primarily affects the lungs. Occasionally, other organs are affected. This form of the disease is called disseminated histoplasmosis, and it can be fatal if untreated. The acute respiratory disease form of histoplasmosisis is characterized by respiratory symptoms, a general ill feeling, fever, chest pains, and a dry or non-productive cough. Distinct patterns may be seen on a chest x-ray. Chronic lung disease resembles tuberculosis and can worsen over months or years. If symptoms occur, they may start within 3 to 17 days of exposure, with an average of 10 days. On a positive note, histoplasmosis is not contagious.

1.2 Psittacosis, although primarily a respiratory disease, can cause a wide variety of clinical manifestations. Generally, about 10 days after infection occurs, the clinical illness begins abruptly with fever, chills, weakness, fatigue, muscle pain, anorexia, nausea, vomiting, excessive sweating and difficulty with breathing, headache, backache, and sensitivity to light.

1.3 Hypersensitivity pneumonitis is also known as pigeon breeder's disease.

## 2.0 Symptoms

2.1 The acute form of hypersensitivity pneumonitis is clinically characterized by chills, fever, cough, breathlessness without wheezing, and malaise 4-10 hours after exposure. In general, an acute attack subsides after 18 to 24 hours.

## 3.0 Treatment

3.1 If a person should develop any of the symptoms as noted above, or others, it is important to see a physician and inform him of an exposure to pigeon/bird or bat excrement. A failure to diagnose the preceding conditions could occur if a treating physician is unaware of a patient's exposure to pigeon/bird or bat excrement.

## 4.0 Prevention

4.1 <u>Prior to work in any area where pigeons or other flying animals may nest, a written statement from the client shall be obtained</u> in regards to the potential for, and extent of, accumulation of excrement on/in the structure from pigeons and other winged animals.

4.2 The client shall be asked to provide appropriate details as to the basis for their statement (e.g., date of last visual survey for pigeon/bird or bat excrement accumulation, date of last excrement removal effort, etc.).

4.3 In no case will an AECOM employee or contract employee be permitted to commence structure inspection procedures without project management having received and evaluated the aforementioned written statement from the client.

4.4 According to NIOSH, the best way to prevent exposure to *H. capsulatum* spores during survey and inspection work is to avoid situations where excrement and other potentially-contaminated material can become airborne and inhaled. Therefore, it is preferable that the efforts to determine if, and to what extent, there is an accumulation of pigeon/bird or bat excrement on/in structures, <u>or</u> the efforts to clean-up/removal/disposal of such contaminated material, be left to the client or subcontracted out.

## 5.0 Safe Work Practices

5.1 In those cases where AECOM employees or contract employees are contracted by the client to determine the extent of accumulation of animal excrement in/on structures, the following minimum safety and health precautions shall be taken. (NOTE: precautionary measures are based on recommendations and best practices prescribed in the NIOSH 2004 public document titled *Histoplasmosis – Protecting Workers at Risk*).

5.2 All workers shall wear disposable protective clothing (Tyvek® coveralls). Disposable overalls with hoods shall be donned when working in areas where *H. capsulatum* spore-contaminated material is likely to fall from overhead.

5.3 All workers shall wear disposable shoe coverings fitted with ridged soles made of slip-resistant material to reduce the likelihood of slipping on wet or dusty surfaces. Gloves shall be worn.

5.4 All workers shall wear a full facepiece air purifying respirator fitted with P100 (HEPA) cartridges. If entering an enclosed area in which the extent of excrement contamination is unknown, additional protective measures shall be taken such that workers shall wear a powered air-purifying respirator (APR) with full facepiece fitted with P100 (HEPA) cartridges. Any variance from these requirements must be approved by the Regional SH&E Manager. Workers donning APRs shall be medically screened, cleared, and trained in their proper use in accordance with AECOM safety program standards.

5.5 If contaminated material must be disturbed for purposes of removal/disposal or during the structure inspect process, it shall be wetted down prior to all work and will be rewetted as necessary to minimize airborne dusting.

5.6 After working in *H. capsulatum* spore-contaminated areas and before removing any respiratory protective equipment, workers shall remove all protective clothing and shoe coverings and seal them in a heavy-duty plastic bag for disposal.

5.7 Workers shall observe a high degree of personal hygiene, even if the exposure is casual. Special care shall be taken to wash hands, face, and other areas of exposed skin thoroughly before eating, drinking or smoking.

# S3NA-313-WI11 Large Carnivores

## 1.0 Hazard

1.1 Most wild carnivores in the feline family (cougars, lynx, and bobcat) or the canine family (wolves and coyotes) are more predictable than bears and are not predatory towards humans; however, all wild animals can be dangerous if they feel threatened or if they are sick or starving.

1.2 Most ungulates (deer, moose, elk, and caribou) will avoid humans and will flee as soon as a human is sighted; however, females with young (during May and June) and males during the mating season (September to November) can be very aggressive, especially if provoked.

## 2.0 Personal Protective Equipment

2.1 Noise makers such as bear bangers, whistles and bells can be used as deterrents for an approaching animal.

2.2 Pepper (bear) spray can be used to ward off an imminent attack.

## 3.0 Safe Work Practice

3.1 Most negative encounters with ungulates or carnivores can be avoided with a few key preventative measures:

3.1.1 When working in wilderness isolation, always travel in pairs and make lots of noise.

3.1.2 Always store food in air-tight containers away from sleeping areas (if camping) and never carry strong smelling foods which could attract animals.

3.1.3 Keep your eyes open for fresh animal signs which may indicate a dangerous situation:

- Extensive fresh rubbing on branches in the fall might indicate the presence of a rutting male ungulate that may become aggressive to defend a potential mate.
- A fresh kill or carcass which might indicate the presence of a carnivore that may become aggressive to defend its food.

3.2 Maintaining a distance of at least 30 metres (100 feet) allows large animals an escape route. If you notice any signs of aggression or behavioral changes, you should move away to a safe location. Wildlife should not be enticed by reaching out or simulating calls.

3.3 Pets should be kept secure and away from wildlife as their actions can provoke an attack. Moose, deer and other wildlife may appear quite docile; however, if a dog makes them feel threatened, their behavior can become unpredictable.

### 3.4 If you are approached by a carnivore (wolf, coyote, or cougar):

3.4.1 Pick up small children immediately.

3.4.2 Try to appear bigger, hold your arms or an object over your head.

3.4.3 Face the animal and retreat slowly. Do not run or play dead.

3.4.4 Maintain steady eye contact with the animal.

3.4.5 If the animal continues to approach, deter an attack by yelling, waving a stick or throwing rocks.

3.4.6 If you are attacked, fight back. Hit the animal with a heavy stick or rock.

**3.5 If you are approached by an ungulate (moose, elk, deer, bison or caribou):**

3.5.1 An angry moose, elk or deer will face you with its head and ears lowered.

3.5.2 Back away slowly.

3.5.3 Look for something to get behind like a tree or a car. You can go faster around an obstacle than the ungulate can.

3.5.4 An ungulate is more likely to bluff charge but if it continues the charge and you are attacked in the open, curl up in a ball on the ground. Always protect your head with your arms and lie still.

3.5.5 Stay still after the attack until the ungulate moves away.

# S3NA-313-WI12 Bear Safety

## 1.0 Hazard

1.1 An encounter with a bear of any species can have a wide variety of outcomes, ranging from a simple sighting, to a false charge, to a serious mauling or even death. Consequently, the risk of a bear encounter must be taken very seriously.

1.2 The hazard or risk associated with a bear encounter varies significantly depending on the location. It is important to research the project area before field work commences to determine the expected probability of encountering a bear. Remoteness from urbanized areas should not be a criterion, as bears have been encountered within city limits, especially near landfills.

1.3 The risk associated with a bear encounter also varies with the species of bear, the season, and the circumstances under which the bear is encountered.

1.4 Preparing staff for any type of encounter is key to managing the risk.

## 2.0 Personal Protective Equipment

2.1 The best deterrent of a “bad bear encounter” is knowledge: a good understanding of the ecology and the behavior of the bears that will likely be encountered.

### 2.2 Bear Spray and Bear Bangers

2.2.1 Staff must have hands-on training for the safe use of bear spray (a pre-season practice run is a good use of expired bear spray).

2.2.2 Prior to work commencing, staff must ensure that the bear spray they are carrying is still valid and not past its expiration date.

2.2.3 During travel, bear spray must be sealed in an airtight container or bag and must not travel in the cab of a vehicle, aircraft, or helicopter.

### 2.3 Firearms

2.3.1 Environments and conditions which pose a high risk of bear encounters, may warrant the use of an armed wildlife monitor. Project managers, in consultation with appropriate project staff and SH&E Management, are responsible for determining the level of risk for their projects and whether or not such measures are required.

2.3.2 A person hired as an armed bear monitor must be properly trained in wildlife monitoring as well as certified in the expert usage of firearms.

2.3.3 The usage of an armed bear monitor is intended only as an additional precautionary measure to be used in specific environments to ensure the protection of field staff; staff should still be equipped and trained appropriately for the risk.

## 3.0 Restrictions

3.1 Staff must not work alone in areas where there is a medium or high risk of a bear encounter.

3.2 Generally, AECOM personnel shall not carry a firearm and attempt to function as a wildlife monitor and/or perform their professional duties. This can only be over-ridden with expressed permission of Regional Management.

## 4.0 Training

4.1 In-house Bear Awareness training must be undertaken by all field staff who work in bear country every three years at a minimum, or more often as required.

4.2 The Bear Awareness training involves testing and improving the employee’s knowledge about bear encounters, watching videos regarding bear awareness and behavior, and participating in group discussions about how to avoid and how to respond to bear encounters.

4.3 Specific considerations are given to black bear, grizzly bear, and polar bear encounters.

## 5.0 Safe Work Practice

5.1 Staff must be aware of wildlife signs and avoid wildlife encounters.

### 5.2 Bear Sign

5.2.1 **Fresh tracks**: It is often better to see the bear's tracks than to see the actual bear. If you can tell the direction that the bear is travelling in, it is prudent to change your course of direction. Bears will travel down the same pathways as people or other large animals use. If you have a clear track you can determine which type of bear has passed through the area. If you see more than one track, you can tell that it is possibly a female with cubs. Avoid females with cubs!

5.2.2 **Scat:** Bear scat will look different depending upon the bear's diet. Close examination of bear scat can sometimes give you an indication of what the bears have been eating at that time of year. If the scat contains remnants of human garbage, there is a human food conditioned bear in the area. These bears associate people with food and can be the most dangerous type of bear to encounter.

5.2.3 **Animal carcasses**: IF YOU COME ACROSS A CARCASS, LEAVE THE AREA IMMEDIATELY. Grizzly bears will often cover their kills for a few days and let it rot, then come back and eat it. THE BEAR WILL STAY CLOSE BY. Grizzly bears will defend their kill and this is a situation that could prompt a defensive attack by a bear.

5.2.4 **Torn-Up Logs and Stumps**: Bears will forage for insects in dead logs and rotting trees. You will often see torn up logs and stumps, evidence of their foraging.

5.2.5 **Evidence of Digging**: Holes dug into the ground are often made by grizzly bears digging for roots or ground squirrels. In particular Grizzlies will dig for food in the early spring soon after they leave their dens.

5.2.6 **Claw Marks on Trees**: Claw marks can be left on trees by black bears when they have climbed up a tree. Grizzly bears will also leave claw marks on trees and on the ground. Bears will often chew a small tree or a sign-post, so watch for signs of chew marks along the trail.

5.2.7 **Hair on Trees**: Bears will rub against trees, usually trees with rough bark, to scratch themselves. You can find evidence of bears by the hair left in the tree's bark. The higher the hair left on the tree, the bigger the bear. Remember that the bear will often stand on its back legs to scratch its back on the tree.

5.2.8 **Daybeds:** Bears will be most active in the early morning and in the evening. It would be prudent for field staff to restrict their field activities during the bear's most active foraging times as much as possible. During the heat of the day, bears will rest in daybeds. These can be shallow depressions of piled up leaves in the forest, trampled vegetation, a shallow scrape or a hole. Daybeds are usually located in cool places. Bears will make daybeds along streams and rivers. Daybeds are often associated with feeding places and therefore should be avoided.

### 5.3 Prevention

5.3.1 Your best defense against bears is to actively practice bear avoidance techniques when working in the field. You can prevent chance encounters by taking the following precautions:

- Know the areas and habitats bears use at different times of the year, and attempt to avoid such areas or be extremely cautious if you have to travel through them.
- Contact the local Fish & Wildlife Office to get current information on the bears in the area. Ask what other camps are in the area and if they are following good bear avoidance practices. (i.e., do they keep a clean camp?) If there are nearby human food sources available, e.g., an open dumpsite, the local bears may not be afraid to approach your camp.
- Always be aware of your surroundings. Stay alert. Watch for signs of bears along your route.
- Use binoculars to look around for bears when you are in open terrain.
- Never approach a bear if you see one feeding in the distance.
- Note the behavior of other wildlife in the area. Flocks of ravens can alert you to a possible animal carcass, and perhaps a bear. The area should be avoided. Bird or squirrel alarm calls might be telling you that a bear is near.
- Whenever possible, travel in daylight and try to avoid areas with restricted visibility. (dense brush)

- Make lots of noise, especially when travelling in dense vegetation. Sing, shout, or talk loudly. You can carry portable air horns or cans of rocks. (Please note that bear bells are not effective – they do not make enough noise to warn a bear that you are approaching. You need to be loud so the bear can hear you coming!) Remember that the noise you make can be masked by loud natural sounds such as the wind or water. Therefore it is possible that the noise you make can go unnoticed by a bear whose attention is focused on feeding. You must make every attempt not to surprise a bear. In areas of loud natural noise, be louder!
- Stay together and travel in groups. Bears are less likely to attack groups of people. When travelling in groups, stay close together. Being in a group doesn't help if the individuals have spread apart along the trail!
- Pets should not accompany you when you are travelling in bear country. If you must take your pet, keep the animal on a short leash at all times. Unleashed dogs will harass bears and once scared, run back to their owner with an angry bear in pursuit.
- Do not wear perfumes or cosmetic products when you are travelling in bear country. Do not mask your human scent.
- Women should use internal sanitary protection, (i.e. tampons) when menstruating and burn all used sanitary products after usage. Keep all used sanitary supplies in sealed bags until you have a chance to burn.
- Children should be kept very close by in bear country.
- Carry bear deterrents and know their limitations. Be familiar with how to use the deterrents, how to transport the deterrent safely and under what conditions it is most effective. Carry the deterrent in a belt, out in front and ready to grab at a moment's notice, never in your backpack.

### 5.4 Field Workers: Precautions in Bear Country

5.4.1 Field workers should take extra precautions when working in bear country.

5.4.2 Make every effort to go out into the field with another person; you should not be working alone in the field. One person can act as a lookout for the other. Keep watch for bear signs.

5.4.3 Never approach a bear.

5.4.4 Report where you are going and when you will return every time you leave camp. Have a plan of action if someone does not report back to camp at a specified time.

5.4.5 Bears do get used to a camp's schedule and you will have fewer surprise encounters if everyone in the camp comes and goes at the same time every day.

5.4.6 Take a two-way radio with you when you go out into the field.

5.4.7 Always carry bear deterrents with you in the field and understand each deterrent's limitations. Carry your deterrents on a belt, out in front and ready to use instantly. Do not carry your deterrents in your backpack.

5.4.8 Keep any food that you take with you sealed in odor-proof/bear proof containers. Make every attempt to take odorless food with you, not something with a heavy scent.

5.4.9 Pack out any garbage in odor-proof containers and burn once you return to camp.

5.4.10 The noise of an ATV or skidoo can scare off a bear. Starting the machine and revving it up can scare off a curious bear. DO NOT CHASE A BEAR WITH AN ATV OR SKIDOO. You may need to drive the ATV around in circles to scare off the bear, but do not chase the bear.

5.4.11 Take extra precautions when travelling along lakes or stream beds; bears use streams and river beds as travel routes. Be sure to carry noise makers.

5.4.12 Limit your workday so you are not out in the early morning or evening when bears are most likely to be foraging.

5.4.13 All Field Workers should be proficient in First Aid. Do not go out into the field without first aid training.

5.4.14 All Field Camps should have a First Aid Kit.

5.4.15 All Field Camps should have means of communication with local ambulance or Air-ambulance personnel.

5.4.16 A person's best defense against bears is to avoid them. If this is not possible, then being heard, smelled, or seen may lessen your chances of surprising a bear and/or provoking an attack.

5.4.17 All wildlife should be respected, avoided, and not harassed at any time.

5.4.18 Cooking in remote areas should be avoided. Any food should be stored in airtight containers and all garbage should be managed appropriately: “pack it in, pack it out”.

5.4.19 A bear in camp or within human structures is not a chance encounter. If this bear challenges you, you must fight, scream, and do whatever is necessary to live, no matter what species the bear is!

5.4.20 In general, there are two types of bear encounters: Defensive and Non-defensive for grizzly bears and black bears. Your response will vary based on your assessment of the situation (your training will help you in identifying these situations and the appropriate response).

## 6.0 Encounters

### 6.1 General Recommendations When Encountering a Bear

6.1.1 Consider your surroundings and assess the situation before you act.

6.1.2 Remain calm. Do not turn your back to a bear.

6.1.3 DO NOT RUN – You will trigger the bear’s natural response to chase you. Bears are extremely fast and you cannot outrun a bear. (They are as fast as an Olympic sprinter, so if you are not faster than an Olympic sprinter, don’t run! They can run 40 km/hr and you can’t!) You cannot outswim a bear either.

### 6.2 Bear Encounters in the Field

6.2.1 Your response will depend upon the type of encounter.

6.2.2 There are several different encounters listed.

6.2.3 Bears are more predictable than once believed and you can determine your best course of action in a confrontation by understanding the bear’s characteristics and motivation. There are two pieces of information you should be aware of in any bear encounter:

- The type of bear you are dealing with; and
- The reason for the encounter.

6.2.4 Some people believe that when you stand your ground against a predatory black bear attack, the bear will feel threatened and leave. This has been effective in some cases. HOWEVER, it is not effective against a grizzly bear predatory attack and it is very difficult to know when it will be effective against black bears. Polar bears do not follow the same behavioral patterns as grizzly and black bears, they are almost always aggressive and will not back down. Special considerations must be given to projects where polar bear encounters are anticipated.

6.3 **If you can leave undetected:**

6.3.1 Leave the area quietly in the same direction that you came from.

6.3.2 Move while the bear’s head is down. Stop moving when the bear lifts its head to check its surroundings.

6.3.3 Stay downwind so the bear will not pick up your scent.

6.3.4 When you have moved a safe distance away, you can either watch and wait until the bear leaves or make a wide detour around the bear.

6.3.5 If the bear is unaware of you and approaching: Allow the bear the right of way.

6.4 **If you cannot leave undetected:**

6.4.1 Let the bear know that you are present by smell first; therefore move upwind so they can pick up your scent.

6.4.2 If it is possible, try to keep the bear in your sight. Watch to see if the bear leaves when it smells that a person is nearby.

6.4.3 Attempt to move out of the way without being noticed by the bear. If you cannot do this, talk loudly to let the bear know where you are.

6.5 **If the bear is aware of you but in the distance:**

6.5.1 Remain calm.

6.5.2 Continue walking slowly in the same general direction, but head away from the bear.

6.5.3 DO NOT RUN. The bear can quickly outrun you if it is so inclined.

6.5.4 If the bear begins to follow you, drop your pack or some article, (not food) to distract the bear. This may distract the bear long enough for you to escape. If you drop food for the bear – you will help the bear associate food with humans and teach it that aggressive behaviour will be rewarded with food.

6.5.5 If it is a grizzly following you, climb a tree if there is a large tree around. Although grizzlies can climb trees, they are often not motivated enough to try. Very large grizzlies are not able to climb trees well. If grizzlies climb, they can go 3 to 4 meters. Grizzlies will try and push trees over so do not climb a small tree.

6.6 **If the bear is aware of you and close:**

6.6.1 A bear will feel threatened in a close confrontation. The bear's natural tendency will be to reduce or to remove the threat. Assist the bear by acting as non-threatening as possible.

6.6.2 Do not make direct eye contact with the bear.

6.6.3 Do not make any sudden moves.

6.6.4 Do not run!

6.6.5 The bear needs to identify you as a person, so talk in low tones and slowly wave your arms over your head.

6.6.6 Attempt to give the bear an opportunity to leave. Be sure the bear has an open escape route. Do not corner a wild animal.

6.6.7 Try to back away slowly and/or climb a tree if appropriate.

6.6.8 Attempt to deter the bear if you are in a safe position.

6.7 **If the bear is close and threatening:**

6.7.1 If you have a deterrent such as a bear banger or bear spray, be prepared to use it depending on how close the bear is. Try to scare the bear off.

6.7.2 If you do not have a deterrent, or if using the deterrent is not successful, act as non-threatening as possible.

6.7.3 Talk to the bear in a calm authoritative tone of voice.

6.7.4 Do not startle or provoke the bear by making sudden moves.

6.7.5 Never imitate the bear's aggressive sounds, signals or posture. The bear is attempting to establish dominance and imitating its moves is a challenge to its dominance.

6.7.6 Back slowly away from the bear and drop a pack or some other article in order to distract the bear momentarily.

6.7.7 Remember that the bear may be defending cubs that you have not yet seen or they have a food cache nearby. Attempt to look as non-threatening as possible.

6.8 **If the bear is very close and approaching:**

6.8.1 A distance of less than 50 meters in an open area and closer in a forested area.

6.8.2 If the bear continues to approach, use your deterrent.

6.8.3 If the bear does not respond to the deterrent you must now STAND YOUR GROUND!

6.8.4 If the bear continues to approach and is acting aggressive, YOU MAY HAVE TO SHOOT if you are carrying a firearm.

6.9 **If the Bear Charges!**

6.9.1 A bear will charge you at high speed down on all four legs and often crouched low to the ground.

6.9.2 Bears do not charge when standing up on its hind legs.

6.9.3 Many charges are bluffs and the bear will often stop or veer off just at the last minute. It is difficult to know if the bear is bluff charging or not until it gets very close.

6.9.4 When faced with a charging bear you have two options:

- Use your bear deterrent; or
- Roll into a ball and cover your neck and head with your arms if you are unarmed and have no other choice.

## 6.10 Playing Dead:

6.10.1 Note: Playing dead is a very controversial topic among seasoned field personnel. Some will tell you to never play dead in any situation, others will swear that it is the only thing you should do. Playing dead is a personal choice that you will have to make.

6.10.2 If you play dead it is possible that you can prevent serious injuries if a chance encounter with a bear results in an attack. Playing dead may reduce the threat that you represent to the bear.

6.10.3 If you decide to play dead, it is important to protect your vital areas. The older information that is still found online states that the person should roll into a ball to protect their vital organs. This has been replaced and you are now advised to lie in the prone position. Lie flat on your stomach and lace your fingers behind your neck (to protect it), Spread your legs apart to provide stability if the bear tries to turn you over. Stay in this position. If the bear manages to roll you over, immediately roll back onto your stomach to protect your face, neck and vital areas. Do not try to resist or struggle as this will intensify or prolong the attack. Once the attack is over, DO NOT MOVE until the bear has left the area. Look around and be very sure that the bear is gone before moving. (If the bear is a female with cubs, she will leave and move her cubs to safety.) If the bear covers you with leaves and vegetation, it probably thinks you are dead. Grizzly's will often cover their prey with vegetation and leave the carcass to ripen for a few days.

6.10.4 It is important to note that if the bear attack is prolonged or if the bear begins to eat you, the attack has changed from what you may have first believed to be a defensive attack, to a predatory attack. Fight back in a predatory attack. Concentrate your efforts on the face, eyes and nose of the bear.

# S3NA-313-WI13 Small Mammals

## 1.0 Hazard

1.1 Working in the field either directly or indirectly with small mammals has inherent risks of injury or exposure to zoonotic diseases (infectious diseases that can be transmitted from animals to humans) that all field staff need to protect themselves against.

1.2 The risks are usually higher when there is direct contact with a wild animal, either through a break in the skin (blood), saliva, or excrement; however, there are also risks through air-borne diseases (e.g., Hantavirus).

1.3 Obviously, wildlife biologists directly handling wildlife, dead or alive, or working with wildlife feces or in enclosed habitats (such as caves), have an increased risk of exposure to a wider range of zoonotic diseases and should take extra precautions.

## 2.0 Personal Protective Equipment

2.1 Full-length clothing (long sleeves and pants).

2.2 Insect repellent.

2.3 Respiratory equipment (when directly handling wildlife).

2.4 Gloves (when directly handling wildlife).

## 3.0 Restrictions

3.1 Wildlife handling must only be completed under direct supervision of an experienced individual.

## 4.0 Training

4.1 Any staff that will be handling wildlife must be adequately trained and/or supervised by a wildlife biologist experienced in the job task.

## 5.0 Safe Work Practice

5.1 Wild animals can carry a variety of diseases that humans can contract: viral, parasitic, bacterial, and protozoal. Basic PPE such as full-length clothing, gloves and a respiratory mask will greatly reduce the risk of exposure.

5.2 Whenever a wild animal must be handled, the procedure must be accomplished as safely and quickly as possible.

5.3 Proper techniques must be employed to avoid or minimize the risk of personal injury while, at the same time, avoiding or minimizing injury to the animal.

5.4 Gloves, catch sticks, caging, and other appropriate equipment may be necessary when handling a wild animal. Most of these animals will be extremely stressed, resisting every restraint attempt.

5.5 In the unfortunate circumstance that a person is bitten or scratched, he or she should cleanse the wound thoroughly with soap and flush with water immediately, providing for a mechanical removal of potentially infective organisms. This should be followed by cleansing under medical supervision and consultation with a physician to consider the potential exposure to the rabies virus.

## 6.0 Rabies

6.1 You will not be able to accurately determine if an animal has rabies simply by observation as traditional symptoms of rabies (foaming at the mouth, biting, etc.) do not occur in all animals nor at all stages. There are some mammals that are at a higher risk than others for the rabies virus, such as raccoons, skunks, stray cats and dogs, foxes, coyotes, rodents. and bats; however, any mammal can contract the virus.

6.2 Rabies is contracted by contact of an infected animal's saliva with an open wound – a bite or a scratch.

6.3 Symptoms of rabies in humans usually do not present themselves for a minimum of 10 days to a year or longer (the average is 30 to 50 days). Symptoms are typical of a flu, including malaise, loss of appetite, fatigue, headache, and fever. Over half of all patients have pain (sometimes itching) or numbness at the site of exposure. They may complain of insomnia or depression. Two to 10 days later, signs of nervous system damage appear; hyperactivity and hypersensitivity, disorientation, hallucinations, seizures, and paralysis.

6.4 Because rabies is so difficult to detect and positively identify, it is very important to consult a physician immediately. If rabies is a possibility, begin treatment with the rabies vaccine as soon as possible (unlike other vaccines, rabies vaccination begins after exposure because the virus takes a comparatively long time to induce disease).

## 7.0 Hantavirus

7.1 Rodents can carry a variety of diseases; of notable concern is the North American hantavirus which can cause Hantavirus Pulmonary Syndrome (HPS).

7.2 A common host of the hantavirus is deer mouse and related species (*Peromyscus spp*.), which are common throughout much of North America.

7.3 Although infection is rare, it can be fatal and; therefore, it is necessary that risk of exposure be minimized. Infection can be spread to humans when they:

7.3.1 Breathe air contaminated by deer mouse saliva, urine or feces containing infectious hantaviruses; or

7.3.2 Accidentally rub eyes, mouth or broken skin with hantavirus-infected deer mouse saliva, urine or feces.

7.4 The following precautions will be taken for all field operations:

7.4.1 Limit exposure to soils handling and use gloves where appropriate.

7.4.2 Wash or sanitize hands often throughout the day and before meals.

7.4.3 Equipment bags, storage areas, and vehicles will be inspected daily for signs of deer mouse infestation.

7.4.4 Rodent-proof storage containers will be used when practical.

7.4.5 Do not enter buildings infested with deer mice without adequate respiratory protection.

7.4.6 Droppings should never be removed by vacuuming or sweeping. Wetting down an area with a mixture of 1:9 household bleach and water solution will reduce risk of airborne exposure.

7.5 If flu-like symptoms develop three days to six weeks after exposure to rodents, a doctor should be contacted immediately (mechanical ventilation is the primary method of treatment).

## 8.0 References

8.1 Trapping and Tagging Small Mammals. A RIC Standard for British Columbia. 1993. Dr. Todd Zimmerling.

# S3NA-313-WI14 Snakes

## 1.0 Hazard

1.1 **Snakes have the ability to inject venom.** A bite from a venomous snake, which may inject varying degrees of toxic venom, is rarely fatal but should always be considered a medical emergency.

## 2.0 Personal Protective Equipment

2.1 Long pants and shirts.

2.2 Heavy gloves if staff will be handling debris or be close to the ground.

2.3 Rubber boots, or boots that fully cover the foot (not sandals!) and preferably are at least 10" high.

2.4 Snake Chaps that cover at least the shin.

2.5 Personal first aid kit.

## 3.0 Restrictions

3.1 Staff must not work alone in areas where the risk of a snake encounter is high.

## 4.0 Training

4.1 Staff must be notified of the hazard before work commences.

## 5.0 Safe Work Practice

5.1 Staff working in areas known to be inhabited by venomous snakes should take extra precautions, be able to identify the local snake species, and understand the best practices for administering first aid.

5.2 Most snakes in Canada are non-venomous; and most snake bites are not fatal, only painful. Learning to identify snake species will assist you in responding appropriately to an encounter, and will assist medical professionals in determining if antivenin needs to be administered if anyone is bit.

5.3 Most snakes are non-aggressive and will only attack if immediately threatened.

### 5.4 Prevention

5.4.1 Before venturing out into the wilderness, familiarize yourself with the snakes in your area, both venomous and non-venomous species.

5.4.2 Learn which habitats the venomous species in your region are likely to be encountered in, and use caution when in those habitats.

5.4.3 Try as much as possible not to take a snake by surprise.

5.4.4 Stay on trails where possible, and watch where you place your hands and feet, especially when climbing or stepping over fences, large rocks, and logs, or when collecting firewood. Take care when overturning any objects on the ground when in snake country.

5.4.5 If you see a snake, give it as much room as possible. Most snakes have a strike distance that is only half the length of their body.

5.4.6 If you get very close to a rattlesnake, hold very still until it calms down and starts to move away. Then slowly move backwards until you are at least one snake-body length away.

### 5.5 Treatment

5.5.1 Venomous snakebites are rare, and they are rarely fatal to humans. Of the 8,000 snakebite victims in the United States each year, only about 10 to 15 die. In Canada the number of snake bites each year is very small. However, for any snakebite the best course of action is to get medical care as soon as possible.

5.5.2 Try to keep the snakebite victim still, as movement helps the venom spread through the body.

5.5.3 Keep the injured body part motionless and just below heart level.

5.5.4 Keep the victim warm, calm, and at rest, and transport him or her immediately to medical care.

5.5.5 Do not allow him to eat or drink anything.

5.5.6 If medical care is more than half an hour away, wrap a bandage a few inches above the bite, keeping it loose enough to enable blood flow (you should be able to fit a finger beneath it). Do not cut off blood flow with a tight tourniquet. Leave the bandage in place until reaching medical care.

5.5.7 If you have a snakebite kit, wash the bite, and place the kit's suction device over the bite. (Do not suck the poison out with your mouth.) Do not remove the suction device until you reach a medical facility.

5.5.8 Identify the snake that caused the bite to determine if it is venomous, and if antivenin needs to be administered. Do not waste time or endanger yourself trying to capture or kill it. Note the shape & color of the snake's head.

5.5.9 If you are alone and on foot, start walking slowly toward help, exerting the injured area as little as possible.

- Note that there are several species of snakes that superficially resemble rattlesnakes. Several species, including Bull, Milk, Fox, and Rat Snakes will even rattle their tails when startled.
- Massasauga Rattlesnake is recognized as a Threatened Species in Ontario and it is an offence to harass, , or destroy the habitat of this species.
- One scorpion species, the Northern Scorpion (*Paruroctonus boreus*) occurs in semi-arid areas of southern British Columbia, Alberta, and Saskatchewan. It carries a stinger on the end of its tail. The sting is painful but not life threatening unless there is an allergic reaction.

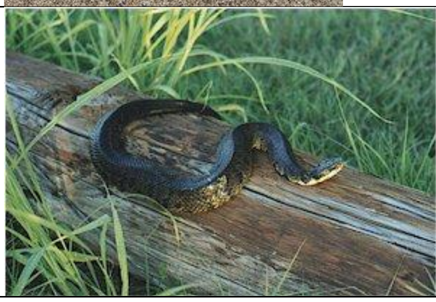
# 6.0 Species

## 6.1 Venomous Snakes in Canada

| | |
|---|---|
| Eastern Massasauga Rattlesnake (*Sistrurus catenatus*) found around Wainfleet, Windsor, Bruce Penninsula and eastern Georgian Bay in Ontario. |  Eastern Massasauga Rattlesnake picture by Michael Redmer/Courtesy Lincoln Park Zoo |
| Northern Pacific Rattlesnake (*Crotalus viridis*) found primarily in Okanagan and Thompson River valleys of southern British Columbia. |   |

| | |
|---|---|
| Prairie Rattlesnake (*Crotalus viridis*) found in south eastern Alberta, and south western Saskatchewan. |  |

## 6.2 Venomous snakes in the U.S.

| | |
|---|---|
| Rattlesnake(*Crotalus cerastes)* found mostly concentrated in the southwestern United States, they extend north, east and south in diminishing numbers and varieties. Every contiguous state has one or more varieties of rattlesnake.<br><br>The rattlesnake is found in many different biomes ranging from along the coast at sea level, the inland prairies and desert areas to the mountains at elevations of more than 10,000 feet.<br>Species include: Sidewinder, Santa Catalina, Western, Mojave, Red Diamond, Western Diamond, Ridge Nosed, Eastern Diamondback, and Pigmy. |  Western Rattlesnake<br> Eastern Diamondback |
| Copperhead (*Agkistrodon contortrix*) is the most common venomous snake found in the eastern US. It can be found in the states of Texas, Oklahoma, Kansas, Missouri, Arkansas, Louisiana, Mississippi, Alabama, Georgia, Florida, South Carolina, North Carolina, Tennessee, Kentucky, Virginia, Illinois, Indiana, Ohio, Iowa, Pennsylvania, Maryland, New Jersey, Delaware, New York, Connecticut, and Massachusetts. |  |
| Cottonmouths (water moccasins) (*Agkistrodon piscivorus)* found in the eastern United States from Virginia, south through the Florida peninsula and west to Arkansas, eastern and southern Oklahoma, and east and central Texas.. |  |

| | |
|---|---|
| Coral Snake (*Micrurus sp.)* found in the southern range of many temperate US states including North Carolina, Georgia, Alabama, Mississippi, Louisiana, Texas, Arkansas, Kentucky, Arizona, and New Mexico. |  Eastern Coral Snake, *Micrurus fulvius* |

## 7.0 References


7.1 *The Eastern Massasauga Rattlesnake Stewardship Guide. A resource and field guide for living with rattlesnakes in Ontario.* Sponsored by the Government of Canada, and distributed on behalf of the Toronto Zoo and the Eastern Massasauga Rattlesnake Recover Team.

7.2 http://www.rattlesnakes.us/

7.3 http://drdavidson.ucsd.edu/Portals/0/snake/Crotalus.htm

# S3NA-313-WI15 Alligators

## 1.0 Hazard

1.1 Your chance of encountering an alligator is greatest during the animal's courtship and mating season, which takes place from March through September. This is when male alligators become most dominant and aggressive as they try to intimidate rival males and attract females by their show of power. Some males end up having to travel to find a mate. July through September is when mother alligators are guarding nests.

1.2 Mating season takes up much of the warmer months - a very popular time in the southeastern USA for outdoor activities - and alligators are solar-powered, so-to-speak. The warmth from the sun fires up their metabolism, giving them renewed energy; and renewed energy means great potential for conflict.

## 2.0 Encounter

2.1 The alligator is naturally wary of humans, and will flee quickly if you get too close to it, or it may utter a very audible and compelling warning hiss. In some cases; however, alligators may charge or attack. Here are some examples of such cases:

2.1.1 An alligator that is accustomed to being fed by humans may not be so shy.

2.1.2 An alligator that is surprised and alarmed by your approach may attack, thinking that it is being attacked itself.

2.1.3 A mother alligator caring for her nest or for live babies. If you see alligator babies, or if you encounter a nest (usually a mound of vegetation mixed with mud), remove yourself to a safe distance, the mother alligator is sure to be close by. If you get close, the mother may sound a very audible and intimidating warning hiss. Such a nest may be difficult to identify for a non-expert, but it is likely the mother will issue you a warning.

2.1.4 Alligator mothers are well-known to be practically fearless when defending their offspring, whether the little ones have hatched or not. A mother alligator was observed leaping, jaws agape, to attack a helicopter as it approached the nest area to land! (The helicopter carried biologists studying alligator nests.)

2.2 Also be careful near heavy vegetation in or near the water's edge. This is where an alligator likes to enjoy privacy and peace during the daylight hours. If you trudge through there and surprise it, the outcome may not be positive.

2.3 Generally, a good minimum distance to keep between you and an alligator or nest is 15 feet/ 4.6 meters.

2.4 When trying to get past an alligator, make sure not to walk between the alligator and the water, because if it's spooked, it's going to run to the water.

2.5 If an alligator does approach in a threatening manner, make as much noise and movement as possible. This should show the alligator that he has taken on more than he can handle and he'll back away.

## 3.0 Alligator Charge

3.1 The alligator is not a natural runner. Those short legs obviously don't serve it like a horse's legs do, and the alligator can actually tire out in a relatively short time. When it charges after a human or animal, it is either trying to scare it away or seize it. It has a fast and furious burst of energy which serves it well for stealth hunting -- grabbing prey when it doesn't expect it. Furthermore, the reptile is opportunistic, which means, quite simply, it doesn't like to work very hard to get its food if it doesn't have to.

3.2 In the very rare event you are charged or chased by an alligator, move in as straight a line as possible away from it as fast as you reasonably can. In many cases, the vegetation features of the wild will serve to protect you by slowing the alligator down, like trees, bumps, bushes, etc. -- your comparatively long legs usually make it easier for you to maneuver through the trees and brush than an alligator's short legs do.

3.3 Most adult humans can outrun even a fast crocodilian, which has been clocked at a maximum of about 10 mph/17 kilometers per hour (kph), compared to a human speed of 15-17 mph/24-27 kph. But this doesn't matter much; an alligator will often give up the chase because it sees that the runner is moving away too quickly, and realizes that too much effort will be required to continue pursuit.

3.4 You may have heard somewhere that the zigzag run (running in a "z" pattern, side-to-side) is a good idea, but this is not only an unnecessary maneuver but probably a very unwise one. Here's why:

3.4.1 Unless you're an Olympic athlete, running zigzag over natural topography increases your risk of tripping and falling over rocks, plants, roots, and the like. And it goes without saying that falling while being pursued by an alligator is not good.

3.4.2 Furthermore, an alligator doesn't have the degree of stereoscopic vision we have. It actually has a small 'blind spot' directly in front of it. Hence, the alligator's vision is most effective in the 'sides' of its field of view. So, running zigzag not only slows your rate of distance from your pursuer, it may clearly indicate to the animal exactly where you are; even this point hardly matters since in many cases the alligator may keep its eyes shut while pursuing so as not to get them hit by twigs, grass stalks and branches in its path.

3.4.3 Finally, an alligator bites very effectively in a side-swiping motion, so if you are trying to run zigzag and are slowed down by plants, rocks, or other obstacles, the backwards flying leg of a running human is an optimal target for side-swiping, chomping jaws (the operative word here is "side").

3.5 Simply put, when faced with an attack, move directly away from the alligator as quickly as possible, navigating the terrain as carefully as possible. The zigzag idea will likely not serve you well.

## 4.0 Alligator Attack

4.1 If it seizes prey, and the prey fights back hard, the alligator may release it, depending on factors such as its own size relative to that of the victim, its own level of aggression, and its measure of hunger. Merely struggling to break free may not be enough counter-aggression to stop an alligator, and may actually prompt a devastating "death roll" response, in which the reptile furiously spins on its central axis to tear muscle and bone free of the victim's body.

4.2 These armored saurian are among the toughest beasts in the animal kingdom, so an attack victim should channel his or her nervous energy and will to survive and take the offensive by fighting hard. Not struggling...fighting very, very, very hard. Others on hand during such an event may be able to help by fighting the reptile, too. This should include punching the snout, poking the eyes, and even jabbing the ears, which are seen as small slits behind the eyes.

## 5.0 Additional Resources

5.1 Additional resources can be found at:

5.1.1 http://www.tpwd.state.tx.us/huntwild/wild/species/alligator/index.phtml

5.1.2 http://corkscrew.audubon.org/Wildlife/Alligators.html

# S3NA-314-PR Working Alone and Remote Travel

## 1.0 Purpose and Scope

1.1 This Procedure establishes the requirements for communication and accountability between personnel at a work site to reduce the potential for incidents occurring to one employee without help readily available and to facilitate the rapid mustering of assistance to employees in the event of an emergency.

1.2 This procedure applies to all AECOM North America-based employees and operations.

## 2.0 Terms and Definitions

2.1 **Buddy System**: A system of organizing employees at a work site in such a manner that each employee is accompanied by at least one other employee or is escorted by a client or contractor representative during work site activities.

2.2 **Controlled Work Areas**: One or more designated work areas on a field project site where hazardous activities and/or strictly defined operations take place. Such controlled work areas include, but are not limited to, remediation or construction sites; a restricted radius where a critical lift operation will take place could be declared a controlled work area. On a HAZWOPER site, the controlled work area is divided into the exclusion zone, the contaminated reduction zone, and the support zone.

2.3 **Working Alone**: Performing work with no line of sight or direct voice communication with another person who is aware of your assignment and capable of initiating emergency response.

## 3.0 Attachments

3.1 S3NA-314-ST Working Alone

3.2 S3NA-314-WI Wilderness Isolation

## 4.0 Procedure

4.1 Employees are discouraged from working alone on any site. If they will be out of contact with other employees, they will establish a buddy system or check-in procedure with another employee or responsible person.

4.2 When traveling alone, staff will take appropriate precautions, including notifying someone of their travel plans as well as carrying a communication device and safety equipment, as appropriate.

4.3 Managers will provide the resources (staff, communication devices, etc.) and plans (emergency response plans, check-in procedures, etc.) necessary so that employees are not working alone or have a buddy system in place.

4.4 No staff person shall work by themselves or out of contact with other personnel if they are conducting a hazardous job task. On the following tasks, a buddy system will be established:

- Working from heights
- Working in a confined space
- Working in a trench
- Lock out/tag out
- Working with electricity
- Working with power tools/equipment
- Working with hazardous substances or materials
- Working with material under pressure
- Working where there is a possible threat of violence
- Working in isolation from first aid services or immediate/emergency assistance
- Traveling in severe weather
- Working in avalanche areas
- Working on water or ice

- Working in remote or wilderness isolation
- Working in a controlled area
- Extreme heat or cold stress environments
- Working around high traffic or mobile equipment

### 4.5 Office Work

4.5.1 Each office will have in place and will communicate as part of its local safety orientation its procedures for the safety and security of an employee working alone in the office.

4.5.2 Employees working in the office after regular working hours or in situations where they are working alone will keep the entrance to the office locked.

4.5.3 If the building is monitored by a security service, employees working in the office after regular working hours or working alone will notify the security guard of their presence and anticipated hours. If the building does not have a security service, it is advisable that a staff person working alone notify a family member, friend, or manager of his or her location.

4.5.4 During all working hours, employees shall stay alert to unauthorized entries into the building and to other suspicious activities and shall report them immediately.

4.5.5 Contact numbers to be used in case of emergency are posted at all major exits.

### 4.6 Field Work

4.6.1 Prior to work commencing, a hazard assessment shall be prepared for all assignments on which employees are to work alone (in accordance with *S3NA-209-PR Project Hazard Assessment and Planning*). The hazard assessment shall consider travel time, weather, available communications, and the hazards associated with the task and work environment.

4.6.2 The assessment should also consider whether the employee assigned to work alone has sufficient training in the tasks to be performed to allow the employee to work safely alone. The employee's personal medical conditions may be considered if the employee has voluntarily made the medical condition know to the Supervisor or Project Manager.

4.6.3 The hazard assessment should identify the controls required for the safety of employees as applicable to the job task and location. Some controls associated with working alone or in remote isolation include a buddy system, standardized check-in times, specialized communication devices, and enhanced emergency supply kits.

### 4.7 Buddy System

4.7.1 When conducting hazardous work, staff will work with a buddy (another responsible individual) at all times.

4.7.2 Client or contractor personnel may be substituted for an AECOM employee's buddy only if they are designated by the client or contractor, are properly trained in this Standard Operating Procedure, and are properly trained in the site's emergency response procedures.

4.7.3 Once assigned as buddies, personnel shall remain in each other's line of sight and in direct voice contact at all times.

4.7.4 When unusual conditions do not permit line of sight and direct voice contact, the site supervisor will be informed. If permission from the site supervisor is obtained to continue the work, voice contact will be achieved using electronic communication devices such as, but not limited to, hand-held radio or cell phone.

4.7.5 When electronic communication devices are used, a protocol will be established and agreed to by each buddy to confirm that periodic effective and faultless communications are maintained:

- The person in communication with the field employee working alone will have direct communication with the employee at a frequency not to exceed each hour.
- The frequency shall be established considering task hazards, weather conditions, personal medical conditions, and the availability of emergency response.
- A missed communication event shall trigger emergency response procedures. The results of each communication event shall be documented in the project files.

### 4.8 Check-In Procedures

4.8.1 All field crews will establish check-in procedures prior to leaving the office and confirmed with the assigned Check-In Person.

4.8.2 The timing and frequency of those check-in procedures schedule shall be established prior to the initiation of field operations and will vary depending on the task and location of the work.

- At a minimum, all crews will check-in by 5:00 p.m.
- Crews working in isolation or on hazardous sites will increase their check-in times accordingly (e.g., noon and 5:00 p.m.).

4.8.3 If crews will separate once they reach their field site, they will then be considered to be “working alone” and will establish a buddy system with the other members of the crew.

4.8.4 Staff working alone or in small crews in remote isolation will have an effective means of communication system including cell/radio/satellite phone as well as established check-in times.

4.8.5 The Check-In Procedure will be reviewed daily as part of the Task Hazard Analysis review or more frequently if there is a change in work arrangements that could adversely affect a worker's well-being or a report that the system is not working effectively.

### 4.9 Emergency Response Procedures (ERP)

4.9.1 All field staff AND the Check-In Person will be provided with the Emergency Response Plan (which is documented on the Task Hazard Analysis, if an ERP does not already exist for the site).

4.9.2 The Check-In Person will have access to a route map or understands their anticipated route of travel.

4.9.3 If communication is lost between buddies or a check-in time is missed, it will be assumed that an emergency situation exists (e.g., severe injury, illness, other accident situation), and the site’s emergency response procedures will be implemented. Site work will cease until the emergency is resolved and the site supervisor directs personnel to restart work.

4.9.4 The established contact person will follow the procedures below if a field staff member has missed a check-in:

- First, they will attempt to make contact with the field staff directly.
- If that fails to provide a response, they will contact other persons who may have been on site, including client supervisors, or other locations where the field staff might be (e.g., hotel, home, office).
- If the field staff still cannot be located, the emergency contact person notifies the project manager or manager responsible for the staff.
- Depending on the location and situation, they will then dispatch either another AECOM staff member, another on-site supervisor, or an appropriate emergency response agency (e.g., police) to travel to the last known location of the field staff.
- If the dispatched responder arrives at the site but cannot locate the field staff, the appropriate public emergency contacts (e.g., police, search and rescue) will be made and the staff members’ personal contacts shall be notified by Human Resources or the manager (if HR is unavailable).
- If the dispatched responder finds the crew in an emergency situation (medical, environmental, structural, etc.), the appropriate steps will be taken to isolate the hazard, administer first aid, and notify the appropriate agencies and emergency support services.

### 4.10 Training

4.10.1 All staff will receive an initial orientation that includes the hazards and controls associated with working alone.

4.10.2 If working in wilderness, all field staff will be able to orienteer using a map and compass—if not, the basic skills of orienteering will be provided by an experienced staff member before work commences.

4.10.3 Staff regularly working in remote, isolated wilderness locations will either participate in a wilderness survival course from a qualified provider (1 or 2 day) or will obtain management approval based on their level of experience/competence in wilderness situations.

## 5.0 Records

5.1 None

## 6.0 References

6.1 Canadian Centre for Occupational Health and Safety (http://www.ccohs.ca/oshanswers/hsprograms/workingalone.html)

6.2 Health Canada (http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/outdoor-plein_air-eng.php)

# S3NA-314-ST Working Alone

The following Occupational Health and Safety regulations apply directly to working alone (and not with a specific job task):

| Jurisdiction | Regulation |
|---|---|
| **United States** | |
| **OSHA** | n/a |
| **Canada** | |
| **Alberta** | OHS Code (2009) Sect 393, 394<br>Alberta's Occupational Health and Safety Code: An Explanation of the "Working Alone" Requirements (November 2006)<br>Working Alone Safely - A Guide for Employers and Employees (September 2000) |
| **British Columbia** | OHS Regulation (1997) Sect 4.20.1 – 4.22 |
| **Manitoba** | Workplace Health and Safety Regulation (217/2006) Sect 9.1 – 9.3 |
| **New Brunswick** | Code of Practice for Working Alone Regulation - Occupational Health and Safety Act (N.B. Reg. 92-133) |
| **Newfoundland/Labrador** | n/a |
| **Nova Scotia** | n/a |
| **NWT/NU Territories** | General Safety Regulations (R.R.N.W.T. 1990, c. S-1), Safety Act (SI-013-92) Sect 14 |
| **Ontario** | n/a |
| **Prince Edward Island** | OHS Regulations (EC180/87) Sect 53.1 – 53.5 |
| **Quebec** | OHS Regulation (R.R.Q., c. S-2.1, r.19.01 O.C. 885-2001) Sect 322<br>Safety Code for the Construction Industry (R.R.Q. 1981, c. S-2.1, r. 6) Sect 3.22.1 |
| **Saskatchewan** | OHS Regulation (R.R.S., c. O-1, r. 1) Sect 35 |
| **Yukon Territory** | n/a |

# S3NA-314-WI Wilderness Isolation

## 1.0 Planning

1.1 Working in wilderness isolation presents many more potential hazards and should only be conducted by teams with documented experience, safety plans, and equipment appropriate for the tasks and conditions of the work.

1.2 A Safe Work Plan will be approved by the Regional SH&E Manager.

## 2.0 Safety Equipment

2.1 All field staff should regularly carry a compass, fire starter, a small folding saw, and a map on their person.

2.2 All field staff should regularly carry a first aid kit and survival equipment applicable to the situation.

2.3 All field staff will be equipped with (or have access to) communication devices appropriate to the type of coverage anticipated in the project area.

2.4 When hiking long distances, it is recommended that a “mini survival kit” that includes the following items be carried:

- Lighter, matches, or a "flint' of fire steel
- Fire starter (tinder). Cotton balls with lip balm work well, or paper egg cartons with cotton balls and paraffin wax; if buying commercial fire starter, test it after several months.
- A whistle
- Heavy tinfoil (to melt snow, to cook on, or to boil water in)
- Some high-energy food
- A Mora knife or folding saw (Japanese tooth rake is best) or "camp chainsaw in a can"
- Cordage/rope (about 50 feet)
- Bear spray (and/or bear bangers)

2.5 When using an ATV or helicopter for isolated work, it is recommended that a survival bag or backpack that can be left at a known muster point be put together. This bag should include the following items:

- Additional fire starter (tinder)
- Matches, fire steel
- A multi-tool (like a Swiss Army knife)
- A folding saw
- 3-8'x6" tarps plus one 12 X 16" tarp or larger (or a tent)
- 100 " of utility cord or parachute cord
- A small pot
- Lean spoon
- A small stove (a small folding military stoves with trioxethelyne tablets will work well)
- Closed cell foam pads or several square feet of double-wall bubble insulation (the silver sided bubble wrap used in construction) to use as a sleeping pad or for hypothermia treatment
- Food
- Water
- Sleeping bag with a mylar bivy sack to be used as a vapor barrier inside

## 3.0 Drinking Water

3.1 No surface water can be considered safe for human consumption without treatment. Even the cleanest looking spring water could be polluted. Untreated water may be contaminated with bacteria, viruses, or protozoa.

3.2 On short trips, carry treated water or obtain water from another safe source.

3.3 When field projects take you into remote isolation where there is the potential for not having access to clean drinking water, be sure to take the appropriate tools with you: a water filter, tin foil or a pot for boiling water, or tablets or chemicals for treating the water prior to consumption.

3.4 Generally, the chances of finding safe drinking water in the mountains increase as you gain altitude. Intense sunlight at high altitudes kills undesirable bacteria and viruses but harmful cysts are unaffected.

3.5 Runoff water from streams below glaciers is often cloudy with silt and should be filtered.

3.6 Well water, fast-moving rivers, and the deepest parts of lakes are the best locations to obtain water. Avoid stagnant water, shoreline water, and water close to human habitations and campsites.

3.7 During the winter, it is best to use an open water source or to obtain water through a hole in the ice. Check the safety of the ice first. Melting ice and snow consumes fuel and takes extra time. Eating snow or ice directly can lead to chilling and hypothermia and could also cause stomach cramps and headaches. Beware of colored snow, which indicates the presence of algae that could cause diarrhea if ingested. Even in winter, all water should be purified.

### 3.8 Water Treatment

3.8.1 Each method of water treatment has its advantages and disadvantages. Use only treated or boiled water for drinking, brushing teeth, or washing fruits and vegetables that will be eaten raw.

3.8.2 Boiling. Heat is the oldest, safest and most effective method of purifying water. Bring the water to a boil for at least one minute (adding one more minute for each 300 m (1000 ft.) above sea level. If the water is cloudy, filter it before boiling. Boiling will give your water a flat taste that can be remedied by pouring the water quickly back and forth from one clean container to another, by letting the water cool, or by adding a pinch of salt per litre of water.

3.8.3 Chemical Purification. When boiling is not practical because of time and lack of a heat source, disinfection with chlorine or iodine compounds may be effective. Use two water containers: one for treating water and the other for carrying purified water. After disinfection, shake the container vigorously. Wait five minutes. Shake it again with the lid loose so that some water leaks out to cleanse the mouth of the container. Disinfection alone may not kill some protozoa. Pass the water first through a filter with a pore size of 0.5 micron (absolute) or less to remove protozoa, then disinfect it to kill viruses and bacteria. Disinfection will give the water a peculiar taste. If you find it unpleasant, try using flavoured drink crystals or concentrated citrus juice to mask the taste of the disinfectant. Add drink powders or juice only after the treatment time has elapsed.

3.8.4 Filtration. Water filters for use in the wilderness are available, but be wary when making your choice. Avoid filters that allow particles larger than 0.5 microns to pass. Filters with a pore size of 0.1 to 0.3 micron can remove protozoa and bacteria but may not remove viruses. Filtration alone is insufficient to purify water; hence, it should be combined with disinfection to remove viruses. Follow the operating and maintenance instructions carefully.

**Table 1: Summary of Water Purification Methods**

| | Boiling | Chlorine | Iodine | Filters |
|---|---|---|---|---|
| Bacteria | E | E | E | M |
| Viruses | E | E | E | N |
| Protozoa | E | M | M | M |
| Chemicals | M | N | N | N |

E = effective    M = may be effective (see text)    N = not effective

3.9 Some water-borne diseases are difficult to diagnose. If you are not feeling well and have recently drunk water from a source in the wild, inform your doctor that you may have consumed untreated water.

# S3NA-315-PR Water, Working Around

## 1.0 Purpose and Scope

1.1 Establishes the minimum requirements and guidance for AECOM personnel assigned to projects that place them at risk of falling into water, including working ashore near to or over water.

1.2 This procedure applies to all AECOM North America (NA) based employees and operations.

## 2.0 Terms and Definitions

2.1 **PFD:** Personal Flotation Device

2.2 **Life Jacket:** A personal flotation device that will turn over an unconscious worker in the water so their face and nose are not submerged.

2.3 **USCG:** United States Coast Guard

2.4 **TC:** Transport Canada

2.5 **Lifebuoy:** A throwable buoyant rescue ring with 28 M (90 feet) buoyant line attached.

## 3.0 Attachments

3.1 S3NA-315-WI1 PFD Descriptions and Use

3.2 S3NA-315-WI2 Safe Work Practices for Shoreline Work

3.3 S3NA-315-WI3 Ice Safe Work Practices

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Project Manager (PM)** is responsible for the overall success of a project and the performance of employees engaged in project activities. The PM shall confirm that all appropriate Safety, Health and Environmental (SH&E) procedures are identified and implemented:

- Determining the applicability of this SOP during the planning stage of field investigation projects.
- Allocating appropriate resources to implement the required measures.
- Designating a field team member to implement and maintain these measures, maintain related documentation, and to communicate with appropriate parties as necessary.
- Consulting with the purchasing department on the appropriate vendors for rentals/leases.
- Confirm that boat/watercraft rental/leasing vendors have appropriate paperwork (licenses, insurance, maintenance records, orientations, etc.).
- Confirming that the project is properly staffed with trained employees.
- Developing and submitting a Health and Safety Plan, Task Hazard Analysis, and other SH&E Planning Documents for review and approval by the **AECOM Region SH&E Manager**.

4.1.2 **SH&E Manager** is responsible for providing support to the **PM** and his/her designee in the evaluation of safety and health risks and the identification of applicable policies, procedures, and appropriate precautions.

- Review all project related Health and Safety Plans, Task Hazard Analysis as required.
- Provide access to safety records, including training records, for field staff.
- Provide support to **PM.**

4.1.3 **Field Task Manager, Supervisor**

- The **Field Task Manager (FTM)** is responsible for verifying current status of field staff's training and equipping them for the work at hand.
- The **FTM** is also responsible for conducting daily safety meetings, performing field safety inspections, confirming that all safety issues and equipment deficiencies are properly corrected,

and that the proper equipment is available to the field staff to safely meet the goals and quality objectives of the project.

4.1.4 **Field Staff**

- Employees are responsible for complying with the safe work practices specified in this policy and all other applicable AECOM SH&E policies or procedures and reporting all unsafe working conditions.
- Review, contribute to, and sign the Task Hazard Analysis prior to beginning the project and whenever new tasks or environmental changes occur.
- Confirming that their SH&E training is up to date.
- Confirming that equipment is properly maintained and functioning.
- Confirm they wear all required PPE.

## 4.2 General Safety Considerations

4.2.1 During project preparation, consideration shall be given to the nature of the site, the type of water hazard, the equipment being used, and the location to determine the PPE and level of emergency preparedness that is required. All projects working near water hazards shall have the appropriate SH&E Plan prepared, including task hazard analysis.

4.2.2 Personal protective equipment (PPE) specified in the Task Hazard Analysis (THA) is to be worn as required, to meet the specific regulations of the work area, including local and federal legislation.

4.2.3 Whenever there exists the possibility of falling into water, personnel shall be attired in a USCG approved Type III or Type V PFD or Life jacket. The vest shall be properly sized for the individual and shall be secured at all times. For cold water conditions (water temperature less than 55 degrees), a USCG approved Shallang suit shall be worn to protect personnel from risks of cold water immersion.

4.2.4 Swimming is prohibited, unless it is being conducted by certified divers in the completion of their assigned task, or to prevent a serious injury or loss of life in a person in a water/person overboard emergency.

4.2.5 The buddy system shall be utilized whenever there is the possibility of falling into water, in which two persons operate as a single unit in order to monitor and assist each other in performing tasks.

4.2.6 Conducting shoreline work alone should be avoided, unless constant communications is maintained between personnel and prior approval by the **Project Manager** is granted.

4.2.7 A throwable lifebuoy with required rescue line attached (Type IV flotation aid) shall be available.

4.2.8 Additional equipment (i.e., sounding alarms, lifting gear, or rescue boat) as required by legislation shall be immediately available to recover an individual from the water. If the shortest dimension of the water body is greater than the length of line attached to the throw buoy, a skiff or boat shall be available to facilitate a rescue.

## 4.3 Personal Protective and Safety Equipment

4.3.1 Personal Protective Equipment (PPE) shall be selected based on the task-specific hazard analysis. The minimum PPE required for wading in water above the knees includes:

- Personal Flotation Devices or lifejackets shall be worn by all workers who are exposed to the danger of drowning in water deep enough for the lifejacket to be effective.
- All inflatable PFD or life jackets shall be approved and have documented regular inspections.
- Shallang suits: In water temperatures below 55° F (regardless of air temperature) personnel are required to wear a USCG approved Shallang jacket or full flotation suit, depending on field conditions. This requirement will replace the need for a wearable PFD as these suits (if properly maintained) will provide adequate flotation.
- Waders with slip resistant sole suitable for the substrate.
- Eye protection (to reduce glare).
- Wading pole (for supporting and testing the substrate before wading).

4.3.2 Rescue equipment shall be on-site that is appropriate to the situation (e.g., life buoys with 28 m (90 ft) of retrieval line, rescue boat, sounding device).

4.3.3 Blankets and an appropriate first aid kit shall be on-site.

4.3.4 Immersion suits, or survival suits as they are often called, can significantly improve survival time in cold water. Recognizing that hypothermia is a major factor in lives lost at sea, the U.S. Coast Guard requires that vessels operating in offshore waters north of 32 degrees North latitude carry an immersion suit for each person aboard. These suits are to be used in place of a Type I PFD in an abandon ship situation. It is recommended that personnel familiarize themselves with their use and practice donning the suit before leaving the dock. It is recommended that personnel be able to get into an immersion suit in under a minute. If necessary to abandon ship, personnel, attired in an immersion suit with head covered in a hat, should enter the water slowly, if possible, keeping their head out of the water.

4.3.5 Suits should be stored in a clean and dry location. Avoid stacking or compressing the suits in storage as it may result in a loss of buoyancy. Federal regulations require that immersion suits be stowed so that they are readily accessible to the individual for whom they are intended, from both the individual’s normal work area and berthing area. If there is no location readily accessible to both areas, then a suit shall be stowed at each location.

### 4.4 Land-based (shoreline/bridge/pier – includes wading)

4.4.1 Use a short line and harness to prevent entry into the water, or approved PFD, when working near fluid filled tanks, ponds, lagoons, or natural waterways and stay close enough to shore to be pulled back to shore by an attendant.

4.4.2 Wading in a stream or water body:

- Always proceed upstream so that the wading team is walking into clear water (no turbidity caused by walking), there is good visibility for any debris floating downstream, and there is a reduced risk that the wading team will be pushed against debris or pushed into a deep hole by the current.
- Wading in water deep enough to become submerged in will be done as a two person crew. If conditions or legislation warrant a “rescue team,” then an appropriately sized crew should be used, with the rescue team stationed on the shore with the appropriate rescue equipment, as per the site-specific rescue plan.

4.4.3 Wading will not occur in the following circumstances:

- If the water is too turbid or too deep to see tripping hazards or deep holes.
- If it appears the bottom is composed of soft sediments where stepping in may result in sinking, or if the bottom consists of clay where slipping is likely.
- If large woody debris is abundant and will be difficult to step over or move around.
- If the water is over the waist of the shortest person on the wading teaming. This does not preclude wading in water bodies that have shallow shorelines that grade into deeper waters. By not wading over waist level there will be approximately 30 cm (12 Inches) of “safety distance” on the chest waders, should a member of the wading team step or slip into a deeper area.
- If there is a risk of the current pushing a member of the team downstream.

### 4.5 Cold Water Operations

4.5.1 Cold water operations are defined as any situation that exposes an individual to falling into water that has a temperature of 55ºF (13ºC) or less.

4.5.2 Sudden immersion in cold water can induce a gasping reaction and uncontrolled breathing which may cause the victim to ingest water and begin choking, experience cardiac arrest, and other physical body conditions all of which can result in a quick drowning.

4.5.3 Cold water incapacitation precedes hypothermia, making swimming and grasping for safety extremely difficult. So while death by hypothermia may occur in roughly one hour in a water temperature of 55ºF (13ºC), incapacitation due to failing muscle function will occur in as little as 10 minutes, so regardless of your age, physical conditioning, or ability to swim – your odds of survival are greatly enhanced if you wear a life jacket.

4.5.4 AECOM requires personnel to wear an approved USCG Shallang suit at all times whenever there is the risk of falling into water. Employees working in these conditions view a training video on the physiological effects of cold water immersion found at: http://www.coldwaterbootcamp.com.

4.5.5 Consideration should be given to the use of immersion of survival suits when project work involves cold water operations.

### 4.6 Working on Ice

4.6.1 Situations which expose personnel to the risk of falling onto ice covered waters. Working on water with the presence of ice either in the waterway or encroaching in from the shoreline.

4.6.2 Working in situations where ice exists shall be strictly limited due to the extreme hazards associated with falling through the ice cap, cold water immersion, and the logistical difficulties associated with executing a rescue. Specific information and safety considerations regarding working on ice can be found in *S3NA-315-GL3 Ice Safety Guidelines* and by viewing the training video on the physiological effects of cold water immersion found at: http://www.coldwaterbootcamp.com,

4.6.3 Personnel working on ice shall be attired in a USCG approved Shallang survival suit and be supported by shore side personnel to assist in recovery in the event of a break through. Depending on the nature of the project, on-ice personnel should either wear a harness tethered back to shore, or push a flat bottom boat along on the ice and have the boat tethered back to shore.

4.6.4 Personnel working on ice covered waters should dramatically reduce vessel speed to avoid damaging propellers, shafts, and rudders. Personnel should be cognizant of shoreline ice which can prevent access to alternative ramps and docks that were considered as egress points in emergency planning.

4.6.5 Personnel should be wary that boat ramps on tidally influenced waters can flash freeze at low tide, precluding or compromising safe access and egress.

4.6.6 Extra safety equipment:

- Extra blankets should be kept on site (in a vehicle) when working on or near frozen water bodies.
- An ice pick, ice chisel, and/or ice auger should be used by a member of the crew with experience or training in identifying thin or weak ice.
- A braided rope, preferably 30 m in length.

4.6.7 **Training**

4.6.8 All field staff and Project Managers working on projects with exposure to open water shall receive training in the hazards, precautions, and rescue procedures associated with working in or over water.

4.6.9 All staff working on or near frozen water bodies shall complete Ice Safety Awareness e-learning.

4.6.10 Staff who will be working on frozen water bodies regularly or for extended periods of time should take an Ice Rescue Training course, or obtain management approval based on their level of experience/competence working on ice.

4.6.11 Staff working near cold water shall complete awareness level training on Cold Water Immersion.

## 5.0 Records

5.1 None

## 6.0 References

6.1 Cold Water Boot Camp - http://www.coldwaterbootcamp.com

6.2 S3NA-419-PR Water, Marine Operations-Boating

6.3 S3NA-420-PR Water, Underwater Diving

# S3NA-315-WI1 PFD Descriptions and Use

## 1.0 Personal Flotation Devices

1.1 AECOM requires all personnel to wear a USCG or Transport Canada approved personal flotation device (PFD) or life jacket at all times whenever there exists the possibility of falling into water. The various types of personal flotation devices to be considered are described below.

1.1.1 **Type I:** Designed for extended survival in rough, open water. This PFD has over 22 pounds of buoyancy and will usually turn an unconscious person face up in the water. It is, however; very bulky and restrictive and not well suited to working on deck; a Type III or Type V PFD is generally preferred. Regardless of this fact, all vessels working in unprotected waters are required to carry a Type I PFD for each person aboard. In the event of an abandon ship situation, all passengers are required to don their Type I PFD as this flotation device will keep you afloat in offshore waters where rescue may be slow in coming.

1.1.2 **Type II:** Designed for calm inland waters where there is a chance of a fast rescue. It is less bulky and less expensive than a Type I, and may turn an unconscious person face-up in the water.

1.1.3 **Type III:** Designed for use in calm water where there is a good chance of a fast rescue. Slightly lighter than a Type II, however; this PFD will generally not turn an unconscious person face-up in the water. Mustang flotation jackets are also considered in the Type III category.

1.1.4 **Type IV:** These are first response rescue devices designed to be thrown to a person overboard or person in the water. These devices include boat cushions, ring buoys, and horseshoe buoys. They are NOT designed to be worn and must be supplemented by wearable PFD. These devices need to be stowed in a location and in a manner that makes them immediately available for emergencies. Type IV devices should not be used for small children, non-swimmers, or unconscious people.

1.1.5 **Type V:** This is a special use PFD and includes 3-piece work vests, flotation deck suits for hypothermia protection (such as Mustang suits), and hybrids for restricted use. Hybrid vests contain some internal buoyancy and are inflatable to provide additional flotation. Immersion suits for cold water survival are also classified as Type V flotation devices.

## 2.0 Standards

The following standards apply to lifejackets and personal flotation devices:

| Association | Standard |
|---|---|
| **British Safety Standard** | BS EN 396-1994, Lifejackets and Personal Buoyancy Aids - Lifejacket 150 N, automatically inflatable units with a minimum buoyancy of 150 N (34 lbs) |
| **Canadian General Standards Board (CGSB)** | *CGSB Standard CAN/CGSB-65.7-M88, Lifejackets, Inherently Buoyant Type* with a minimum buoyancy of 93 N (21 lbs)<br>CGSB Standard CAN/CGSB-65.11-M88, Personal Flotation Devices with a minimum buoyancy of 69 N (15.5 lbs)<br>CGSB Standard 65-GP-14M, Lifejackets, Inherently Buoyant, Standard Type with a minimum buoyancy of 125 N (28 lbs) |

# S3NA-315-WI2 Safe Work Practices for Shoreline Work

## 1.0 Planning

1.1 Projects being conducted along the shoreline, on piers or bulkheads, or near or over any water of any kind where there exists the risk of falling into water should incorporate the following safety guidelines when developing field logistical plans.

## 2.0 Safe Work Practice

2.1 All work shall be performed in accordance with the "Buddy System".

2.2 If sampling near or in flowing water environments, be aware of slippery or steep banks and fast currents. If the current is fast or the water looks deeper than knee height, do not enter the water. If you must enter the water, a restraining system must be worn and secured to the bank for your retrieval in the event of an emergency.

2.3 Whenever possible, positive controls in the form of fencing or barricades should be considered for long-term waterfront projects to form a security perimeter 10 feet in from the water's edge to prevent personnel from being exposed to water hazards.

2.4 Personnel involved in sampling contaminated sediments or surface waters or conducting shoreline surveys may require a Hepatitis A and/or tetanus vaccination depending on site conditions and are advised to consult with their SH&E Manager. An OSHA 40-hr HAZWOPER may be required for personnel working on site if warranted by the Project.

2.5 Take special care on slippery rocks along shorelines, lakeshores, riverbanks, and creeks. Always look ahead at the ground when walking around the water's edge and avoid stepping on stones that have algal growth, especially those in intertidal areas, as these are extremely slippery. It is suggested that workers not be permitted to access areas where these slip/fall hazards exist, especially in locations containing tidal water flow.

## 3.0 Personal Protective Equipment

3.1 AECOM requires that whenever there exists the possibility of falling into water, personnel shall be attired in a USCG approved Type III or Type V work vest. The vest must be properly sized for the individual and must be secured at all times. Prior to and after each use, the PFD/suit shall be inspected for defects, which may alter their strength or buoyancy. Defective units shall be discarded and replaced.

3.2 Personnel protective gear must include long pants, steel-toed rubber boots; with adequate puncture resistance, and Kevlar gloves (whenever sampling or picking up or manipulating ground cover). It is recommended that personnel use a rake to move ground cover and debris and not touch these items directly by hand whenever possible.

3.3 Waders may not be worn when working along, over, or in moving waters; or in waters influenced by tides or acted upon by waves when water depths exceed knee height unless specifically approved by the Project Manager. Waders may be worn in still waters in water depths up to the waist if bottom conditions are firm and well understood. Waders shall never be worn aboard a watercraft of any kind.

## 4.0 Emergency Response

4.1 Emergency preparedness applies to any work where there exists the risk of falling into water, especially moving waters, along piers, bulkheads, and river banks with a sharp drop off in bathymetry.

4.2 Personnel working alongside waters, especially moving waters, where there exists the possibility of falling in must have an emergency response plan to recover someone in the event they have fallen in.

4.3 A throwable rescue device must be immediately available in the event of an emergency situation. In these situations the position and accessibility of throw rings and other rescue devices (ex: ladders) and the mechanism to recover a person from the water must be considered.

4.4 The number and placement of ladders and throw rings shall be sufficient so that the maximum swimming distance to them is no more than 25 feet.

4.5 Whenever possible, or as required by regulation, at least one lifesaving skiff/boat should be immediately available at locations where employees are working over or adjacent to moving waters, especially strong currents which can quickly move a person out of range of a throwable life ring. For these conditions, it is recommended that a qualified operator be on stand-by for immediate response to aid in recovering a person from the water. Other means such as lifebuoy with throw line and boat hooks, shall also be available to assist in the rescue of an incapacitated person in the water.

4.6 If workers have the potential to get stuck in mud or fluidized sediment, air injection equipment designed to free worker’s feet/legs may need to be available onsite. At a minimum, a safety line should be available to be deployed from safe ground. If a worker does get stuck, they should not struggle as this causes further sinking. Use a pole to conduct sediment probing to assess water depths, the stability of shoreline terrain, and the bearing capacity of bottom sediments ahead of the chosen path.

# S3NA-315-WI3 Ice Safe Work Practices

## 1.0 Background

1.1 There is no such thing as 100 percent safe ice; there are a number of factors detailed herein which affect the bearing capacity of ice.

1.2 New ice is usually stronger than old ice. Four inches of clear, newly-formed ice may support one person on foot, while a foot or more of old, partially-thawed ice may not. Additional bearing capacity guidelines based on ice thickness can be found at: http://www.dnr.state.mn.us/safety/ice/thickness.html

1.3 Ice seldom freezes uniformly. It may be a foot thick in one location and only an inch or two just a few feet away.

1.4 Ice formed over flowing water and currents is often dangerous. This is especially true near streams, bridges and culverts. Also, the ice on the outside of river bends is usually weaker due to the undermining effects of the faster current.

1.5 The insulating effect of snow slows down the freezing process. The extra weight also reduces how much weight the ice sheet can support. Also, ice near shore can be weaker than ice that is further out.

1.6 Booming and cracking ice isn't necessarily dangerous. It only means that the ice is expanding and contracting as the temperature changes.

1.7 Schools of fish or flocks of waterfowl can also adversely affect the relative safety of ice. The movement of fish can bring warm water up from the bottom of the lake opening holes in the ice which can cause snowmobiles and cars to break through.

1.8 Heavy snowfall early in the season may result in reduced ice thickness due to the insulating effect of the snow.

1.9 A fresh fall of snow will often cover areas that would otherwise be recognized as hazardous.

1.10 Water overflow and ponding caused by increased water levels can cover hazardous areas. Be aware of overhanging riverbanks when ascending and descending.

## 2.0 Safe Work Practices

2.1 If considering work on frozen waters or in the presence of shoreline ice, the following requirements shall be followed:

2.1.1 Working in situations where ice exists shall be strictly limited. The risks of cold water immersion; slippery shorelines, docks and boat ramps; and navigation hazards around ice and frozen shorelines should be avoided. Field work should be rescheduled to periods of warmer temperatures, when ice and cold water hazards are not an issue.

2.1.2 Avoid working on water immediately prior to freeze-up because of floating ice sheet hazards. Avoid working on ice prior to break-up because of ice cover instability.

2.1.3 Care should be exercised when near the following areas: tributary/stream inflows, lake narrows, beaver dams, riffle areas, industry discharges, sewage lagoons, and open water, as the ice is usually thinner in these areas. Pressure ridges should also be avoided, as there may be open leads, weak ice and/or slush ice in these areas.

2.1.4 Work shall be performed in accordance with the "Buddy System" with rescue communications available.

2.1.5 Do not walk or work on ice unless there is no other way of performing work. Whenever possible, use alternate methods. One suggestion is to have personnel push a flat-bottomed boat onto the ice. The boat shall have a safety tether tied to it that can be handled by workers standing off the ice cover along the shore line.

2.1.6 Only walk on ice that is fully frozen, not cracked or brittle, with a thickness that will support the necessary weight of workers and associated equipment.

2.1.7 When working on or near an ice surface, personnel should always check the ice thickness and condition thoroughly using an ice pick, ice chisel, and/or ice auger. It is virtually impossible to describe all conditions that may be encountered while working on ice cover; however, the following can be used as guidelines:

- The color of ice, which may range from blue to white to grey, provides an indication of its quality and strength.
- Clear blue ice is generally the strongest.
- White, opaque ice (snow ice) has a relatively high air content and its strength depends on the density; the lower the density, the weaker the ice; but high density white ice has a strength approaching that of clear blue ice.
- Grey ice generally indicates the presence of water as a result of thawing, and shall be considered highly suspect as a load-bearing surface.

2.1.8 When possible, conduct a reconnaissance prior to freeze-up and prior to actually working on the ice cover to become familiar with any potential hazards.

### 2.2 Personal Protective Equipment

2.2.1 Workers are required to wear an approved Shallang flotation suit in accordance with the manufacturer's requirements.

2.2.2 Workers shall wear a restraining system (a lifeline attached to the front of a full-body harness) and stay close enough to the edge to make it possible for a shoreline attendant to pull the individual back off the ice.

2.2.3 Workers shall have available (on their person) tools that can be used to partially penetrate the ice and gain leverage to help in pulling themselves out of the water and back up onto the ice. Equipment is available with capped ends that can be worn safely until needed.

### 2.3 Unknown Conditions

2.3.1 The following guidelines shall be used when there is insufficient evidence to prove the ice is safe for travel and when the job task cannot be postponed:

- Select an area where the ice is of good quality and hazards are minimized.
- Establish a two person team where one person acts as an "anchorperson" on shore and the second person, connected to the anchorperson by a braided rope, acts as the "checker", slowly moving out over the ice to sampling locations. (When working on a river, testing with an ice auger or ice bar shall be more frequent than on a lake due to the uncertain nature of river ice.)
- The anchorperson continually looks for hazards and signs of ice failure. (When testing the safety of an ice cover, the best method is to use an ice pick/axe.) The ice in front and to the sides should be struck a solid blow every few paces. The checker should proceed carefully outward checking the ice every few paces. Both staff should work to keep the rope from becoming snagged on ice blocks. The anchorperson should maintain their position as long as the site is deemed hazardous. If the anchorperson has to move, the checker should remain stationary until the anchor has re-established a secure position. When returning from the sample site, the checker should use the above procedure, if required.
- Crews should not be operating on ice greater than 30 m (or the length of a rope) from shore without appropriate equipment and Rope/Harness Restraint and Rescue System training, unless there is sufficient evidence to prove the ice is safe for travel.

## 3.0 Vehicle Traffic

3.1 Vehicles operated on ice shall travel with their windows down and with their seatbelt off, and their speed should not normally exceed 15 km/hr (in order to avoid the effects of the hydrodynamic wave). Nor should speed be less than 1.5 km/hr, in order to avoid the effects of a stationary load. Ice thickness should be checked frequently when travelling over long stretches of ice.

3.2 Particular care should be exercised when approaching or travelling close to shore, or over shallow water, because of severe stressing of the ice due to reflection of the generated wave.

3.3 Stationary loads should be relocated to shore as soon as feasible and not left overnight.

The following tables contain guidelines for weight loads on ice.

**Table 1. Ice Strength for Continuous Travel**

| Permissible Load (kg) | Effective Ice Thickness (cm) (clear, blue ice) | |
|---|---|---|
| | Lake | River |
| **One person on foot** | 5.0 | 6.0 |
| **Group, in single file** | 8.0 | 9.0 |
| **Passenger car 2,000** | 18 | 21 |
| **Light truck 2,500** | 20 | 23 |
| **Medium truck 3,500** | 26 | 30 |
| **Heavy truck 7,000** | 35 | 41 |
| **10,000** | 38 | 44 |
| **25,000** | 63 | 73 |
| **45,000** | 80 | 92 |
| **70,000** | 100 | 115 |
| **110,000** | 123 | 144 |

**Table 2. Ice Strength for Stationary Loads (more than 2 hours) and Working on Ice**

| Permissible Load (kg) | Effective Ice Thickness (cm) (clear, blue ice) | |
|---|---|---|
| | Lake | River |
| **1,000** | 20 | 23 |
| **2,000** | 30 | 35 |
| **4,000** | 45 | 52 |
| **8,000** | 60 | 69 |
| **25,000** | 110 | 127 |
| **45,000** | 150 | 173 |
| **70,000** | 180 | 207 |
| **110,000** | 230 | 265 |

## 4.0 Rescue

4.1 If someone falls through ice:

4.1.1 Don't approach the hole.

4.1.2 Call the emergency number prior to attempting a rescue.

4.1.3 Throw a rope or line to the victim to pull them out.

4.1.4 Get medical assistance for the victim.

4.2 If you fall through the ice:

4.2.1 Remain calm and look towards the shore.

4.2.2 Place your hands and arms on the unbroken surface of the ice using the ice picks if available.

4.2.3 Work forward by kicking your feet.

4.2.4 If the ice breaks maintain your position and slide forward again.

4.2.5 Once on the surface of the ice, don't stand. Instead, roll away from the hole.

4.2.6 Crawl back to shore along your original path.

# S3NA-405-PR Drilling, Boring, and Direct Push Probing

## 1.0 Purpose and Scope

1.1 Provides the minimum requirements to be followed when drilling and boring work are performed.

1.2 This procedure applies to all AECOM North America-based employees and operations.

## 2.0 Terms and Definitions

2.1 None

## 3.0 Attachments

3.1 S3NA-405-FM1 Drill Rig Inspection

3.2 S3NA-405-FM2 Subsurface Investigation Checklist

3.3 S3NA-405-ST Drilling and Boring

3.4 S3NA-405-WI Core Drilling Machine Safety Card

## 4.0 Procedure

4.1 All client on-site safety procedures shall be understood and adhered to.

4.2 Be aware of the provincial/territorial regulations that govern drill rig operations and exposed moving parts.

4.3 **Roles and Responsibilities**

4.3.1 **Project Manager or Resident Engineer** is responsible for ensuring that sound principles of safety, training, inspection, maintenance, and operation consistent with all resource data available from the manufacturer, OSHA, and ANSI is provided to the operator and users by the Contractor or operating entity.

4.3.2 **Site Safety Coordinator (SSC)** shall assist the **Project Manager** in compliance with the requirements of this procedure.

4.3.3 The **SH&E Department** shall assist site management with guidance about this procedure.

4.3.4 **AECOM employees** engaged in project field activities shall be cognizant of contractor activities that may affect their safety and shall follow these procedures.

4.3.5 **AECOM Equipment Operator**

- In cases where AECOM owns and operates drilling, boring, or probing equipment, the lead equipment operator is responsible for the maintenance and safe operation of equipment under their control consistent with those responsibilities of a Contractor.
- Operations will be terminated during an electrical storm, and all crew members will move away from the rig. If lightning is observed, shut down all rig operations immediately.

4.3.6 **Contractors**

- **Contractors** have direct control over the application and operation of all drilling, boring, and probing equipment owned by their organization.
- It is the **Equipment Contractor** operator's responsibility to implement safe work practices provided by the **Contractor's** project management or supervisory staff supplemented by good judgment, safe control, and caution whenever operating drilling, boring, and probing equipment.

4.3.7 **Safety Representative**: Unless the **Contractor** has a designated **Safety Representative**, the **Contractor'**s responsible person for safety for the drill crew will be the drill rig operator. The safety person's responsibilities are to

- Consider the "responsibility" for safety and the "authority" to enforce safety to be a matter of first importance.

- Be the leader in using proper personal protective equipment (PPE) and set an example in following the rules that are being enforced on others. See section 4.5 for PPE required by this SOP.
- Enforce the use of proper safety equipment and take appropriate corrective action when proper PPE is not being used.
- Understand that the proper maintenance of tools and equipment and general housekeeping on the drill rig will provide an environment that promotes and enforces safety. See Sections 4.7 and 4.9 for housekeeping and maintenance requirements of this SOP.
- Ensure that the operator has had adequate training and is thoroughly familiar with the rig, its controls, and its capabilities prior to commencement of drilling activities.
- Inspect the l rig at least daily for structural damage, loose bolts and nuts, proper tension in chain drives, loose or missing guards or protective covers, fluid leaks, damaged hoses, and/or damaged pressure gauges and pressure relief valves. A Rig Inspection Form has been provided in S3NA-405-FM1 Drill Rig Inspection for use in performing inspections when the Contractor does not have their own.
- Check and test all safety devices such as emergency shutdown switches at least daily and preferably at the start of a work shift. Rig operation should not be permitted until all emergency shutdown and warning systems are working correctly. Wiring around, bypassing, or removing an emergency device is not permitted.
- Check that all gauges, warning lights, and control levers are functioning properly, and listen for unusual sounds on each starting of an engine.
- Ensure that all new rig workers are informed of safe operating practices on and around the rig. Provide each new rig worker with a copy of the organization's drilling operations safety procedures and, when appropriate, the rig manufacturer's operations and maintenance manual. The safety person should ensure that each new employee reads and understands the safety procedures.
- Ensure that a first aid kit and fire extinguishers are available and properly maintained on each rig and on each additional vehicle.
- Be well trained and capable of using a first aid kit, a fire extinguisher, and all other safety devices and equipment.
- Maintain a list of addresses and telephone numbers of emergency assistance units (ambulance services, police, hospitals, etc.), and inform other members of the drill crew of its location.
- See that new workers are instructed in rig safety, and observe the new worker's progress toward understanding safe operating practices.
- Observe the mental, emotional, and physical capability of workers to perform the assigned work in a proper and safe manner. Dismiss from the job site any worker whose mental and physical capabilities might cause injury to the worker or coworkers.
- Rig Crew and Other Field Personnel (Those employees involved in fieldwork): All personnel engaged in site activities are required to become thoroughly familiar with, and to conform to, the provisions of AECOM's safety plan, procedures, and such other safety directives as may be considered appropriate by **Project Managers**, **Safety Officers,** and **Supervisors**.
- Rig Workers: Personnel are encouraged to offer ideas, suggestions, or recommendations regarding any operational condition, procedure, or practice that may enhance the safety of site personnel or the public. Their primary responsibilities will be:
  - Perform all required work safely.
  - Familiarize themselves with and understand the plan, including proper use of personal protective equipment.
  - Report any unsafe conditions to supervisory personnel.
  - Be aware of signs and symptoms of thermal stress.

## 4.4 Training

4.4.1 All staff shall be provided with on-site orientation to the rig and its operator.

4.4.2 All operators and assistants shall have industry-standard safety training and be versed in the equipment to be utilized. This may include, but is not limited to, HAZWOPER, Petroleum Safety Training (or Construction Safety Training), and H2S Alive as appropriate.

4.5 **Personal Protective Equipment**

4.6 For most geotechnical, mineral, and/or groundwater drilling projects, PPE should include

- Hard hat: Hard hats shall be worn by everyone working at a drilling/boring site. Hats should meet the requirements of ANSI Z89 and be kept clean and in good repair with the headband and crown straps properly adjusted for the employee.
- Safety shoes: Safety shoes or boots shall be worn by all drilling personnel and all visitors to the site who observe operations within close proximity of the rig. Safety shoes or boots should meet the requirements of ANSI Z4 1.1.
- Safety glasses: All rig personnel shall wear safety glasses meeting the requirements of ANSI Z87.1.
- High Visibility Class II Safety Vest shall be worn by all **AECOM employees**. All rig personnel should attempt to wear high-visibility clothing that should be close fitting and not have large cuffs or loose material that can catch on rotating or translating components of the rig.
- Close fitting gloves and clothing: All rig personnel should wear gloves for hand protection against cuts and abrasions that could occur while handling wire rope or cable and from contact with sharp edges and burrs on drill rods and other drilling or sampling tools. Gloves should be close fitting and not have large cuffs or loose ties which can catch on rotating or translating components of the rig.
- Other protective equipment: For some operations, the project may dictate use of other protective equipment. The management of the contractor and its safety person shall determine the requirements. Such equipment might include face or ear protection or reflective clothing. The design and composition of the protective equipment and clothing should be determined as a joint effort of management and the client.
- Each worker should wear noise reducing ear protectors around operating equipment or during elevated noise levels.
- When drilling, boring, or probing is performed in chemically or radiological contaminated ground, special protective equipment and clothing will probably be required.
- The clothing of the individual rig worker is not generally considered protective equipment; however, clothing should be close fitting and comfortable without loose ends, straps, draw strings or belts or otherwise unfastened parts that might catch on some rotating or translating component of the rig. Rings and jewelry should not be worn during a work shift.

4.7 **Housekeeping**

4.7.1 A key requirement for safe field operations is that the Contractor safety person understands and fulfills the responsibility for maintenance and “housekeeping” on and around the drill rig, including the following:

- Suitable storage locations should be provided for all tools, materials, and supplies so that tools, materials, and supplies can be conveniently and safely handled without hitting or falling on a member of the crew or a visitor.
- Storage or transporting tools, materials, or supplies within or on the mast (derrick) of the rig should be avoided.
- Pipe, drill rods, probe rods, casing augers, and similar tooling should be orderly stacked on racks or sills to prevent spreading, rolling, or sliding.
- Penetration or other driving hammers should be placed at a safe location on the ground or be secured to prevent movement when not in use.
- Work areas, platforms, walkways, scaffolding and other accesses should be kept free of materials, debris and obstructions and substances such as ice, grease, or oil that could cause a surface to become slick or otherwise hazardous.
- All controls, control linkages, warning and operation lights, and lenses should be kept free of oil, grease, and/or ice.
- Do not store gasoline in any portable container other than a non-sparking, red safety container with a flame arrester in the fill spout and having the word “gasoline” easily visible.

## 4.8 Traffic Control

4.8.1 When operating near public vehicular and pedestrian traffic, the on-site personnel shall take every precaution necessary to see that the work zone is properly established, identified, and isolated from both moving traffic and passerby pedestrians.

4.8.2 All traffic control devices shall be installed, placed, and maintained in accordance with the Traffic Control Plan, client specifications, and/or the Manual of Uniform Traffic Control Devices (MUTCD). Traffic control devices shall consist of and not be limited to:

- Directional and informational signage;
- High visibility barricades, cones, or barrels;
- Lighting; and
- Other equipment and devices as required.

## 4.9 Maintenance & Inspection

4.9.1 Good maintenance and thorough inspection will make operations safer. Maintenance tasks should be done safely by a qualified maintenance person. Inspection and maintenance tasks include but are not limited to the following requirements:

- Inspections shall be completed at the beginning of each day by the equipment operator and in the presence of an AECOM employee when the equipment is not owned and operated by AECOM. A Rig Inspection Form is provided in S3NA-405-FM1 Drill Rig Inspection for use in performing inspections.
- Safety glasses should be worn when performing maintenance on a rig or on drilling or probing tools.
- The drill rig engine should be shut down to make repairs or adjustments to a drill rig or to lubricate fittings (except repairs or adjustments that can only be made with the engine running).
- Precautions should be taken to prevent accidental starting of an engine during maintenance by removing or tagging the ignition key.
- Wheels or the lowering of leveling jacks or both should be blocked ("zero energy state") and hand brakes set before working under a drill rig.
- When possible and appropriate, all pressure on the hydraulic systems should be released as well as the drilling fluid system and the air pressure systems of the drill rig prior to performing maintenance. In other words, reduce the drill rig and operating systems to a “zero energy state” before performing maintenance. Use extreme caution when opening drain plugs and radiator caps and other pressurized plugs and caps.
- Personnel shall not touch an engine or the exhaust system of an engine following its operation until the engine and exhaust system have adequate time to cool.
- Welding and cutting shall not occur on or near a fuel tank.
- Wire rope safety factors shall be in accordance with American National Standards Institute B 30.5-1968 or SAE J959-1966.
- Gasoline or other volatile or flammable liquids shall not be used as a cleaning agent on or around an l rig.
- The manufacturer's recommendations should be followed for applying the proper quantity and quality of lubricants, hydraulic oils, and/or coolants.
- All caps, filler plugs, protective guards, panels, high-pressure hose clamps, chains, or cables that have been removed for maintenance should be replaced.

## 4.10 Hand Tools

4.10.1 A large number of hand tools can be used on or around a drill or probe rig and in repair shops and more than an equal number of instructions for proper use exist. “Use the tool for its intended purpose” is the most important rule. Additionally, equipment operators and assistants should not use their hand in place of the proper tool; work shall be stopped until the correct tool can be found. The following are a few specific and some general suggestions that apply to the safe use of several hand tools that are often used on and around rigs:

- When a tool becomes damaged, either repair it before using it again or get rid of it.
- When using a hammer, any kind of hammer for any purpose, wear safety glasses and require all others around you to wear safety glasses.

- When using a chisel, any kind of chisel, for any purpose, wear safety glasses and require all others around you to wear safety glasses.
- Keep all tools cleaned and orderly stored when not in use.
- Use wrenches on nuts; don't use pliers on nuts.
- Use screwdrivers with blades that fit the screw slot.
- When using a wrench on a tight nut, first use some penetrating oil, use the largest wrench available that fits the nut, when possible pull on the wrench handle rather than pushing, and apply force to the wrench with both hands when possible and with both feet firmly placed. Don't push or pull with one or both feet on the drill rig or the side of a mud pit or some other blocking-off device. Always assume that you may lose your footing – check the place where you may fall for sharp objects.
- Keep all pipe wrenches clean and in good repair. The jaws of pipe wrenches should be wire brushed frequently to prevent an accumulation of dirt and grease which would otherwise build up and cause wrenches to slip. Replace hook and heel jaws when they become visibly worn.
- Avoid the use pipe wrenches in place of a rod-holding device whenever possible.
- When breaking tool joints on the ground or on a drilling platform, position your hands so that your fingers will not be smashed between the wrench handle and the ground or the platform, should the wrench slip or the joint suddenly let go.

## 4.11 Clearing Work Areas

4.11.1 Prior to set up, adequate site clearing and leveling should be performed to accommodate the rig and supplies and provide a safe working area. Clearing the site includes clearing the intended drilling area of underground utilities in accordance with *S3NA-417-PR Utilities*, *Underground*. Drilling or probing should not be commenced when tree limbs, unstable ground or site obstructions cause unsafe tool handling conditions.

4.11.2 Start-Up

- All rig personnel and visitors should be instructed to "stand clear" of the rig immediately prior to and during starting of an engine.
- Make sure all gear boxes are in neutral, all hoist levers are disengaged, all hydraulic levers are in the neutral-actuating positions, and the cathead rope is not on the cathead before starting a drill rig engine.
- Start all engines according to the manufacturer's manual.

## 4.12 Drilling and Probing Operations

4.12.1 The following safety measures shall be taken during drilling and probing operations on-site:

- The operator and helper shall be present during all active rig operations.
- Site personnel shall remain within visual contact of the rig operator.
- Hard hats, approved safety boots and hearing protection shall be worn in the presence of a rig.
- Services shall be cleared prior to drilling or probing.
- Hands shall be kept away from moving parts (augers).
- The emergency shut-off switch on the rig should be identified to site personnel and tested on a regular basis by the operator.
- Unauthorized personnel shall be kept clear of the rig.

4.12.2 Safety requires the attention and cooperation of every worker and site visitor.

- Do not drive the rig from hole to hole with the mast (derrick) in the raised position.
- Before raising the mast (derrick) look up to check for overhead obstructions. Refer to *S3NA-417-PR Utilities, Underground* and *S3NA-406-PR Electrical Lines, Overhead*.
- Before raising the mast (derrick), all rig personnel (with the exception of the operator) and visitors should be cleared from the areas immediately to the rear and the sides of the mast. All rig personnel and visitors should be informed that the mast is being raised prior to raising it.
- Before the mast (derrick) of a drill rig is raised and drilling is commenced, the drill rig shall be first leveled and stabilized with leveling jacks and/or solid cribbing. The drill rig should be releveled if it settles after initial set up. Lower the mast (derrick) only when the leveling jacks are down, and do not raise the leveling jack pads until the mast (derrick) is lowered completely.

- Before starting drilling operations, secure and/or lock the mast (derrick) if required according to the drill manufacturer's recommendations.
- The operator of a rig should only operate a drill rig from the position of the controls. If the operator of the rig shall leave the area of the controls, the operator should shift the transmission controlling the rotary drive into neutral and place the feed control lever in neutral. The operator should shut down the drill engine before leaving the vicinity of the drill.
- Throwing or dropping tools will not be permitted. All tools should be carefully passed by hand between personnel or a hoist line should be used.
- Do not consume alcoholic beverages or other depressants or chemical stimulants prior to starting work on a rig or while on the job.
- If it is necessary to operate the rig within an enclosed area, make certain that exhaust fumes are conducted out of the area. Exhaust fumes can be toxic and some cannot be detected by smell.
- Clean mud and grease from your boots before mounting a rig platform and use hand holds and railings. Watch for slippery ground when dismounting from the platform.
- During freezing weather, do not touch any metal parts of the rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
- All air and water lines and pumps should be drained when not in use if freezing weather is expected.
- All unattended bore holes shall be adequately covered or otherwise protected to prevent rig personnel, site visitors, or animals from stepping or falling into the hole. All open bore holes should be covered, protected, or backfilled adequately and according to local or state regulations on completion of the drilling project.
- “Horsing around” within the vicinity of the drill rig and tool and supply storage areas should never be allowed, even when the rig is shut down.
- When using a ladder on a rig, face the ladder and grasp either the side rails or the rungs with both hands while ascending or descending. Always use adequate fall protection and a full body harness when climbing above six feet of the ground. Do not attempt to use one or both hands to carry a tool while on a ladder. Use a hoist line and a tool “bucket” or a safety hook to raise or lower hand tools.

### 4.13 Elevated Derrick Platforms

4.13.1 The following precautions should be used:

- When a rig worker first arrives at a derrick platform, the platform should immediately be inspected for broken members, loose connections, and loose tools or other loose materials.
- A derrick platform over 4 feet (1.2 m) above ground surface should have toe boards and safety railings that are in good condition.
- When climbing to a derrick platform that is higher than 6 feet (am), a fall arresting device shall be used. The fall arresting device should consist of a full body harness and fall protection. The harness should fit snugly but comfortably. The lifeline when attached to the derrick should be less than 6 feet (2 m) long and attached to a fall arrester. The harness and lifeline should be strong enough to withstand the dynamic force of a 250-pound (115 kg) weight (contained within the belt) falling 6 feet (2 m).
- When a rig worker is on a derrick platform, the lifeline should be fastened to the derrick just above the derrick platform and to a structural member that is not attached to the platform or to other lines or cables supporting the platform.
- Tools should be securely attached to the platform with safety lines. Do not attach a tool to a line attached to your wrist or any other part of your body.
- When you are working on a derrick platform, do not guide drill rods or pipe into racks or other supports by taking hold of a moving hoist line or a traveling block.
- Loose tools and similar items should not be left on the derrick platform or on structural members of the derrick.
- Workers on the ground or the drilling floor should avoid being under rig workers on elevated platforms whenever possible.

4.14 **Lifting Heavy Objects**

4.14.1 Before lifting any object without using a hoist, make sure that the load is within your personal lifting capacity. If it is too heavy, ask for assistance.

4.14.2 Before lifting a relatively heavy object, approach the object by bending at the knees, keeping your back vertical and unarched while obtaining a firm footing. Grasp the object firmly with both hands and stand slowly and squarely while keeping your back vertical and unarched. In other words, perform the lifting with the muscles in your legs, not with the muscles in your lower back.

4.14.3 If a heavy object shall be moved some distance without the aid of machinery, keep your back straight and unarched. Change directions by moving your feet, not by twisting your body.

4.14.4 Move heavy objects with the aid of handcarts or lifting devices whenever possible.

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4.15 **Use of Wire Line Hoists, Wire Rope, and Hoisting Hardware**

4.15.1 The use of wire line hoists, wire rope, and hoisting hardware should be as stipulated by the American Iron Steel Institute, Wire Rope Users Manual.

- All wire ropes and fittings should be visually inspected during use and thoroughly inspected at least once a week for abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper revving, jamming, crushing, bird caging, kinking, care protrusion, and damage to lifting hardware. Wire ropes should be replaced when inspection indicates excessive damage according to the Wire Rope Users Manual. All wire ropes that have not been used for a period of a month or more should be thoroughly inspected before being returned to service.
- End fittings and connections consist of spliced eyes and various manufactured devices. All manufactured end fittings and connections should be installed according to the manufacturer's instructions and loaded according to the manufacturer's specifications.
- If a ball-bearing type hoisting swivel is used to hoist drill rods, swivel bearings should be inspected and lubricated daily to ensure that the swivel freely rotates under load.
- If a rod-slipping device is used to hoist drill or probe rods, do not drill through or rotate drill rods through the slipping device; do not hoist more than 1 foot (.3 m) of the rod column above the top of the mast (derrick); and do not hoist a rod column with loose tool joints while the rod column is being supported by a rod slipping device. If rods should slip back into the hole, do not attempt to break the fall of the rods with your hands or by applying tension to the slipping device.
- Most sheaves on exploration drill rigs are stationary with a single part line. The number of parts of line should never be increased without first consulting with the manufacturer of the drill rig.
- Wire ropes shall be properly matched with each sheave. If the rope is too large, the sheave will pinch the wire rope; if the rope is too small, it will groove the sheave. Once the sheave is grooved, it will severely pinch and damage larger-sized wire ropes and therefore shall be replaced.

4.15.2 The following procedures and precautions shall be understood and implemented for safe use of wire ropes and rigging hardware.

- Use tool-handling hoists only for vertical lifting of tools (except when angle hole drilling). Do not use tool-handling hoists to pull on objects always from the rig; however, drills may be moved using the main hoist if the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.
- When struck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull to the hoist line or the feed mechanism of the drill.
- When attempting to pull out a mired down vehicle or drill rig carrier, only use a winch on the front or rear of the vehicle and stay as far as possible away from the wire rope. Do not attempt to use tool hoists to pull out a mired down vehicle or drill rig carrier.
- Minimize shock loading of a wire rope. Apply loads smoothly and steadily. Avoid sudden loading in cold weather.
- Never use frozen ropes.
- Protect wire rope from sharp corners or edges.
- Replace faulty guides and rollers.

- Replace damaged safety latches on safety hooks before using.
- Know the safe working load of the equipment and tackle being used. Never exceed this limit.
- Clutches and brakes of hoists should be periodically inspected and tested.
- Know and do not exceed the rated capacity of hooks, rings, links, swivels, shackles, and other lifting aids.
- Always wear gloves when handling wire ropes.
- Do not guide wire rope on hoist drums with your hands.
- Following the installation of a new wire rope, first lift a light load to allow the wire rope to adjust.
- Never carry out any hoisting operations when the weather conditions are such that hazards to personnel, the public, or property are created.
- Never leave a load suspended in the air when the hoist is unattended.
- Keep your hands away from hoists, wire rope, hoisting hooks, sheaves, and pinch points while slack is being taken up and when the load is being hoisted.
- Never hoist the load over the head, body, or feet of any personnel. Never use a hoist line to "ride" up the mast (derrick) of a drill rig.
- Replacement wire ropes should conform to the drill rig manufacturer's specifications.

### 4.16 Use of Cathead and Rope Hoists

4.16.1 The following safety procedures should be employed when using a cathead hoist:

- Keep the cathead clean and free of rust and oil and/or grease. The cathead should be cleaned with a wire brush if it becomes rusty.
- Check the cathead periodically, when the engine is not running, for rope wear grooves. If a rope groove forms to a depth greater than 1/8 inches (3 mm), the cathead should be replaced.
- Always use a clean, dry, sound rope. A wet or oily rope may “grab” the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast.
- Should the rope “grab” the cathead or otherwise become tangled in the drum, release the rope and sound an appropriate alarm for all personnel to rapidly back away and stay clear. The operator should also back away and stay clear. If the rope “grabs” the cathead, and tools are hoisted to the sheaves at the top of the mast, the rope will often break, releasing the tools. If the rope does not break, stay clear of the drill rig until the operator cautiously returns to turn off the drill rig engine and appropriate action is taken to release the tools. The operator should keep careful watch on the suspended tools and should quickly back away after turning off the engine.
- The rope should always be protected from contact with all chemicals. Chemicals can cause deterioration of the rope that may not be visibly detectable.
- Never wrap the rope from the cathead (or any other rope, wire rope or cable on the drill rig) around a hand, wrist, arm, foot, ankle, leg or any other part of your body.
- Always maintain a minimum of 18 inches of clearance between the operating hand and the cathead drum when driving samplers, casing or other tools with the cathead and rope method. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground.
- Never operate a cathead (or perform any other task around a drill rig) with loose unbuttoned or otherwise unfastened clothing or when wearing gloves with large cuffs or loose straps or lacings.
- Do not use a rope that is any longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.
- Do not use more rope wraps than are required to hoist a load.
- Do not leave a cathead unattended with the rope wrapped on the drum. Position all other hoist lines to prevent contact with the operating cathead rope.
- When using the cathead and rope for driving or back driving, make sure that all threaded connections are tight and stay as far away as possible from the hammer impact point.
- The cathead operator shall be able to operate the cathead standing on a level surface with good, firm footing conditions without distraction or disturbance.

4.17 **Use of Augers**

4.17.1 The following general procedures should be used when starting a boring with continuous flight of hollow-stem augers:

- Prepare to start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low RPM.
- Apply an adequate amount of down pressure prior to rotation to seat the auger head below the ground surface.
- Look at the auger head while slowly engaging the clutch or rotation control and starting rotation. Stay clear of the auger.
- Slowly rotate the auger and auger head while continuing to apply down pressure. Keep one hand on the clutch or the rotation control at all times until the auger has penetrated about one foot or more below ground surface.
- If the auger head slides out of alignment, disengage the clutch or hydraulic rotation control and repeat the hole starting process.
- An auger guide can facilitate the starting of a straight hole through hard ground or a pavement.
- The operator and tool handler should establish a system of responsibility for the series of various activities required for auger drilling, such as connecting and disconnection auger sections, and inserting and removing the auger fork. The operator shall ensure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation.
- Only use the manufacturer's recommended method of securing the auger to the power coupling. Do not touch the coupling or the auger with your hands, a wrench, or any other tools during rotation.
- Whenever possible, use tool hoists to handle auger sections.
- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.
- Never allow feet to get under the auger section that is being hoisted.
- When rotating augers, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason.
- Use a long-handled shovel to move auger cuttings away from the auger. Never use your hands or feet to move cuttings away from the auger.
- Do not attempt to remove earth from rotating augers. Augers should be cleaned only when the drill rig is in neutral and the augers are stopped from rotating.

4.18 **Rotary and Core Drilling**

4.18.1 Rotary drilling tools should be safety checked prior to drilling:

- Water swivels and hoisting plugs should be lubricated and checked for "frozen" bearings before use.
- Drill rod chuck jaws should be checked periodically and replaced when necessary.
- The capacities of hoists and sheaves should be checked against the anticipated weight to the drill rod string plus other expected hoisting loads.

4.18.2 Special precautions that should be taken for safe rotary or core drilling involve chucking, joint break, hoisting, and lowering of drill rods:

- Only the operator of the drill rig should brake or set a manual chuck so that rotation of the chuck will not occur prior to removing the wrench from the chuck.
- Drill rods should not be braked during lowering into the hole with drill rod chuck jaws. Drill rods should not be held or lowered into the hole with pipe wrenches.
- If a string of drill rods are accidentally or inadvertently released into the hole, do not attempt to grab the falling rods with your hands or a wrench.
- In the event of a plugged bit or other circulation blockage, the high pressure in the piping and hose between the pump and the obstruction should be relieved or bled down before breaking the first tool joint.
- When drill rods are hoisted from the hole, they should be cleaned for safe handling with a rubber or other suitable rod wiper. Do not use your hands to clean drilling fluids from drill rods.

- If work shall progress over a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross members. The mud pit should be equipped with rough-surfaced, fitted cover panels of adequate strength to hold drill rig personnel.
- Drill rods should not be lifted and leaned unsecured against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage or lay the rods down.

### 4.19 Site Movement of Equipment

4.19.1 The individual who transports a rig on and off a drilling site should:

- Be properly licensed and should only operate the vehicle according to federal, state, and local regulations.
- Know the traveling height (overhead clearance), width, length and weight of the rig with carrier and know highway and bridge load, width and overhead limits, making sure these limits are not exceeded with and adequate margin.
- Never move an l rig unless the vehicle brakes are in sound working order.
- Allow for mast overhand when cornering or approaching other vehicles or structures.
- Be aware that the canopies of service stations and motels are often too low for a drill rig mast to clear with the mast in the travel position.
- Watch for low hanging electrical lines, particularly at the entrances to drilling sites or restaurants, motels, other commercial sites.
- Never travel on a street, road, or highway with the mast (derrick) of the rig in the raised or partially raised position.
- Remove all ignition keys if rig is left unattended.

4.19.2 Loading and Unloading

- Use ramps of adequate design that are solid and substantial enough to bear the weight of the rig with carrier, including tools.
- Load and unload on level ground.
- Use the assistance of someone on the ground as a guide.
- Check the brakes on the rig carrier before approaching loading ramps.
- Distribute the weight of the rig, carrier, and tools on the trailer so that the center of eight is approximately on the centerline of the trailer and so that some of the trailer load is transferred to the high of the pulling vehicle. Refer to the trailer manufacturer's weight distribution recommendations.
- The rig and tools should be secured to the hauling vehicle with ties, chains, and/or load binders of adequate capacity.

4.19.3 Off-Road Movement

The following safety suggestions relate to off-road movement:

- Before moving a drill rig, first walk the route of travel, inspecting for depressions, stumps, gullies, ruts, and similar obstacles.
- Always check the brakes of a drill rig carrier before traveling, particularly on rough, uneven, or hilly ground.
- Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts, and mountings.
- Discharge all passengers before moving a drill rig on rough or hilly terrain.
- Engage the front axle (for 4 x 4, 6 x 6, etc. vehicles or carriers) when traveling off highway on hilly terrain.
- Use caution when traveling side-hill. Conservatively evaluate side-hill capability of drill rigs, because the arbitrary addition of drilling tools may raise the center of mass. When possible, travel directly uphill or downhill. Increase tire pressures before traveling in hilly terrain (do not exceed rated tire pressure).
- Attempt to cross obstacles such as small logs and small erosion channels or ditches squarely, not at an angle.
- Use the assistance of someone on the ground as a guide when lateral or overhead clearance is close.

- After the drill has been moved to a new drilling site, set all brakes and/or locks. Always block/chock the wheels.

### 4.20 Tires, Batteries, and Fuel

4.20.1 Tires on the rig shall be checked daily for safety and during extended travel for loss of air and they shall be maintained and/or repaired in a safe manner. If tires are deflated to reduce ground pressure for movement on soft ground, the tires should be inflated to normal pressures before movement on firm or hilly ground or on streets, roads and highways. Under-inflated tires are not as stable on firm ground as properly inflated tires. Air pressures should be maintained for travel on streets, roads, and highways according to the manufacturer's recommendations. During air pressure checks, inspect for:

- Missing or loose wheel lugs.
- Objects wedged between dual or embedded in the tire casing. Damaged or poorly fitting rims or rim flanges.
- Abnormal wear, cuts, breaks, or tears in the casing.
- The repair of truck and off-highway tires should only be made with required special tools and following the recommendations of a tire manufacturer’s repair manual.

4.20.2 Batteries contain strong acid. Use extreme caution when servicing batteries.

- Batteries should only be serviced in a ventilated area while wearing safety glasses.
- When a battery is removed from a vehicle or service unit, disconnect the battery ground clamp first.
- When installing a battery, connect the battery ground clamp last.
- When charging a battery with a battery charger, turn off the power source to the battery before either connecting or disconnecting charger leads to the battery posts. Cell caps should be loosened prior to charging to permit the escape of gas.
- Spilled battery acid can burn your skin and damage your eyes. Spilled battery acid should be immediately flushed off of your skin with lots of water. Should battery acid get into someone's eyes, flush immediately with large amounts of water and see a physician at once.
- To avoid battery explosions, keep the cells filled with electrolyte; use a flashlight (not an open flame) to check electrolyte levels and avoid creating sparks around the battery by shorting across a battery terminal. Keep lighted smoking materials and flames away from batteries.

4.20.3 Special precautions shall be taken for handling fuel and refueling the rig or carrier. Only use the type and quality of fuel recommended by the engine manufacturer.

- Refuel in a well-ventilated area.
- Do not fill fuel tanks while the engine is running. Turn off all electrical switches. Do not spill fuel on hot surfaces. Clean any spillage before starting an engine. Wipe up spilled fuel with cotton rags or cloths. Do not use wool or metallic cloth.
- Keep open lights, lighted smoking materials, and flames or sparking equipment well away from the fueling area.
- Turn off heaters in carrier cabs when refueling the carrier or the drill rig.
- Do not fill portable fuel containers completely full to allow expansion of the fuel during temperature changes.
- Keep the fuel nozzle in contact with the tank being filled to prevent static sparks from igniting the fuel.
- Do not transport portable fuel containers in the vehicle or carrier cab with personnel.
- Fuel containers and hoses should remain in contact with a metal surface during travel to prevent the buildup of static charge.

### 4.21 First Aid (see S3NA-207-PR Medical Services and First Aid)

4.21.1 At least one member of the crew (and if only one, preferably the drilling and safety supervisor) should be trained to perform first aid. First aid is taught on a person-to-person basis, not by providing or reading a manual. Manuals should only provide continuing reminders and be used for reference. It is suggested that courses provided or sponsored by the American Red Cross or a similar organization would best satisfy the requirements of first aid training for drill crews.

4.21.2 For drilling and probing operations it is particularly important that the individual responsible for first aid should be able to recognize the symptoms and be able to provide first aid for electrical shock, heart attack, stroke, broken bones, eye injury, snake bite, and cuts or abrasions to the skin. Again, first aid for these situations is best taught to drill crewmembers by instructors qualified by an agency such as the American Red Cross.

4.21.3 A first aid kit should be available and well maintained on each drill site. The contents of the first aid kit shall be placed in a weatherproof container with individual sealed packages for each type of item.

4.22 **Rig Utilization**

4.22.1 Do not attempt to exceed manufacturers' ratings of speed, force, torque, pressure, flow, etc.

4.22.2 Only use the drill rig and tools for the purposes that they are intended and designed.

4.23 **Rig Alterations**

4.23.1 Alterations to a rig or drilling or probing tools should only be made by qualified personnel and only after consultation with the manufacturer.

## 5.0 Records

5.1 None

## 6.0 References

6.1 None

# S3NA-405-FM1 Drill Rig Inspection

**Project Name**:
**Project Number**:
**Date**:
**Subcontractor Inspected**:
**Site Manager**:

| **General Safety** | | |
|---|---|---|
| Safety Officer Designated for Job: | ☐ Yes | ☐ No |
| Name: | | |
| Safety Meeting Performed (Daily) | ☐ Yes | ☐ No |
| **Personal Protective Equipment (PPE)** | | |
| Hard Hats | ☐ Yes | ☐ No |
| Safety Glasses | ☐ Yes | ☐ No |
| Steel-toed Boots | ☐ Yes | ☐ No |
| Hearing Protection | ☐ Yes | ☐ No |
| Work Gloves | ☐ Yes | ☐ No |
| Orange Work Vests | ☐ Yes | ☐ No |
| Traffic Cones and Signs | ☐ Yes | ☐ No |
| Other | ☐ Yes | ☐ No |
| Disposal of PPE in Proper Waste Containers (if applicable) | ☐ Yes | ☐ No |
| Comments: | | |
| **Daily Inspections of Drill Rig** | | |
| Structural Damage, Loose Bolts | ☐ Yes | ☐ No |
| Proper Tension in Chain Drives | ☐ Yes | ☐ No |
| Loose or Missing Guards, Fluid Leaks | ☐ Yes | ☐ No |
| Damaged Hoses and/or Damaged Pressure | ☐ Yes | ☐ No |
| Gauges and Pressure Relief Valves | ☐ Yes | ☐ No |
| Comments: | | |

| | | |
|---|---|---|
| Check and test all safety devices such as: | | |
| Emergency shutdown switches, at least daily | ☐ Yes | ☐ No |
| All gauges and warning lights, and ensure control levers are functioning properly | ☐ Yes | ☐ No |
| First aid and fire extinguishers on drill rig | ☐ Yes | ☐ No |
| Back up alarm functioning properly | ☐ Yes | ☐ No |
| Comments: | | |

| **Drill Crew Training Requirements** | | |
|---|---|---|
| 40-hour OSHA Training | ☐ Yes | ☐ No |
| 8-hour Annual Refresher Training | ☐ Yes | ☐ No |
| Drill Rig Training/Safe Operating Practices | ☐ Yes | ☐ No |
| First Aid/CPR | ☐ Yes | ☐ No |
| Emergency Procedures | ☐ Yes | ☐ No |
| Emergency Phone Numbers Posted | ☐ Yes | ☐ No |
| Site Orientation | ☐ Yes | ☐ No |
| Health and Safety Plan Review | ☐ Yes | ☐ No |
| Comments: | | |

| **Housekeeping** | | |
|---|---|---|
| Suitable storage for tools, materials, and supplies | ☐ Yes | ☐ No |
| Pipes, drill rods, casing, and augers stacked on racks to prevent rolling and sliding | ☐ Yes | ☐ No |
| Platforms and other work areas free of debris materials and obstructions | ☐ Yes | ☐ No |
| Comments: | | |

| Hand Tools | | |
|---|---|---|
| Tools in good condition | ☐ Yes | ☐ No |
| Broken tools discarded and replaced | ☐ Yes | ☐ No |
| Right tool used for the right job | ☐ Yes | ☐ No |
| Comments: | | |

| Drilling Operations | | |
|---|---|---|
| Mast or derrick down when moving rig | ☐ Yes | ☐ No |
| Overhead obstructions identified before mast is raised | ☐ Yes | ☐ No |
| Drill rig stabilized using leveling jacks or solid cribbing | ☐ Yes | ☐ No |
| Secure and lock derrick | ☐ Yes | ☐ No |
| Comments: | | |

| Overhead and Buried Utilities | | |
|---|---|---|
| Buried utilities identified and marked | ☐ Yes | ☐ No |
| Safe distance of drill rig from overhead power lines | ☐ Yes | ☐ No |
| Comments: | | |

| Wire Line Hoists, Wire Rope, and Hardware | | |
|---|---|---|
| Inspection for broken wires where reduction in rope diameter, wire diameter, fatigue, corrosion, damage from gear jamming, crushing, bird caging, kinking | ☐ Yes | ☐ No |
| Inspect and lubricate parts daily | ☐ Yes | ☐ No |
| Comments: | | |

**Auger Operations—what to look for:**

- A system of responsibility between the operator and the tool handler when connecting and disconnecting auger sections and inserting and removing auger fork.
- During connecting and disconnecting auger sections and inserting auger for the tool, handler should position himself away from the auger column while it is rotating.
- When securing the auger to the power coupling, pin should be inserted and tapped into place using a hammer or other similar device.
- Tool hoist should be used to lower second section of auger into place.
- Both operators should be clear of auger as it is being lifted into place.
- Long-handled shovel should be used to move dirt away from auger.

**Overall Summary:**

# S3NA-405-FM2 Subsurface Investigation Checklist

Name of Contractor:

Location: Project #:

Date: Time: Weather:

Person Conducting Inspection: Title:

*Note: As you conduct your inspection, you should be able to answer each question with a* ***YES****.*
*If the answer to any question is* ***NO,*** *this deficiency should be corrected as soon as possible.*

Deficiency Corrected?

| | | YES | NO | OK | N/A |
|---|---|---|---|---|---|
| 1. | Do on-site personnel have required-level PPE (steel-toe boots, safety vests, hard hats, safety glasses, and gloves)? | ☐ | ☐ | ☐ | ☐ |
| 2. | Is there a copy of HASP and EAP available at each drill rig location? | ☐ | ☐ | ☐ | ☐ |
| 3. | Are there a PID, multi-gas meter, and a colorimetric pump available at each drill rig location? | ☐ | ☐ | ☐ | ☐ |
| 4. | Has the field screening equipment been calibrated in the morning? | ☐ | ☐ | ☐ | ☐ |
| 5. | Are calibration gases available at the site? | ☐ | ☐ | ☐ | ☐ |
| 6. | Are drilling fluids contained in the mud tub? | ☐ | ☐ | ☐ | ☐ |
| | 6a. Does mud tub setup provide adequate splash guards to protect the public? | ☐ | ☐ | ☐ | ☐ |
| | 6b. Does setup present five (5) feet of walk space for the public? | ☐ | ☐ | ☐ | ☐ |
| | 6c. Will the mud tub be emptied at end of day? | ☐ | ☐ | ☐ | ☐ |
| | 6d. Explain how the mud tub will be covered to prevent an accident. | ☐ | ☐ | ☐ | ☐ |
| | 6e. Are adequate containment practices being implemented to prevent mud tub liquids from being released onto pedestrian walkways? | ☐ | ☐ | ☐ | ☐ |
| 7. | Is the drill rig properly grounded? | ☐ | ☐ | ☐ | ☐ |
| 8. | Is there a DOT permit available on site at each drill rig location? | ☐ | ☐ | ☐ | ☐ |
| | 8a. Are operations in compliance with DOT permit? | ☐ | ☐ | ☐ | ☐ |
| 9. | Is there an orange snow fence with appropriate warning signage erected as a site barrier around the drill rig to keep pedestrians out of the work area? | ☐ | ☐ | ☐ | ☐ |
| 10. | Are hydrant water hoses out of the pedestrian sidewalk? | ☐ | ☐ | ☐ | ☐ |
| 11. | Are smoking and eating prohibited in the immediate work area? | ☐ | ☐ | ☐ | ☐ |
| 12. | Does each drill rig have a fire extinguisher, absorbent materials to cleanup a spill, and a first aid kit? | ☐ | ☐ | ☐ | ☐ |
| 13. | Is the waste from the mud tub properly contained in 55-gallon drums? | ☐ | ☐ | ☐ | ☐ |
| | 13a. Are drums properly labeled? | ☐ | ☐ | ☐ | ☐ |
| 14. | Are proper housekeeping procedures followed to avoid slips, trips, and falls? | ☐ | ☐ | ☐ | ☐ |
| 15. | Are decontamination/hand washing facilities available at the site? | ☐ | ☐ | ☐ | ☐ |

**COMMENTS:**

# S3NA-405-ST Drilling and Boring

| Jurisdiction | Regulation |
|---|---|
| **United States** | |
| **OSHA** | 29CFR 1910.212 |
| **Canada** | |
| **Alberta** | OHS Code (2009) Sect 310, 362 |
| **British Columbia** | OHS Regulation (1997) Sect 8.10, 16.27, 16.28 |
| **Manitoba** | Workplace Health and Safety Regulation (217/2006) Sect 16.5, 22.5 |
| **New Brunswick** | OHS Regulation (91-191) Sect 237, 241, 242 |
| **Newfoundland/Labrador** | OHS Regulation (C.N.L.R. 1165/96) Sect 52, 61, 68, 71, 73 |
| **Nova Scotia** | OHS Regulation (N.S. Reg. 44/99) Sect 87, 88 |
| **NWT/NU Territories** | General Safety Regulations (R.R.N.W.T. 1990, c. S-1), Safety Act (SI-013-92) Sect 39, 97, 141, 220 |
| **Ontario** | O. Reg. 851 Sect 24 |
| **Prince Edward Island** | OHS Regulations (EC180/87) Sect 30.2, 30.8 |
| **Quebec** | OHS Regulation (R.R.Q., c. S-2.1, r.19.01 O.C. 885-2001) Sect 340<br>Safety Code for the Construction Industry (R.R.Q. 1981, c. S-2.1, r. 6) Sect 2.10.2, 3.10.13 |
| **Saskatchewan** | OHS Regulation (R.R.S., c. O-1, r. 1) Sect 135 |
| **Yukon Territory** | OHS Regulations (O.I.C. 2006/178) Sect 1.12, 7.19 |

# S3NA-405-WI Core Drilling Machine Safety Card

## 1.0 Objective / Overview

1.1 Core drilling machines are used on all types of jobs. They can be electrical or gas powered and come with a stand or can be hand held. Caution should be used when operating such a machine. It may look harmless and easy to run, but drilling machines have many hazards.

## 2.0 Safe Operating Guidelines

2.1 Clean the flanges before mounting the blade.

2.2 Make sure the blade is correct for the material being cut and that the arrow on the blade corresponds with the direction of rotation of the machine spindle.

2.3 Avoid tilting the blade when cutting.

2.4 Use only the machines that have an approved safety guard.

2.5 Remove the diamond blade from the machine during transit to prevent accidental damage.

2.6 Inspect the blades frequently to detect cracks or undercutting of the steel center.

2.7 Don't let excessive heat be generated at the cutting edge of the blade.

2.8 Use adequate water supply to both sides of the blade.

2.9 Follow the manufacturers recommended pulley sizes and operating speeds for specific blade diameters.

2.10 Make sure to tighten drive belts to ensure full available power.

2.11 Don't force the blade on the blade shaft or mount blade on an undersized spindle.

## 3.0 Potential Hazards

3.1 Electrical shock.

3.2 Flying debris.

3.3 Severe cuts.

3.4 Hearing loss.

3.5 Breathing fumes or dust.

3.6 Binding/biting – torque control.

## 4.0 Training Requirements

4.1 Review of Applicable SOPs (e.g., *S3NA-305-PR Hand and Power Tools*; *S3NA-302-PR Electrical, General*).

4.2 Demonstrated knowledge on the use of a coring machine.

4.3 Review and follow manufacturers' operating guidelines.

## 5.0 Personal Protective Equipment (Level D PPE)

5.1 Leather gloves.

5.2 Face shield.

5.3 Steel-toed/composite-toed boots.

5.4 Hearing protection.

5.5 Respirator or dust mask.

## 6.0 Other Safety Tips

6.1 Keep fingers and hands away from the cutting edge.

6.2 Hold handle firmly when operating.

6.3 A subsurface utility clearance should be performed prior to initiating drilling operations.

6.4 Stand firmly and apply body weight at anchored side of guarded platform.

# Electrical Lines, Overhead

**S3NA-406-PR**

## 1.0 Purpose and Scope

1.1 Provides the safe work requirements to be observed where overhead electrical lines, electrical apparatus, or any energized (exposed or insulated) parts are present at a job site.

1.2 This procedure applies to all AECOM Americas employees and operations, except where local or governmental regulations are more stringent.

## 2.0 Terms and Definitions

2.1 Types of **Overhead Lines:**

- Overhead electrical lines
- Structural cable supports
- Guy wires
- Cable television / communication lines

2.2 **Arc Flash Hazard:** A dangerous condition associated with the possible release of energy caused by and electric arc. Arc flash is the light and heat produced from an electric arc supplied with sufficient electrical energy to cause substantial damage, harm, fire, or injury.

2.3 **Electrical Hazard:** A dangerous condition such that contact or equipment failure can result in electric shock, arc flash burn, thermal burn, or blast.

2.4 **Minimum Approach Distance (M.A.D.):** The minimum approach distance (M.A.D.) is the closest distance any employee or any part of the operating equipment is permitted to approach an energized or a grounded object.

2.5 **Qualified Person (Electrical Transmission and Distribution):** A person trained and knowledgeable in the construction and operation of electrical transmission and distribution equipment or a specific work method, and has been trained to recognize and avoid electrical hazards that might be present with respect to that equipment or work method.

## 3.0 Attachments

3.1 S3NA-406-FM Overhead Electrical Lines Acknowledgement Form

## 4.0 Procedure

4.1 An appropriate distance must be kept between equipment, its occupants, their tools and energized overhead lines, electrical apparatus, or any energized parts.

4.2 **Project Managers** must contact the overhead line owner/operator (i.e. local utility company) before work is done or before equipment is operated within 50 feet (15.25 meters) of an energized overhead line, to determine the voltage of the overhead line and establish the appropriate M.A.D. as identified in this procedure.

4.3 These minimum approach distances do not apply to a load, equipment, or building that is transported under energized overhead power lines if the total height, including equipment transporting it, is less than 13.5 feet (4.15 metres).

4.4 Employers or Project Managers must formally notify (using the *S3NA-406-FM Overhead Electrical Lines Acknowledgement form*) all subcontractors or equipment operators of an energized overhead line before work is done or equipment is operated in the vicinity of the overhead line at distances less than 50 feet (15.25 meters) and obtain the operator's assistance in protecting workers involved.

4.5 Employees must not place earth or other material under or beside an overhead line if doing so reduces the safe clearance to less than 50 feet (15.25 meters).

4.6 To maintain a safe distance of 50 feet (15.25 meters):

- Install warning devices and signs (hang a sign from and mark all guy wires to warn traffic of low clearance; provide warning signage for all overhead services).
- Install telescopic, nonconductive posts and flagging across right-of-way at the minimum allowable clearance as allowed by regulations for the line voltage.
- Position signs or other devices to determine the “Danger Zone.”
- Inform all job site personnel of the danger zone and the safe distances required.
- Beware of atmospheric conditions, such as temperature, humidity, and wind, that may dictate more stringent safety procedures.

4.7 Operation of heavy equipment and cranes in areas with overhead lines represents a significant arc flash and electrical hazard to all personnel on the job site. Accidental contact with an energized overhead line or arcing between a high power line and grounded equipment, can cause harm to nearby equipment operators or ground personnel and damage to power transmission systems and/or operating equipment.

4.8 Although maintaining a safe distance from all energized overhead lines is the preferred means for control of this hazard, this may not always be feasible due to site conditions. If work will (or may) occur within 50 feet (15.25 meters) of any energized conductor, the procedures outlined below will be observed:

4.8.1 Overhead electrical lines will be identified on each job site before the work commences. For each identified line, the Project Manager must determine whether it is energized (and the operating voltage for energized lines), and whether work operations will require that activities with heavy equipment (excavators, loaders, cranes, aerial work platforms, etc.) will occur within 50 feet (15.25 metres) of the line.

4.8.2 **Project Managers** must contact the overhead line owner/operator (e.g. local utility company) before work is done or before equipment is operated within 50 feet (15.25 meters) of an energized overhead line, in order to determine the voltage of the power line and establish the appropriate M.A.D. as identified in this procedure.

4.8.3 Figure 4-1 lists the Phase-to-Phase voltage rating voltages in kilovolts and the M.A.D.s applicable to all AECOM operations:

**Figure 4-1: Minimum Approach Distances (M.A.D.)**

| Voltage Range (Phase-to-Phase) | Minimum Approach Distance (M.A.D.) in Feet (Meters) |
|---|---|
| Personnel must allow for equipment movement and electrical line swaying when establishing an M.A.D. | |
| 0 – 50 KV | 10 (3) |
| Over 50 – 200 KV | 15 (5) |
| Over 200 – 350 KV | 20 (6) |
| Over 350 – 500 KV | 25 (8) |
| Over 500 – 750 KV | 35 (11) |
| Over 750 – 1,000 KV | 45 (14) |
| **Note: This requirement shall apply except where client, local, or governmental regulations are more stringent.** | |

Source: American National Standards Institute, Publication B30.5.

4.8.4 Job site personnel must maintain a clearance of at least 10 feet (3 meters) between any part of the operating equipment, its occupants and their tools from any overhead line carrying up to 50,000 volts.

4.8.5 One (1) foot (0.3 meters) additional clearance is required for every additional 30,000 volts or less.

4.9 Project Managers must formally notify all subcontractors of overhead lines with the attached *S3NA-406-FM Overhead Electrical Lines Acknowledgement* form.

## 5.0 Minimum Approach Distance Reduction

5.1.1 Where any work task will not allow the minimum safe working distance to be maintained, an alternate means of protection must be implemented by the **Project Manager** and approved by the **SH&E Department.** In order of preference, acceptable procedures are:

- De-energize the overhead line(s)/lockout by local utility authorities; or
- Implement alternative procedures as identified by the overhead line owner/operator or a registered professional engineer.

5.1.2 De-energize Overhead Lines

- Elimination of electrical power provides the most acceptable means of ensuring safety of personnel. While temporary site overhead lines are often under the control of the site manager (and can be de-energized locally), electrical distribution and transmission lines can be de-energized only by the owner/operator of the overhead line. De-energizing of an overhead line often requires advance coordination with the owner/operator. At least one week advance notice should be provided.
- **Project Managers** must confirm with the utility owner/operator that the overhead line has been de-energized and visibly grounded at the job site.

5.1.3 Alternative Procedures

- Project Managers may implement alternative procedures to prevent arc flash and electrical contact. These procedures must be identified by the overhead line owner/operator or a registered Professional Engineer who is a Qualified Person with respect to electrical power transmission and distribution.
- A planning meeting with the **Project Manager**, **SH&E Department** and the utility owner/operator (or register Professional Engineer) must be held to determine the most effective alternative procedures.
- Alternative procedures shall meet all client, local and governmental regulatory requirements.
- Insulating Barriers - Must be rated for the voltage line being guarded. These barriers may not be part of or attached to the equipment. The M.A.D. shall only be reduced within the designed working dimensions of the insulating barrier. This determination shall be made by a Qualified Person in accordance with local or governmental requirements for work practices near energized equipment.
- Dedicated Line Spotters – Must be must be trained to enable them to effectively perform their task, including training on the applicable local and governmental regulations.

## 6.0 Training

6.1.1 **Project Managers** shall ensure that each equipment operator and crew member assigned to work with the equipment is trained in the following:

- The procedures to be followed in the event of electrical contact with an overhead line.
- Overhead lines are presumed to be energized unless the utility owner/operator confirms that the overhead line has been and continues to be de-energized and visibly grounded at the worksite.
- Overhead lines are presumed to be uninsulated unless the utility owner/operator or a registered Professional Engineer who is a Qualified Person with respect to electrical power transmission and distribution confirms that a line is insulated.
- The limitations of an insulating link/device, proximity alarm, and range control (and similar) device, if used.
- The procedures to be followed to properly ground equipment and the limitations of grounding.

## 7.0 Additional Safety Measures

7.1.1 The following additional safety measures may be implemented as needed when working around energized power lines:

- Provide equipment with proximity warning devices. These provide an audible alarm if any part of the equipment gets too close to a line.
- Install ground safety stops. These prevent vehicles from accidentally entering hazardous areas.
- Equip cranes with a boom-cage guard. This prevents the boom from becoming energized if an electrical line is contacted.
- Utilize insulated links and polypropylene tag lines. These prevent the transmission of electricity to loads or tag line handlers if an electrical line is contacted.

NOTE: These additional safeguards are intended as supplemental protection. Use of these measures is not permissible as a substitute for maintaining the safe working distance or implementation of the procedures in Section 4.1.

## 8.0 Emergency Planning

8.1.1 **Project Managers** shall complete a site-specific emergency plan for all operations during which equipment is operated within 50 feet (15.25 meters) of an energized overhead power line or conductor. This procedure shall identify the following information:

- The importance to the operator's safety of remaining inside the cab except where there is an imminent danger of fire, explosion, or other emergency that necessitates leaving the cab.
- The safest means of evacuating from equipment that may be energized.
- The potentially energized zone around the equipment.
- The need for crew in the area to avoid approaching or touching the equipment and the load.
- The means to de-energize the power line or live conductor.
- The contact information for the utility owner/operator and emergency services.
- AECOM notification requirements in accordance with S3NA-004 PR, “Incident Reporting”.

## 9.0 Records

9.1 None

## 10.0 References

10.1 29 CFR 1926 Subpart CC, “Cranes & Derrics in Construction”

10.2 29 CFR 1926 Subpart V, “Power Transmission and Distribution”

10.3 29 CFR 1926.453, “Aerial Lifts”

10.4 National Fire Protection Agency (NFPA) 70E, “Standard for Electrical Safety in the Work Place”

10.5 American National Standards Institute (ANSI) A92 Series, “Elevating and Vehicle Lift Devices”

10.6 ANSI B30.5, “Mobile and Locomotive Cranes”

# S3NA-412-PR Powder-Actuated Tools

## 1.0 Purpose and Scope

1.1 Establishes requirements addressing the potential hazards associated with the use of powder-actuated tools and identifies appropriate controls for their use.

1.2 This procedure applies to all AECOM North America-based employees and operations.

## 2.0 Terms and Definitions

2.1 **Powder-actuated tool:** A nail gun (often called a “Hilti gun” or “Ramset gun” after two of the companies who manufacture the tools) used in the construction and manufacturing industries to join materials to hard substrates like steel and concrete. Also known as "direct fastening," this technology relies on a controlled explosion created by igniting a small chemical propellant charge, similar to the process that activates a firearm.

2.2 **High velocity tool:** A powder-actuated tool that fires a charge at an average test velocity of greater than 492 feet per second *(these types are illegal in the United States).*

2.3 **Low velocity tool:** A powder-actuated tool that fires a charge at an average test velocity of less than 492 feet per second.

## 3.0 Attachments

3.1 S3NA-412-FM Powder-Actuated Tool Pre-Operational Inspection

3.2 S3NA-412-WI Powder-Actuated Tools Safety Card

## 4.0 Procedure

### 4.1 Roles and Responsibilities

#### 4.1.1 Region SH&E Managers

- Conduct/support powder-actuated tool hazard assessments/evaluations and recommend appropriate precautions to project teams.
- Provides technical guidance and support as to this procedure.

#### 4.1.2 Project Managers/field task managers

- Verify that all personnel using powder-actuated tools are properly trained.

#### 4.1.3 Supervisors/Project Managers

- Verify the training and credentials of powder-actuated tool users.[1]
- Verify that the tool user carries a special certification card where required by a state, province, territory, or other local governing body.
- Prevent unauthorized access to areas where powder-actuated tools are in use.
- Remove from service and red tag powder-actuated tools that develop defects.
- Verify that all powder-actuated tools and cartridges are securely stored when not in use to prevent unauthorized and unlawful use.

#### 4.1.4 Employees

- Operate the powder-actuated tool in accordance with the manufacturer’s instructions.[2]
- Inspect powder-actuated tools prior to use utilizing the Powder-Actuated Tool Pre-Operational Inspection Form.
- Notify the supervisor of a tool malfunction, defect, or improper cartridge discharge.

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[1] The State of California requires a specific certification card in order to use a powder-actuated tool.

[2] All powder-actuated tools will comply with the requirements set forth in the American National Standards Institute (ANSI) A10.3-1995, *Safety Requirements for Powder-Actuated Fastening Systems*.

- Properly secure all tools and cartridges when they are not in use.

4.1.5 Nonessential employees are to remain outside the work areas where powder-actuated tools are in use. Operation and use of powder-actuated tools are as follows:

- Only qualified employees will operate tools. The operator will be trained by a certified instructor and will carry, when operating such tools, a card as proof of training and qualifications.
- Only powder-actuated tools meeting the design requirements of ANSI A10.3-1995 *Safety Requirements for Powder-Actuated Fastening Systems* may be used.
- Power-actuated tools can be dangerous when not used in accordance with the manufacturer's information and instruction.
- Tools will be operated in strict accordance with the manufacturer's instructions.
- Neither loaded nor empty tools will be pointed at any person.
- Operators of powder-actuated tools will wear eye/face protection and hearing protection when the tool is in use. Personnel will be notified when a powder-actuated tool is to be used in the area through a verbal announcement such as "Firing!"
- Each day, prior to use, the operator will inspect the tool, using the Powder-Actuated Tool Pre-operational Inspection Checklist in Attachment 1 to determine that it is in proper working order. Any tool found not to be in proper working condition will be immediately removed from service and tagged as "DEFECTIVE/REMOVE FROM SERVICE." It will not be used until it has been properly repaired in accordance with the manufacturer's instructions.
- The proper shield, fixture, adaptor, or accessory suited for the application, as recommended and supplied by the manufacturer, will be used.
- Center Punch Test Procedure. This is a very simple, quick test that can be made to determine base material suitability. Use a fastener as a punch on the actual base material for the following:
  - If the material shows a clear fastener point impression and the fastener point is not blunted, proceed with the first test fastening.
  - If fastener point is blunted, material is too hard.
  - If material cracks or shatters, material is too brittle.
  - If fastener sinks into material with an average hammer blow, the material is too soft.
- No tool will be loaded unless it is being prepared for immediate use. If the work is interrupted after loading, the tool will be unloaded at once. Even if equipped with keepers, restrainers, or captive stud capabilities, the tool will not be pointed at any person.
- The tool will always be held perpendicular to the work surface when fastening into any material, except for specific applications recommended by the tool manufacturer.
- Hands and feet will be kept clear of the open barrel end.
- Should a misfire occur, the tool will be held against the work surface for a full 30 seconds, and then follow the manufacturer's instructions for subsequent actions.
- Control of the charges by supervision at the work site is required to prevent mishap.
- The issuing personnel will have a current list of certified operators and numbers of powder actuated tools.

## 4.2 Limitations of Use

- Powder-actuated tools will not be used where flammable gases, vapors, dusts, or explosives are present.
- The fastener will not be driven into an existing hole unless a guide supplied by the manufacturer is used to ensure proper alignment.
- Fasteners will not be fired into very hard or brittle materials, some of which include cast iron, glazed tile, surface hardened steel, glass block, live rock, face brick, and hollow tile. Fasteners will not be driven into soft or thin materials that could be completely penetrated by the fastener unless there is a backing that would prevent penetration through the other side.
- Fasteners will not be driven closer than 1/2 in. (13mm) from the edge of steel or 3 in. (76mm) from the edge of masonry materials, except for specific applications recommended by the manufacturer.
- Fasteners will not be driven into concrete unless material thickness is at least three times the fastener shank penetration.
- Fasteners will not be driven into any spalled area.

### 4.3 Storage and Handling

- Powder-actuated tools and power loads, e.g. cartridge, will be kept in a dry metal container and secured by lock and key. The container will be painted red with white letters, and only authorized personnel will be permitted access to it. The container will be labeled, "Powder Actuated Tool" on the outside and "For Use By Authorized Personnel Only" and "Keep Locked When Not In Use" on the inside of the container.
- An instruction manual, a power load chart, repair tools, cleaning tools, and a tool inspection record will be stored in the tool container.
- Unfired power loads will not be thrown into trash containers or carelessly discarded. Unfired power loads will be returned to the original place of issuance.
- Power loads of different power levels will be stored separately.

### 4.4 Training

- All users of powder-actuated tools will be properly trained and provide copies of training credentials as required.
- Only persons trained and authorized by the tool manufacturer or by an authorized representative of the tool manufacturer will be qualified to instruct and qualify operators for the manufacturer's powder-actuated tools.
  - All authorized instructors will have in their possession a valid authorized instructor's card issued and signed by an authorized representative of the manufacturer.

## 5.0 Records

5.1 None

## 6.0 References

6.1 None

AECOM

# S3NA-412-FM Powder-Actuated Tool Pre-Operational Inspection

Name of Contractor:

Location: Project #:

Date: Time: Tool S/N:

Person Conducting Inspection: Title:

Note: As you conduct your inspection you should be able to answer each question with a **YES**. If the answer to any question is **NO,** this deficiency must be corrected prior to use of the specific tool.

| | | | Deficiency Corrected? | |
|---|---|---|---|---|
| | **YES** | **NO** | **OK** | **N/A** |
| Operators of powder-actuated tools trained? | ☐ | ☐ | ☐ | ☐ |
| Tool tested daily to ensure that safety devices are in proper working condition? *(This method of testing shall be conducted as per manufacturer recommendation)* | ☐ | ☐ | ☐ | ☐ |
| Proper PPE available and used? | ☐ | ☐ | ☐ | ☐ |
| All employees cleared of area? | ☐ | ☐ | ☐ | ☐ |
| Fastenering surfaces are not very hard or brittle materials? | ☐ | ☐ | ☐ | ☐ |
| Driving into easily penetrated materials avoided, unless such materials are backed by a substance that will prevent the fastener from passing completely through? | ☐ | ☐ | ☐ | ☐ |
| New fastening area chosen if first fastening rejected? | ☐ | ☐ | ☐ | ☐ |
| Tools not used when explosive or flammable atmospheres are present? | ☐ | ☐ | ☐ | ☐ |
| All guards in place on tool? | ☐ | ☐ | ☐ | ☐ |
| Does the powder-actuated tool meet the requirements set forth in ANSI A10.3- 1995, Safety Requirements for Powder-Actuated Fastening Systems? | ☐ | ☐ | ☐ | ☐ |

**COMMENTS:**

# S3NA-412-WI Powder-Actuated Tools Safety Card

## 1.0 Objective / Overview

1.1 Powder-actuated tools should be used with extreme caution in order to prevent personal injury. A fundamental practice of using the right tool in a correct manner, together with proper storage, is necessary to prevent personal injury and property damage.

1.2 Only trained, authorized personnel will operate powder-actuated tools. Along with training, other safety measures include reviewing the manufacturer's instructional booklet, proper maintenance of equipment, and personal protective equipment.

## 2.0 Safe Operating Guidelines

2.1 Only powder-actuated tools meeting the design requirements of ANSI A10.3-1995 *Safety Requirements for Powder-Actuated Fastening Systems* may be used.

2.2 The powder-actuated tool must be kept in a locked container.

2.3 Only qualified operators may have keys to the storage container for powder-actuated tools.

2.4 Each tool must be supplied with the following: operator's instruction and service manual, powder load and fastener chart, tool inspection record, and service accessories.

2.5 The tool will be loaded only prior to use.

2.6 Tools will never be left unattended when not securely stored.

2.7 Unauthorized personnel will be cleared from the work area when the tool is in use.

2.8 Prior to actuating the tool, the operator will signal actuation by giving a verbal signal to all nearby personnel, such as "Firing!"

2.9 Never place your hand or other body parts over the front muzzle end of the tool.

2.10 Never use the tool in an explosive or flammable area.

2.11 Always unload a powder-actuated tool before disassembling, assembling, replacing the barrel, or cleaning.

2.12 Always make sure that you point the tool away from your body and others during loading or handling.

2.13 Powder actuated fastening tools shall be inspected and tested each day before loading to verify that the safety devices are in proper working condition. Any tool found not to be in proper working order shall be immediately removed from service until repairs are made.

2.14 **Potential Hazards:**

2.14.1 Tool kick-back

2.14.2 Flying debris

2.14.3 Noise exposure

2.15 **Training Requirements:**

2.15.1 Review of applicable SOPs

2.15.2 Demonstrated knowledge on the use of a powder-actuated tool

2.15.3 Review of manufacturers operating guidelines

2.16 **Personal Protective Equipment (Level D PPE) and:**

2.16.1 Leather gloves

2.16.2 Faceshield

2.16.3 Hearing protection

## 2.17 Other Safety Tips:

2.17.1 A loaded tool shall never be left unattended.

2.17.2 Powder-actuated tool powder loads contain very precise amounts of special powder to maintain consistent driving performance. Make sure you use the correct powder load for your particular application.

2.17.3 Always hold the tool perpendicular to the work surface.

2.17.4 Tools shall not be loaded until just prior to the intended firing time.

# S3NA-417-PR Utilities, Underground

## 1.0 Purpose and Scope

1.1 Establishes requirements to ensure that underground installations are identified properly before excavation work commences.

1.2 This procedure applies to all AECOM North America-based employees and operations.

## 2.0 Terms and Definitions

2.1 **Underground Utilities:** All utility systems located beneath grade level, including, but not limited to, gas, electrical, water, compressed air, sewage, signaling and communications, etc.

2.2 **Ground Disturbance (GD):** Any indentation, interruption, intrusion, excavation, construction, or other activity in the earth's surface as a result of work that results in the penetration of the ground.

## 3.0 Attachments

3.1 S3NA-417-FM Identifying Underground Installations Checklist

3.2 S3NA-417-WI One Call System Definition and Directory

3.3 S3NA-417-ST Underground Utilities

## 4.0 Procedure

4.1 Ground disturbance may be a conducted for a variety of purposes, including, but not limited to, exposing existing buried lines, soil sampling, remedial excavations, or installing monitoring wells or test pits.

4.2 Improper ground disturbance may impact a buried pipeline or utility line and cause a major release of a hazardous substance, flood, or electrocution. Serious injuries and significant property damage have resulted from insufficient/inadequate identification of underground installations during the course of ground disturbance work.

4.3 To control hazards associated with coming in contact with such installations, the American Public Works Association's (APWA) guidelines for the uniform identification of underground installations has been adopted.

4.4 **Project Managers** are responsible for ensuring that all work, including the identification, location, and access to all underground utilities, is planned and performed in accordance with contract specifications and safety requirements.

4.4.1 The planning for associated work and avoidance of contacting underground utilities shall be part of the project safety planning in the HASP.

4.5 The **Lead Site Manager or Supervisor** is responsible for the execution of work in accordance with this and other associated AECOM SOPs, including:

- The review of the HASP.
- Verification that all steps have been taken to identify existing underground utilities in the area to be disturbed.

4.6 **Region SH&E Manager** provides guidance as needed.

### 4.7 Personal Protective Equipment

- Long sleeved shirt and pants (coveralls/Nomex LILA for upstream oil and gas)
- Safety toe boots
- Hard hat
- High-visibility clothing
- Gloves
- Respirator with organic vapor/particulate filter cartridge (for use when the exposure exceeds the occupational exposure limit stated on the MSDS), as required

- Hydrogen Sulfide (H2S) Monitor (for areas with known or suspected H2S

## 4.8 Training

4.8.1 Staff shall successfully complete a Ground Disturbance training course.

4.8.2 Some clients may also have required client-based Ground Disturbance training.

## 4.9 Underground Utility Lines

4.9.1 To avoid injury from electrical and other utilities on site, utility lines shall be located and marked prior to conducting any drilling or digging on site. If available, refer to site drawings or client interviews for information pertaining to utilities on site.

4.9.2 Types of underground lines:

- Gas line
- Potable water line
- Raw water line
- Sewer line
- Power line
- Cable television/communication line
- Cathodic protection lines
- Grounding cable
- Process piping/flow line

4.9.3 Prior to conducting the ground disturbance, you shall locate all pipelines and utilities that pass within (30 m) of the work area. This is your search and control area. To do so, you need to do the following:

- Notify all pipeline and utility companies, and confirm that their notification requirements are fulfilled prior to conducting a ground disturbance.
- Identify pipelines, power lines, utilities, and irrigation canals in a 30-foot (9.1 m) zone of the work area with the owner of the utility.
- On private property, a properly trained and competent third party utility locator shall be used.
- Get approval for work within a right-of-way (ROW) or within 15 feet (4.6 m) of a line if there is no ROW.
- Prepare a site map identifying the search area, the ground disturbance area, and known underground utilities.
- Confirm that all pipelines, power lines, and utilities are marked.

4.9.4 Look for pipeline indicators:

- Look for warning signs where pipelines cross roads or water courses.
- Look for cut lines, wells, tanks, or valves that may indicate the presence of pipelines.
- Look for ground settling from previous work.
- Talk to nearby landowners and residents.
- Look for vegetation appearing “different” from the surrounding vegetation (e.g., greener, taller, shorter, or more brown than surrounding vegetation).

4.9.5 When you are working within a pipeline right-of-way, you shall get written approval from the pipeline owner prior to doing your work.

4.9.6 Call the pipeline owner at least two full working days before you dig so the pipeline can be located and marked.

4.9.7 Expose the pipeline by hand/hydrovac before digging within 15 feet (4.6 m) of the pipeline with machinery (no machinery comes may come within 2 feet [60 cm] of the pipeline) with the supervision of the owner or their representative, and call the owner at least one full day before you cover the exposed line.

4.9.8 During ground disturbance:

- All underground utilities shall be hand exposed or hydrovac'd within 3.3 feet (1 m) of a mark out or within the distance required by the owner of the utility before operating any mechanized equipment.
- Make arrangements for supervision ("a Signal Person") during hand exposure.
- If for any reason these hand excavations are temporarily filled in, mark them.
- Make arrangements for supervision ("a Signal Person") during any mechanical excavation within 5 m of the underground utility.
- Make arrangements for supervision ("a Signal Person") during backfilling of utilities.
- Cutting back and shoring of excavations shall be completed to ensure that there are no cave-ins (follow *SOP S3NA-303-PR Excavation and Trenching*).
- Do not damage utilities by shovels when hand exposing and picks should not be used.
- Remember that all workers have the right and responsibility to refuse to carry out any work or procedures that they feel are unsafe.
- If the ground disturbance is deeper than 3.3 feet (1 m), all crew members shall have appropriate training for excavations and trenches and shall be protected from cave-ins or sliding/rolling materials (follow *SOP S3NA-303-PR Excavation and Trenching*).
- Remember that incidents, injuries, and near misses shall be reported immediately.
- Review the site-specific emergency response plan.

4.9.9 If you hit an underground facility, stop the work immediately and notify the owner of the facility.

- The owner shall be informed of the location of the contact and the type of damage that resulted.
- If the facility is a pipeline, the company (client) shall immediately notify the required agencies and regulatory bodies of the location of the contact and the type of damage that resulted.
- The government agencies will require a written record and the company (client) should conduct an incident investigation into the causes and make recommendations for the future prevention of this incident.

### 4.10 Identification of Installations

4.10.1 Various forms of underground utility lines or pipes may be encountered during AECOM deployments to field sites. Damaged utilities, in particular, can present other hazards including asbestos, explosion, electric shock, scalding, etc., and they shall be avoided. The presence of damaged utilities at any work location shall be immediately brought to the attention of the field Lead Manager or other member of the AECOM site management team.

4.10.2 Guidance will be provided on the appropriate action to be taken, which could include suspension of work until the responsible utility agency is contacted and the hazard is either isolated or eliminated.

4.10.3 Extreme caution shall always be exercised when attempting to locate underground utilities. The location of utilities can be in some cases not consistent as shown on drawings, as indicated by the placement of surface signage, or as described by personnel. Coordination and planning of the job shall be required with the client or owner.

- Prior to digging and drilling operations, the client shall always be informed of the potential location(s) of underground utility systems.
- If a utility permit is required from the client or owner, it shall be secured.
- The client shall explain how the utility line may be identified—e.g., red concrete encasement.
- All underground installations shall be considered "live" and "operational" until the owner, client, or utility authority isolates any hazardous energy or deactivates the system and can demonstrate that condition.
- Where a line placement and depth is known or suspected and where there is potential for contact, hand digging, or hand auguring, instrumentation and other investigative techniques shall be used.

4.10.4 The One Call System Definition and Directory or its equivalent shall be used to prepare for excavation work in the event the identity of an underground installation(s) is unknown.

4.10.5 Line location documentation (or appropriate regional agency or company) provides a listing of companies that have registered buried facilities in the proposed work area. Some public utilities and private companies are not members of the One Call System. In order to give line operators sufficient time to respond to a request to locate, a minimum waiting period of 72 business hours is required prior to beginning work.

4.10.6 Once the underground installation has been identified, proper surface markings shall be made in accordance with the guidelines contained in this SOP or as contract-specified.

### 4.11 Surface Markings

4.11.1 Color-coded surface marks (paints or similar coatings) shall be used to indicate the type, location, and route of buried installations. Additionally, to increase visibility, color-coded vertical markers (temporary stakes or flags) shall supplement surface marks.

4.11.2 All marks and markers shall indicate the name, initials, or logo of the company that owns or operates the installation and the width of the installation if it is greater than two inches.

4.11.3 If the surface over the buried installation is to be removed, supplemental offset marking shall be used. Offset markings shall be on a uniform alignment and shall clearly indicate that the actual installation is a specific distance away.

### 4.12 Uniform Color-Coding

4.12.1 The colors and corresponding installation type are as follows unless otherwise contract-specified.

4.12.2 Red: Electric Power Lines, Cables, Conduit, and Lighting Cables

4.12.3 Yellow : Gas, Oil, Stream, Petroleum, or Gaseous Materials

4.12.4 Orange : Communication, Alarm or Signal Lines, Cables, or Conduit

4.12.5 Green: Sewers and Drain Lines

4.12.6 White : Proposed Ground Disturbance area

4.12.7 Pink: Temporary Survey Markings

4.12.8 Purple: Nonpotable Water

## 5.0 Records

5.1 The following records on the identification of and response to underground utilities will be maintained in the project files:

5.1.1 All information regarding the identification of underground installations (this information can also be transferred to the appropriate drawings and/or prints and shall be available on site).

5.1.2 Drawings and/or prints shall be maintained for the life of this project.

5.1.3 Identifying Underground Installations Checklist.

## 6.0 References

6.1 American Public Works Association, Excavator's Damage Prevention Guide and One-Call System Directory International 1990-1991, Utility Location and Coordination Committee.

# S3NA-417-FM Identifying Underground Installations Checklist

Name of Contractor:

Location: Project #:

Type of Ground Disturbance Planned:

Date: Time: Weather:

Person Conducting Inspection: Title:

**Responsibilities of the Ground Disturbance Contractor**

***Supply as much pertinent information as possible when calling in location (house #, pole #, facility #, landmark to measure distance, nearest intersection, etc.)***

| | Completed | N/A |
|---|---|---|
| Notify the One-Call Center 3 business days in advance but no more than 10 days prior to activities. | ☐ | ☐ |
| Hand expose or hydrovac within 2 feet (60cm) of a mark out or within the distance required by the owner of the utility before operating any mechanized equipment. | ☐ | ☐ |
| Mark and identify perimeter of proposed site of excavation or boring locations in white. | ☐ | ☐ |
| Protect and preserve markings, staking, or other designations until no longer necessary for safe excavation, demolition, or blasting. | ☐ | ☐ |
| Obtain new ticket every 30 business days. | ☐ | ☐ |
| Check surrounding area before initiating ground disturbance. | ☐ | ☐ |
| **Recordkeeping** | | |
| Confirmation number received. | ☐ | ☐ |
| Copy of mark-out ticket readily available. | ☐ | ☐ |
| Site Map documenting ground disturbance area and identified utilities completed. | ☐ | ☐ |
| Records have been maintained to document any damage. | ☐ | ☐ |

Comments:

# S3NA-417-WI One Call System Definition and Directory

## 1.0 What Is It?

1.1 It is a communication system established by two or more utilities, governmental agencies, or other operators of underground facilities to provide one telephone number for excavating contractors and the general public to call for notification of their intent to use equipment for excavating, tunneling, demolition, or any other similar work. This one-call system provides the participating members an opportunity to identify and locate their underground facilities.

## 2.0 Why Is It Needed?

2.1 Damage to underground facilities increased considerably following the building boom of the 1950s, 1960s, and early 1970s when the trend was to go underground with utilities. Thousands of miles of underground facilities were vulnerable to excavating machines such as backhoes, and the resulting damage interrupted utility service and threatened life, health, and property.

## 3.0 How to Get It

3.1 Write or call the number of the Utility Location and Coordination Council (ULCC) One-Call Systems International Committee representing the area within your American Public Works Association (APWA) region shown on the map. They will be pleased to assist you. For further information on ULCC programs, write APWA headquarters.

## 4.0 Disclaimer

4.1 The purpose of this directory is to illustrate the extent of one-call service available. The accuracy of information is not guaranteed by APWA or the one-call systems. Users must verify information including the extent and limit of service from local sources.

| Province/State | One-Call Agency | Number |
|---|---|---|
| Canada | | |
| British Columbia | http://www.bconecall.bc.ca/ | 1.800.474.6886 |
| Alberta | http://www.alberta1call.com/ | 1.800.242.3447 |
| Saskatchewan | http://www.sask1stcall.com/ | 1.866.828.4888 |
| Manitoba | www.callb4udig.mb.ca/ | 1.800.827.5094 |
| Ontario | http://www.on1call.com/ | 1.800.400.2255 |
| Québec | http://www.info-ex.com/ | 1.800.663.9228 |
| British Columbia | http://www.bconecall.bc.ca/ | 1.800.474.6886 |
| United States | http://www.mail-house.com/utility.htm | 811 |
| Alabama | Alabama Line Location Center, Inc. | 1.800.292.8525 |
| Alaska | Locate Call Center of Alaska, Inc. | 1.800.478.3121 |
| Arizona | Arizona Blue Stake, Inc. | 1.800.STAKE.IT (1.800.782.5348) |
| Arkansas | Arkansas One Call System, Inc. | 1.800.482.8998 |
| California | Underground Service Alert North | 1.800.227.2600 |
| Colorado | Utility Notification Center of Colorado | 1.800.922.1987 |

| Province/State | One-Call Agency | Number |
|---|---|---|
| Connecticut | Call Before You Dig | 1.800.922.4455 |
| Delaware | Miss Utility of Delmarva | 1.800.282.8555 |
| Florida | Call Sunshine | 1.800.432.4770 |
| Georgia | Utilities Protection Center, Inc. | 1.800.282.7411 |
| Idaho | Dig Line | 1.800.342.1585 |
| | Kootenai County Utility Coordinating Council | 1.800.428.4950 |
| | One Call Concepts – Idaho | 1.800.626.4950 |
| | Palouse Empire Underground Coordinating Council | 1.800.822.1974 |
| | Shoshone County One Call | 1.800.398.3285 |
| | Utilities Underground Location Center | 1.800.424.5555 |
| Illinois | Digger (Chicago Utility Alert Network) | 312.744.7000 |
| | Julie, Inc. | 1.800.892.0123 |
| Indiana | Indiana Underground Plant Protection Services, Inc. | 1.800.382.5544 |
| Iowa | Underground Plant Location Service, Inc. | 1.800.292.8989 |
| Kansas | Kansas One-Call Center | 1.800.DIG.SAFE |
| Kentucky | Kentucky Underground Protection Inc. | 1.800.752.6007 |
| Louisiana | Louisiana One Call System, Inc. | 1.800.272.3020 |
| Maine | Dig Safe – Maine | 1.800.225.4977 |
| Maryland | Miss Utility | 1.800.257.7777 |
| | Miss Utility of Delmarva | 1.800.282.8555 |
| Massachusetts | Dig Safe – Massachusetts | 1.800.322.4844 |
| Michigan | Miss Dig System, Inc. | 1.800.482.7171 |
| Minnesota | Gopher State One Call | 1.800.252.1166 |
| Mississippi | Mississippi One-Call System, Inc. | 1.800.227.6477 |
| Missouri | Missouri One Call System, Inc. | 1.800.344.7483 |
| Montana | Utilities Underground Location Center | 1.800.424.5555 |
| Nebraska | Diggers Hotline | 1.800.331.5666 |
| Nevada | Underground Service Alert North | 1.800.227.2600 |
| New Hampshire | Dig Safe – New Hampshire | 1.800.225.4977 |
| New Jersey | Garden State Underground Plant Location Service | 1.800.272.1000 |
| New Mexico | New Mexico One Call System, Inc. | 1.800.321.ALERT |
| New York | New York City – Long Island One Call Center | 1.800.272.4480 |
| | Underground Facilities Protective Organization "UFPO" | 1.800.962.7962 |
| North Carolina | The North Carolina One Call Center, Inc. | 1.800.632.4949 |

| Province/State | One-Call Agency | Number |
|---|---|---|
| North Dakota | Utilities Underground Location Center | 1.800.454.5555 |
| Ohio | Ohio Utilities Protection Service | 1.800.362.2764 |
| Oklahoma | Call Okie | 1.800.522.6543 |
| Oregon | Douglas Utilities Coordinating Council | 1.503.673.6676 |
| | Josephine Utilities Coordinating Council | 1.503.476.6676 |
| | Rogue Basin Utility Coordinating Council | 1.503.779.6676 |
| | Utilities Notification Center | 1.800.332.2344 |
| | Utilities Underground Location Center | 1.800.424.5555 |
| Pennsylvania | Pennsylvania One Call System, Inc. | 1.800.242.1776 |
| Rhode Island | Dig Safe – Rhode Island | 1.800.225.4977 |
| South Carolina | Palmetto Utility Protection Service Inc. "PUPS" | 1.800.922.0983 |
| South Dakota | South Dakota One Call | 1.800.781.7474 |
| Tennessee | Tennessee One-Call System, Inc. | 1.800.351.1111 |
| | Rogue Basin Utility Coordinating Council | 1.503.779.6676 |
| | Utilities Notification Center | 1.800.332.2344 |
| Utah | Blue Stakes Location Center | 1.800.662.4111 |
| Vermont | Dig Safe – Vermont | 1.800.225.4977 |
| Virginia | Miss Utility | 1.800.257.7777 |
| | Miss Utility of Delmarva | 1.800.441.8355 |
| | Miss Utility of Virginia | 1.800.552.7001 |
| Washington | Chelan-Douglas Utilities Coordinating Council | 1.509.663.6111 |
| | Grays Harbor & Pacific County Utility Coordinating Council | 1.206.532.3550 |
| | Inland Empire Utility Coordinating Council | 1.509.456.8000 |
| Utah | Blue Stakes Location Center | 1.800.662.4111 |
| Vermont | Dig Safe – Vermont | 1.800.225.4977 |
| Virginia | Miss Utility | 1.800.257.7777 |
| | Miss Utility of Delmarva | 1.800.441.8355 |
| | Miss Utility of Virginia | 1.800.552.7001 |
| Washington | Chelan-Douglas Utilities Coordinating Council | 1.509.663.6111 |
| | Grays Harbor & Pacific County Utility Coordinating Council | 1.206.532.3550 |
| | Palouse Empire Utilities Coordinating Council | 1.800.822.1974 |
| | Upper Yakima County Underground Utilities Council | 1.800.553.4344 |
| | Utilities Council of Cowlitz County | 1.360.425.2506 |
| | Utilities Notification Center | 1.800.332.2344 |
| | Utilities Underground Location Center | 1.800.424.5555 |
| West Virginia | Miss Utility of West Virginia, Inc. | 1.800.245.4848 |
| Wisconsin | Diggers Hotline, Inc. | 1.800.982.0299 |
| Wyoming | Albany County Utility Coordinating Council | 1.307.742.3615 |
| | Call-in Dig-in Safety Council | 1.307.382.9811 |
| | Carbon County Underground Utility Coordinating Council | 1.307.324.6666 |
| | Central Wyoming Utilities Coordinating Council | 1.800.759.8035 |

| Province/State | One-Call Agency | Number |
|---|---|---|
| | Converse County Utility Coordination Council | 1.800.562.5561 |
| | Fremont County Utility Coordinating Council | 1.800.489.8023 |
| | Southeast Wyoming Utilities Coordinating Council | 1.307.638.6666 |
| | Southwest Wyoming One Call | 1.307.362.8888 |
| | Utilities Underground Location Center | 1.800.454.5555 |
| | Wyoming One-Call | 1.800.348.1030 |
| | Palouse Empire Utilities Coordinating Council | 1.800.822.1974 |
| | Upper Yakima County Underground Utilities Council | 1.800.553.4344 |
| | Utilities Council of Cowlitz County | 1.360.425.2506 |
| | Utilities Notification Center | 1.800.332.2344 |
| | Utilities Underground Location Center | 1.800.424.5555 |
| West Virginia | Miss Utility of West Virginia, Inc. | 1.800.245.4848 |

# S3NA-417-ST Underground Utilities

## 1.0 Regulations

1.1 Every province and territory has strict regulations governing the procedures and practices that MUST be followed. As these regulations vary slightly, before work can commence, the Project Manager MUST review these documents and identify how all of the hazards will be addressed and how the regulations will be adhered to:

1.1.1 Occupational Health and Safety Code

1.1.2 Regional or industry-specific regulations (e.g., Alberta EUB (Pipeline Act).

## 2.0 Occupational Health and Safety Regulations

2.1 The following Occupational Health and Safety regulations apply directly to ground disturbance:

| Jurisdiction | Regulation |
|---|---|
| **United States** | |
| **OSHA** | CFR 1926.651 |
| **Canada** | |
| **Alberta** | OHS Code (2009) Sect 441 – 464, Schedule 9 |
| **British Columbia** | OHS Regulation (1997) Sect 20.78 – 20.101 |
| **Manitoba** | Workplace Health and Safety Regulation (217/2006) Sect 26.0 – 26.47 |
| **New Brunswick** | OHS Regulation (91-191) Sect 93 – 94.1, 180 – 188 |
| **Newfoundland/Labrador** | OHS Regulation (C.N.L.R. 1165/96) Sect 139 – 148 |
| **Nova Scotia** | OHS Regulation (N.S. Reg. 44/99) Sect 153, 166 – 173 |
| **NWT/NU Territories** | General Safety Regulations (R.R.N.W.T. 1990, c. S-1), Safety Act (SI-013-92) Sect 396 – 432 |
| **Ontario** | O. Reg. 213/91 Sect 6, 7, 222 – 242 |
| **Prince Edward Island** | OHS Regulations (EC180/87) Sect 12.1 – 12.15 |
| **Quebec** | Safety Code for the Construction Industry (R.R.Q. 1981, c. S-2.1, r. 6) Sect 3.15.1 – 3.15.10 |
| **Saskatchewan** | OHS Regulation (R.R.S., c. O-1, r. 1) Sect 257 – 265, Schedule Table 17 |
| **Yukon Territory** | OHS Regulations (O.I.C. 2006/178) Sect 10.62 – 10.72 |

# S3NA-419-PR Boat and Vessel Operations

## 1.0 Purpose and Scope

1.1 Establishes the procedure for AECOM employees who perform work on boats and vessels.

1.2 This procedure applies to all AECOM North America-based employees and operations.

## 2.0 Terms and Definitions

2.1 **Small Boat:** A boat less than 18 feet in length including canoes, kayaks, rafts, and dingys with an outboard motor.

2.2 **Mid-size Boat**: A boat greater than 18 feet but less than 26 feet in length, including single and pontoon style hulls, barges, or other platforms.

2.3 **Large Vessel:** A boat or vessel larger than 26 feet in length.

2.4 **Boat or Vessel Operator:** Person responsible for the overall safe operation of the boat/vessel.

## 3.0 Attachments

3.1 S3NA-419-WI1 Nautical Terminology

3.2 S3NA-419-WI2 Boating Safe Work Practices

3.3 S3NA-419-WI3 Small Boat Operation

3.4 S3NA-419-WI4 Float Plan

3.5 S3NA-419-WI5 Marine Safety Equipment

3.6 S3NA-419-WI6 Emergency Response Procedures

3.7 S3NA-419-WI7 Hazardous Weather Operations

3.8 S3NA-419-WI8 Charters and Subcontractors

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 The **Safety, Health and Environment (SH&E) Department** shall provide training and technical guidance to operations in support of the requirements of this SOP, including:

- Approval of **Marine Safety Officers**.

4.1.2 **Project Managers (PM)** are responsible for the overall success of a project and the performance of employees engaged in project activities. The **PM** identifies and implements all appropriate Safety, Health and Environmental (SH&E) procedures. Additional responsibilities include:

- Confirming that subcontractors selected to support project operations have been approved by the AECOM **Region SH&E Manager**.
- Selecting an appropriate boat/vessel for the planned work activities.
- Obtaining approval from the AECOM **Region SH&E Manager** for the operation of any vessel in offshore, ports or harbors, navigation channels, or waterways handling commercial ship traffic.
- Developing and submitting a Safe Work Plan, Task Hazard Analysis, Float Plan and other SH&E Planning Documents for review and approval by the AECOM **Region SH&E Manager**.
- Allocating appropriate resources, including emergency and safety equipment, to complete the project as planned.
- Designating a **Marine Safety Officer** to implement and maintain safe work practices and procedures. A **Marine Safety Officer** is required for all mid-size and large vessel operations.

4.1.3 **Marine Safety Officers (MSO)** are responsible for the following:

- Implementing and monitoring safe work practices specified by this procedure and supporting SH&E documentation.
- Conducting marine safety briefings and inspections as needed.
- Conducting field verification of the competency of **boat/vessel operators** and field staff.

4.1.4 **Boat/Vessel Operators** are responsible for the following:

- Maintaining current boating/vessel licenses as required by local, state, provincial, and federal regulations and standards.
- Operating boats/vessels in accordance with this SOP and as required by local, state, provincial, and federal regulations and standards.

4.1.5 **Field Staff** are responsible for

- Complying with the safe work practices specified in this procedure and all other applicable AECOM SH&E policies.
- Verifying that they meet training and qualification requirements, and reporting deficiencies to their **supervisor** and **project manager**.
- Use equipment that has been inspected, and use equipment only as intended.
- Following all safe work practices in this procedure, in the project SH&E documents, as required by local, state, provincial, and federal regulations or standards, and as instructed by the **MSO** or **Vessel Operator**.
- Immediately reporting incidents, near misses, unsafe acts and conditions when they occur to the **MSO** and/or the responsible **supervisor**.

## 4.2 Training and Qualifications

4.2.1 All personnel working aboard boats/vessels shall have completed and maintain a current:

- Safe Boating Course (approved by **Region SH&E Manager**).
- CPR/First Aid certification.
- Hazardous Waste Operations and Emergency Reponses training (if marine operations involve hazardous waste or the response to a hazardous waste emergency response).
- Hepatitis A vaccination (if marine operations involve sampling sediments or surface waters with contamination from sewage).
- Fire extinguisher training (if a fire extinguisher is required on board).
- Additionally, all personnel shall be competent swimmers.

4.2.2 **Vessel Operators** shall have completed and maintain current:

- All training and qualification requirements noted above for all personnel working aboard boats/vessels.
- Field competency verification training or documented experience with operating the boat/vessel and that they understand all applicable marine safety regulations.
- Maintain current boat/captain licenses per local, state, provincial, and federal regulations and standards.

4.2.3 **Marine Safety Officers**

- Shall be designated by the **Project Manager** and approved by the **Region SHE Manager**.
- Have experience in boat and vessel operations similar to those planned for the operation.

## 4.3 Procedures

4.3.1 All boats and vessels shall be operated by a qualified **Vessel Operator** in accordance with local, state, provincial, and federal Marine Safety Laws. This procedure and project specific requires documents such as the Task Hazard Analysis, and Site Safety Plan.

4.3.2 Personal Protective Equipment (PPE) shall be selected based on the task-specific hazard analysis.

4.3.3 All boats and vessel will be outfitted with safety equipment as required by local, state, provincial, and federal regulations or standards, and as identified in the task-specific hazard analysis.

4.3.4 Vessels working offshore shall be sized to withstand and remain stable through all forms of expected weather conditions.

4.3.5 All boats/vessels equipped with propulsion machinery shall be licensed and registered in accordance with local, state, provincial, and federal regulations or standards.

4.3.6 Should the vessel have locations designated as confined spaces, they shall be managed in accordance with *S3NA-301-PR Confined Spaces*.

4.3.7 Chartered or subcontracted boats/vessel or operators shall be evaluated by the **Project Manager** for overall suitability for the intended task. Charters/subcontractors are responsible for providing qualified operators and licensed and inspected boats/vessels and for stocking and maintaining emergency supplies and equipment.

4.3.8 All tasks performed aboard a boat/vessel shall be assessed for hazards, and hazards shall be controlled. Assessment and controls shall be documented in the Task Hazard Analysis.

4.3.9 Impacts to marine traffic shall be evaluated as a part of project planning. Notification of the Coast Guard or other jurisdictional agency shall be made, as required by local, state, provincial, and federal regulations and standards. Additional notifications to other vessels via day shapes may be necessary.

4.3.10 Local weather, tide, current conditions, and navigational needs shall be evaluated as a part of project planning.

4.3.11 Work in security zones and security sensitive areas (near bridges, reservoirs, etc.) shall be performed only with the authorization of governing security agency(s).

4.3.12 A daily safety inspection will be conducted by the **MSO** prior to beginning marine operations. The inspection criteria shall be developed as a part of project SH&E documentation.

4.3.13 A daily safety briefing of all field staff and operators shall be conducted by the **MSO** prior to beginning marine operations. The daily safety briefing shall include, at a minimum:

- Review of planned activities, including the associated Task Hazard Analysis.
- Review of emergency procedures, including the location and operation of emergency supplies.
- Discussion of personal protective equipment required for planned actives.
- Opportunity for field staff to ask questions.

## 5.0 Records

5.1 None

## 6.0 References

6.1 None

# S3NA-419-WI1 Nautical Terminology

## 1.0 Nautical Terminology

1.1 **Abeam**: At right angles to the keel of the boat, but not on the boat.

1.2 **Aboard**: On or within the boat.

1.3 **Above Deck**: On the deck (not over it - see Aloft).

1.4 **Aft**: Toward the stern of the boat.

1.5 **Aground**: Touching or fast to the bottom.

1.6 **Ahead**: In a forward direction.

1.7 **Aloft**: Above the upper deck of the boat.

1.8 **Amidships**: In or toward the center of the boat.

1.9 **Anchor**: A heavy metal device, fastened to a chain or line, to hold a vessel in position, partly because of its weight but chiefly because the designed shape digs into the bottom.

1.10 **Astern**: In back of the boat, opposite of ahead.

1.11 **Bearing**: The direction of an object expressed either as a true bearing as shown on the chart, or as a bearing relative to the heading of the boat.

1.12 **Bight**: Any curved section, slack part, or loop formed in a rope or line.

1.13 **Boat**: A vessel for transport by water. Constructed to provide buoyancy by excluding water and shaped to give stability and permit propulsion.

1.14 **Bow**: The forward end of the boat.

1.15 **Bulkhead**: Wall-like constructions inside a vessel, as for forming watertight compartments, subdividing space, or strengthening the structure.

1.16 **Buoy**: An anchored float used for marking a position on the water, a hazard, or a shoal. A surface marker floats for a mooring.

1.17 **Captain**: A person who is at the head of or in authority of all others aboard a vessel.

1.18 **Certified Vessel (or Inspected Vessel):** A category of vessel that is subject to a mandatory U.S. Coast Guard safety inspection.

1.19 **Cleat**: A fitting to which lines are made fast. The classic cleat to which lines are belayed is approximately anvil-shaped.

1.20 **Cockpit**: A sunken, open area, generally in the after part of a small vessel, provides space for part or all of the crew.

1.21 **Dive**: A descent into the water, an underwater diving activity utilizing compressed gas, an ascent, and return to the surface.

1.22 **Dock**: A protected water area in which vessels are secured to a pier or a wharf.

1.23 **Drain Plug**: A removable plug in the transom used for draining water out of a boat.

1.24 **EPIRB**: Emergency Position Indicating Radio Beacon – transmits a signal that allows rescue personnel to determine a vessels position at sea once it is activated in the event of an emergency.

1.25 **Fathom**: A depth increment of 6 feet.

1.26 **Fender**: A cushion, placed between boats, or between a boat and a pier, to prevent damage.

1.27 **Float Plan**: A document prepared by the boat crew and left with a competent person shore side that defines the itinerary and particulars of the vessel and crew, serving as an informational resource for emergency responders in the event the boat does not return at the appointed time.

1.28 **Freeboard**: The portion of the side of a hull that is above the water.

1.29 **Gunwales**: The widened edge at the top of the side rail of the boat, where the edge is reinforced.

1.30 **Knot**: A measure of speed equal to one nautical mile (6076 feet) per hour or 1.16 mph.

1.31 **Knot**: A fastening made by interweaving rope to form a stopper, to enclose or bind an object, to form a loop or a noose, to tie a small rope to an object, or to tie the ends of two small ropes together.

1.32 **Leeward**: The direction away from the wind.

1.33 **Life-line**: A line secured along the deck to lay hold of in heavy weather.

1.34 **Listing:** Leaning to one side due to the unequal distribution of weight.

1.35 **Mooring**: An arrangement for securing a boat to a mooring buoy or a pier.

1.36 **Overboard**: Over the side or out of the boat.

1.37 **Personal Flotation Device (PFD):** PFD is official terminology for life jacket. When properly used, the PFD will support a person in the water and keep their face and nose (airway) out of the water in either a conscious or unconscious condition.

1.38 **Port**: The left side of the boat when looking forward (toward the bow).

1.39 **Running Lights**: Navigation lights required to be shown on boats underway between sundown and sunup.

1.40 **SCUBA Diving**: A diving mode independent of surface supply in which the diver uses an open circuit, self-contained underwater breathing apparatus.

1.41 **Starboard**: The right side of the boat when looking forward (toward the bow).

1.42 **Station bill**: The posted bill showing assigned stations for each crew member during maneuvers and emergency drills.

1.43 **Stem**: The forward most part of the bow.

1.44 **Stern**: The after part (back) of the boat.

1.45 **Transom**: The aft face or back board of the boat.

1.46 **Wake**: Moving waves, track, or path that a boat leaves behind when moving across the water.

1.47 **Wide berth**: At a considerable distance.

1.48 **Windward**: Toward the direction from which the wind is coming (a.k.a. weather side); the opposite of leeward.

# S3NA-419-WI2 Boating Safe Work Practices

## 1.0 General

1.1 Verify experience or conduct field competency verification of all Boat/Vessel Operators for the boat/vessel to which they are assigned prior to starting operations.

1.2 Boats/vessels operated offshore, in ports or harbors, in navigation channels, or in waterways handling commercial traffic require approval by the Project Manager and Regional SH&E Manager.

1.3 Project managers shall select a vessel of appropriate size and configuration for expected work and operating conditions.

1.4 Vessels larger than 18 feet in length and/or greater than 25 horsepower must be approved for use by the Project Manager and the Regional SH&E Manager.

1.5 Project managers shall select a Boat/Vessel-qualified Operator, Marine Safety Officer, and field staff for the operating conditions.

1.6 Vessel operations are limited to 12 hours (dock to dock) to minimize fatigue.

1.7 Singlehanded boat/vessel operations are not permitted unless approved by the Project Manager and the Regional SH&E Manager. Controls, such as a communication and/or rescue plan, shall be in place for all singlehanded boat/vessel operations.

1.8 Field staff are not permitted to work on deck alone unless approved by the Project Manager and the Regional SH&E Manager. Controls, such as a communication and/or rescue plan, shall be in place for all field staff working alone.

1.9 The buddy system is required for all tasks, unless approved by the Project Manager and the Regional SH&E Manager. Controls, such as a communication and/or rescue plan, shall be in place for all field staff working alone.

1.10 Vessel operators shall observe speed limits, right-of-way, and other applicable boating restrictions and guidelines.

1.11 Only qualified and authorized field staff are permitted to operate hydraulic machinery (winches, A-frames, etc.) for the deployment and recovery of scientific gear or surveying equipment.

1.12 All personnel shall be advised of the inherent risks associated with marine operations, including exposure to weather, marine operations, and chemical, biological, and physical hazards.

1.13 Swimming is prohibited, unless it is being conducted by certified divers in the completion of their assigned task or to prevent a serious injury or loss of life in a person in water/person overboard emergency.

1.14 A float plan shall be filed prior to departure.

1.15 All gear, personnel effects, and deck equipment shall be properly stowed to prevent shifting and blocking of walking/working paths.

1.16 All field staff in small boats shall remain properly seated at all times while the boat is underway. Sitting on the gunwales is not permitted. Standing at the edge of open transoms whenever the boat is underway or preparing to maneuver is not permitted.

1.17 All field staff shall keep their hands, arms, legs, and body away from docks, pilings, and other stationary objects when the vessel approaches to prevent a crushing injury.

1.18 Running is prohibited on the deck of any vessel.

1.19 All lines shall be stored to prevent tripping or entanglement. All field staff shall stay clear of lines, cables, or chains under tension.

1.20 Moving and carrying gear aboard a boat shall be conducted with one free hand to hold onto railings whenever using stairwells. Heavy and bulky items shall be broken down into smaller lifts or lifted with assistance from another field staff member.

1.21 When loading boats/vessels with gear or people, distribute weight evenly to prevent listing.

# S3NA-419-WI3 Small Boat Operation

## 1.0 Starting the Engine

1.1 The transport lock for the engine should be lifted or adjusted and the engine should be lowered into the water. If starting in a shallow area, make sure that the engine is at least lowered to the point where the cooling water intake is below the waterline

1.2 Attach engine electronics to battery leads.

1.3 Check to make sure the fuel line is properly attached. Prime the fuel line by squeezing the fuel “bulb” until it becomes firm. Open the air vent on the top of the gas can cap.

1.4 Make sure throttle position is in neutral and if necessary turn choke on.

1.5 Turn the key or pull the start recoil to start engine. Inspect engine to make sure that cooling water system is working (i.e. a stream of water is flowing from the engine). If the cooling water system is not working, stop the engine immediately and check to make sure water intake and exit ports are clear.

1.6 Allow engine to warm up at idle speed before leaving dock or shore.

## 2.0 Leaving Dock or Shore

2.1 Make sure all personnel on board are wearing life jackets.

2.2 Loosen bow and stern lines, having one line tender hold a single wrap around a cleat to hold fast until the operator has given the command to release lines.

2.3 Prior to leaving shore or dock, the boat operator will make one final observation to determine if there are any oncoming boats or other hazards.

2.4 If the waterway is clear to proceed, the boat operator will instruct the line tender to release the lines and push away from the dock.

2.5 With all personnel seated and in position, and all docking lines and boat fenders recovered, the boat operator may put the engine in gear and make headway.

## 3.0 Returning to Dock or Shore

3.1 Before approaching dock or shore, determine which personnel will be in charge of bow and stern lines. Notify line tenders not to “pull” the boat in by the line while docking; this may cause the operator to lose control of the boat.

3.2 Approach the dock or shore at low speed heading into any prevailing currents. Place the throttle in neutral position when arriving at dock. If the boat is still moving forward when at the dock, apply a quick burst of reverse throttle to stop the forward motion of the boat, recognizing that it may take several feet of travel to cease forward motion.

3.3 If necessary, secure fenders to the side of the boat next to the dock prior to landing

3.4 When the boat has stopped its forward motion and is sitting alongside the dock, have the bow and stern personnel step off the boat to secure the lines. Jumping any open water gap between the boat and dock is strongly discouraged; falling into the water between the boat and dock can cause serious injury. Once the lines have been secured, the engine can be secured.

## 4.0 Anchoring

4.1 If short-term vessel anchoring is a required part of project operations, select an area offering maximum shelter from wind, current, and boat traffic.

4.2 Determine depth of water and type of bottom (preferably sand or mud). Calculate the amount of anchor line you will need. General rule: the required length of anchor line is 5 to 7 times the depth of water plus the distance from the water to where the anchor will attach to the bow. For example, if the water depth is 8 feet and it is 2 feet from the top of water to your bow cleat, you would multiply 10 feet by a factor of 5 to 7 to get the amount of anchor line to put out. In tidal areas, be aware that the scope may need to be adjusted with tidal changes and boat swing.

4.3 Bring the bow of the vessel into the wind or current. When you get to the spot where you want to anchor, place the engine in neutral. When the boat comes to a stop, slowly lower the anchor. Do not throw the anchor over, as it will tend to entangle the anchor in the anchor line.

4.4 When adequate anchor line has been let out, back down on the anchor with the engine in idle reverse to help set the anchor. Secure the anchor line to the bow cleat at the point where you want it to stop; make certain you take a couple wraps around the cleat prior to "cleating off."

4.5 When the anchor is firmly set, use reference points (landmarks) in relation to the boat to make sure the boat is not drifting. Check these points frequently, especially in areas subject to tidal changes. If the holding ground is questionable, let out additional anchor line, "cleat off,' and then back down on the anchor to get a good "bite" into the bottom.

## 5.0 Proper Fuel Management

5.1 To ensure that you will have enough fuel to safely return to the dock, always apply the one-third rule for fuel management, which proportions your available fuel supply as follows:

5.1.1 One-third of fuel going out.

5.1.2 One third of fuel to get back.

5.1.3 One third of fuel for reserve.

## 6.0 Small Boat Trailering

6.1 All boats/watercraft will be transported in accordance with federal, state, provincial, and local regulations. Appropriate equipment (racks or trailers) will be used to transport boats/watercraft to the project site. Always launch from trailers at a designated boat ramp.

6.2 Prior to moving vehicle to boat ramp:

6.3 Attach bow and stern lines to boat. Make sure length of lines are such that the lines reach the dock or shore where the boat will be placed.

6.4 Remove the belly strap holding the boat to the trailer.

6.5 Determine one individual who will assist the driver in backing the boat down the ramp. Work out audible and visual signals to assist driver in the off-loading process.

6.6 Check to make sure drain plug is inserted in the boat.

6.7 Disconnect trailer signal light cable.

## 7.0 At the Boat Ramp

7.1 Before backing vehicle and trailer down the boat ramp, make sure the trailer and vehicle are in a straight line

7.2 Check to make sure that boat ramp is clear of personnel, vehicles, or boats before proceeding. The individual assisting the driver in backing up should stand to the driver's side of vehicle and well clear of trailer and either be positioned where the driver can make direct visual contact or see them in a mirror.

7.3 Back the trailer down the boat ramp to the edge of the water, and stop. The driver's assistant should disconnect the safety chain and cable from the boat and roll up any excess cable onto the trailer winch. (Disconnect the safety chain and cable ONLY if located on a LEVEL surface; otherwise, leave the cable and safely chain attached until the boat is floated off the trailer). The driver's assistant should take bow and stern lines in hand and then move clear of the trailer and vehicle.

7.4 Once all personnel are clear of vehicle, back the trailer into the water until the wheels are covered or the boat begins to float on its own. The backing momentum will push the boat away from the trailer. Once the boat is clear of the trailer, the trailer can be pulled out of the water. The boat should be pulled to the dock or shore and secured using bow and stern lines.

## 8.0 Loading the Trailer

8.1 Determine job assignments for personnel, one person will have to pilot the boat onto the trailer, one shore person will have to attach the safety cable and reel the winch, and one person will have to drive the vehicle.

8.2 Back the vehicle and trailer down the boat ramp, stopping when the tires of the trailer are submerged, or when all but the two rollers nearest the vehicle are submerged. (Apply the emergency or parking brake on the vehicle).

8.3 Maneuver the boat away from the dock and approach the trailer at a very slow speed. The boat operator should aim the bow of the boat for the bow roller. Place the control of the boat in neutral just before arriving at the trailer. The shore person should stand clear as the vessel approaches and rides up the trailer.

8.4 When the boat comes to a complete stop, the shore person steps in, attaches the safety cable to the boat, and begins to reel in the cable. As the boat is being reeled in, care should be taken to keep the boat in line with the trailer.

8.5 Once the bow of the boat is snug with the bow roller, the boat operator should raise the engine and lock it for transport. The boat operator can then climb out of the boat. Care should be taken when climbing out of the boat. Using a step ladder to facilitate exiting the boat is recommended.

8.6 Once all personnel are clear of the boat and trailer, the vehicle driver should place the vehicle in drive and slowly begin to apply the accelerator. As this is being done, the driver should release the emergency brake and pull the trailer from the water. Make sure the boat is resting on all of the trailer rollers in an even manner. If this is not the case, then back the trailer into the water, loosen the safety cable and reposition the boat.

8.7 Once the trailer is completely out of the water, stop the vehicle on a level surface. A staging area is typically provided to complete final preparations for securing the boat and equipment prior to getting on the road.

## 9.0 Prior to Hauling the Boat

9.1 Remove all loose equipment from boat such as personal flotation devices (PFDs), personal effects, sensitive survey instrumentation, or other marine electronics. Remove all trash or flyaway items.

9.2 Secure compartment hatches, and stow and lash down anchors and other loose gear.

9.3 Remove the drain plug.

9.4 Attach the belly strap to firmly secure the boat to the trailer.

9.5 Connect the trailer electrical connection to vehicle electrical plug. Check the turn signals, brake lights, and running lights on the trailer to make sure they are all working properly.

9.6 Return the boat/watercraft to the appropriate facility.

## 10.0 Special Considerations for Transporting a Boat

10.1 For car top transportation of canoes and kayaks, be sure the rack system is appropriately sized and configured to secure the boat and that the vehicle is properly rated to handle the increased weight. Ratcheting or grip lock fasteners should be used to properly secure the boat and prevent shifting. A minimum of two belly straps plus additional lines both fore and aft are recommended.

10.2 For transporting small Jon-boats in the bed of a pick-up truck, ratcheting straps or grip lock fasteners are to be used to pull and hold the boat in the truck bed. One belly strap at the front end of the truck bed is also recommended to hold the boat down.

10.3 In either scenario, loads that project more than 3 feet beyond the rear bumper of the vehicle are required to fly a red warning flag from the back of the boat to warn motorists of the overhanging load.

# S3NA-419-WI4 Float Plan

## 1.0 Float Plan

1.1 Float plans shall be prepared for all vessel operations to document vessel information (make/model, hull color, and other distinguishing features), personnel on board, description of activities being performed, expected time of departure, planned time and location for arrival, course being traveled, and pertinent contact calling information for reaching the vessel. This information shall be submitted to a competent individual on shore who assumes the responsibility of initiating emergency response procedures if the vessel does not check in at the designated time.

1.2 In the event that a vessel's return is delayed, and it is not an emergency, the boat crew must inform those holding the float plan and subsequently notify them upon returning to the dock so that the float plan can be closed out, avoiding an unnecessary and costly search.

1.3 If the vessel was trailered to a public ramp, then vehicle information (make/model and license), ramp location, and contact information for the local police department should be included in the float plan.

## 2.0 Sample Float Plan

# FLOAT PLAN

INSTRUCTIONS: Complete this plan before you go boating and leave it with a reliable person who can be depended upon to notify the Coast Guard, or other rescue organization, should you not return or check-in as scheduled. If you have a ***change of plans*** after leaving, be sure to notify the person holding your Float Plan.

**Do NOT file this plan with the Coast Guard.**

www.cgaux.org www.uscgboating.org

**VESSEL**

**IDENTIFICATION:**

Name & Home Port ____

Doc. / Registration No. ____

Year & Make ____

Length ____ Type PWR Draft ____ (Inch/CM) Hull Mat. Fiber

Hull Color(s) ____

Prominent Feature(s) ____

**TELECOMMUNICATIONS:**

Radio Call Sign ____

DSC MMSI Number ____

Radio-1: Type VHF-FM Ch / Freq. Monitored ____

Radio-2: Type ____ Ch / Freq. Monitored ____

Cell Phone ____

Pager ____

**PROPULSION:**

Primary - Type Gas IO No. Eng __ Fuel Capacity ____

Auxiliary - Type none No. Eng __ Fuel Capacity ____

**NAVIGATION:** **(Check all on board)**

☐ Maps ☐ Charts ☐ Compass ☐ GPS / DGPS

☐ Radar ☐ Loran C ☐ Sounder ☐ ____

**SAFETY & SURVIVAL**

**VISUAL DISTRESS SIGNALS:**

☐ Day Only type

☐ Night Only type

☐ Day & Night type

**PFDs: (Do not count Type IV devices)**

___ Quantity on board

**AUDIBLE DISTRESS SIGNALS:**

☐ Horn / Whistle

☐ Bell

☐ ____

**GROUND TACKLE:**

☐ Anchor - line length ____ ft.

**OTHER GEAR / SUPPLIES:**

☐ Lifeboat / Life Raft ☐ Flashlight / Searchlight

☐ Dinghy / Skiff ☐ Signal Mirror

☐ Food / Water ☐ Drogue / Sea Anchor

☐ EPIRB none ☐ ____

☐ Foul Weather Gear ☐ ____

**PERSONS ON BOARD**

**OPERATOR:** Age M/F Notes (Special medical condition, Can't swim, etc.)

Name ____ ____ M ____

Address ____ Experience: w/Boat ☐ w/Area ☐

City ____ State ____ Zip code ____ Home Phone ____

Vehicle (Year, Make & Model) ____ Vehicle License No. ____

Where will trailer be parked? ____ Trailer License No. ____

**PASSENGERS:** Name & Home Phone Age M/F Notes (Special medical condition, Can't swim, etc.)

1. ____
2. ____
3. ____
4. ____
5. ____

Attach Supplemental Passenger List if additional passengers on board

**ITINERARY**

| | DATE | TIME | LOCATION | MODE OF TRAVEL | REASON FOR STOP | CHECK-IN TIME |
|---|---|---|---|---|---|---|
| Depart | | | | | | |
| Arrive | | | | | | |
| Depart | | | | | | |
| Arrive | | | | | | |
| Depart | | | | | | |
| Arrive | | | | | | |
| Depart | | | | | | |
| Arrive | | | | | | |
| Depart | | | | | | |
| Arrive | | | | | | |
| Depart | | | | | | |
| Arrive | | | | | | |

Attach Supplemental Itinerary if additional space required.

Contact 1 ____ Phone Number ____

Contact 2 ____ Phone Number ____

If you have a genuine concern for the safety or welfare of any persons on board this vessel, who have not returned or checked-in within a reasonable amount of time, then follow the step-by-step instructions on the **Boating Emergency Guide** included with this plan, or on the World Wide Web at:

http://www.uscgaux.org/~floatplan/BoatingEmergencyGuide.htm

# S3NA-419-WI5 Marine Safety Equipment

## 1.0 Requirements

1.1 All boats and vessel will be outfitted with marine safety equipment as required by local, state, provincial, and federal regulations and standards, and as identified in the task-specific hazard analysis.

1.2 This includes, but is not limited to:

1.2.1 USCG approved personal floatation device for each person aboard the boat/vessel.

1.2.2 Sufficient lines for securing boat/vessel dockside.

1.2.3 A sound-signalling device or appliance.

1.2.4 Emergency engine shut-off lanyard, securely attached to boat/vessel operator.

1.2.5 Lifeboats/rafts (offshore vessels).

1.2.6 Fire/smoke detection equipment Marine fire extinguishers.

1.2.7 VHF Marine Radio.

1.2.8 Emergency Position Radio Beacon (EPIRB).

1.2.9 Life Ring/Retrieval Line.

1.2.10 Survival Suits: For cold water conditions (water temperature less than 55 degrees), a Coast Guard-approved Mustang suit shall be worn to protect personnel from risks of cold water immersion.

1.2.11 Functioning, battery-operated spot or flashlights.

1.2.12 Paddles or manual propelling devices.

1.2.13 A bailing container.

1.2.14 Buoyant heaving line no less than 15 m (49'3") in length.

1.2.15 Maps or appropriate navigation equipment.

1.2.16 First aid kit.

1.3 Safety equipment selected shall be in accordance with local, state, provincial, and federal regulations and standards.

1.4 Safety equipment shall be appropriate for the configuration and crew size as well as the size of the vessel.

# S3NA-419-WI6 Emergency Response Procedures

## 1.0 Requirements

1.1 Specific emergency response procedures shall be developed in the project specific health and safety plan.

1.2 Emergency procedures prior to departure to ensure that all hands understand their individual roles and responsibilities in the event of an emergency, and the location and proper use of emergency equipment aboard.

1.3 The following summary information is provided for consideration in the development of project-specific emergency response plans.

1.4 Emergency response plans may vary depending on the size and configurations of boats/vessels and the size and abilities of the crew.

## 2.0 Person Overboard

2.1 A person in the water shall be considered a person in distress, and immediate emergency response actions shall be taken.

2.2 Prior to the start of operations, the Marine Safety officer shall confirm that suitable rescue equipment is available to facilitate the emergency rescue of an individual who has fallen into the water.

2.3 The MSO shall conduct a safety briefing to discuss emergency response procedures, the type and location of safety gear that is available, and the roles and responsibilities of each crew members during an emergency.

2.4 All crew members should be instructed to

- NEVER LOSE SIGHT OF THE INDIVIDUAL IN THE WATER,
- Inform the Captain, or vessel operator, as quickly as possible.
- Throw a ring lifebuoy to the general vicinity of the victim. Do not throw a ring lifebuoy directly at the victim. Hitting the victim with the ring buoy may cause additional injuries.

2.5 All person-overboard situations shall be reported as an incident in accordance with *S3NA-004-PR-Incident Reporting.*

## 3.0 On-Board Fire

3.1 The MSO will conduct a safety orientation to inform crew members of the location of fire extinguishers, specific emergency procedures, and the individual responsibilities expected of all hands in the event of an on-board fire.

3.2 If a fire is encountered, DO NOT attempt to fight the fire without sounding an alarm first. What could appear to be a small fire can quickly get out of control.

3.3 The extinguishers generally found on project vessels are portable hand-held units designed for multiple use applications, i.e., extinguishers labeled "BC" are approved for both B and C type fires. These types of extinguishers can be carried to the fire to quickly knock down the fire before it has the chance to get out of control. Crew members must be aware that, because these extinguishers are portable, they carry only a limited supply of extinguishing agent. In general, continuous application can be sustained for only a minute or less. Extinguishers are activated by pulling the safety pin and squeezing the release handle. Aim the extinguisher at the base of the flame. Apply the extinguishing agent in short bursts and in a sweeping motion across the base of the fire until the fire is extinguished. If you must enter a space, never let the fire get between you and the door. If your initial attack with a portable extinguisher fails get out immediately and close the door.

## 4.0 Abandon Ship

4.1 The MSO will conduct a safety orientation prior to departure to point out the location of life rafts, procedures for manually deploying the raft, and specific individual responsibilities expected of all hands in the event the vessel needs to be abandoned.

4.2 The decision to abandon ship is a matter of last resort; it is always better to remain with the boat, which is much more visible, until rescue assistance arrives on the scene. If the severities of the situation, through causes that include collision, sinking, fires, or grounding dictate that it is safer to abandon ship, then a distress call must be made to inform authorities of your situation so that rescue assistance can be provided and that your time in the water is kept to a minimum.

4.3 For coastal and offshore waters, a distress call is made on the marine VHF radio using Channel 16. This frequency is monitored by the USCG and it is the official hailing frequency reserved for ship-to-ship calling and broadcasting safety information and distress calls. Appropriate actions for transmitting a distress signal will be taken by the ship's crew, but if matters need to taken into your own hands, the protocols of a distress call are:

4.4 A distress call protocol begins with "MAYDAY" "MAYDAY" "MAYDAY," after which the following information is provided:

4.4.1 Vessel name and description,

4.4.2 A brief description of your emergency

4.4.3 Your position and the last landmark seen,

4.4.4 The number of people that are on board and/or in the water,

4.4.5 What form of assistance is needed/advise of any imminent dangers,

4.4.6 Your cell phone number if calling by cell, and

4.4.7 If hailing on the marine VHF wait 10 seconds for a response. Repeat this information if there is no response.

4.5 For inland waters, or work within protected coastal waters where local authorities (marine patrol, harbormaster, police, and fire rescue) may provide a more effective response, dial 911 emergency services and provide the same information listed above. It is also important to remember that most powered vessels built after 1978 are designed to float even when full of water or in the capsized position. If either of these situations occurs, it is important that you stay with the boat if possible, and remain calm. To reduce the effects of hypothermia, climb into or onto the boat to get as much of your body as possible out of the water.

4.6 Vessels working offshore must carry sufficient numbers of USCG-approved life rafts to accommodate 100 percent of the persons aboard. These units are designed to float free from the sinking vessel and to inflate automatically in the unlikely event that the vessel should sink. A hydrostatic release mechanism and weak link are provided on the life raft container to satisfy this requirement. The life raft container can also be removed from the storage cradle and deployed manually, if the situation provides sufficient time to safely achieve this task. An instruction card is generally displayed in a prominent location aboard the vessel and can also be found directly on the raft container. If the vessel is operating in ocean service or coastwise transit the life raft must be rated for Ocean Service.

4.7 The decision to abandon ship lies solely with the Captain of the vessel. If the order is ever given, you will be expected to follow the directions of the ships' crew, in a calm and orderly fashion. DO NOT PANIC! You will be required to assemble at a predetermined station, fully clothed, with your lifejacket on. For offshore cold-water operations, bring your immersion suit. If time permits, don your immersion suit; the suit will protect you from the elements and provide plenty of flotation, but keep your lifejacket with you. Stand by calmly at your station and await further orders. Bring a portable radio unit and ensure that the ships' EPIRB (see below) has been energized. If the order to abandon ship is given, enter the life rafts in an orderly fashion and remain in the general vicinity of the vessel until rescue assistance arrives.

## 5.0 Emergency Position Indicating Radio Beacon (EPIRB)

5.1 The Emergency Position Indicating Radio Beacon (EPIRB) is a battery-operated, self-activating emergency transmitter. All vessels operating more than 20 miles from land are required to carry at least one approved Class-A EPIRB.

5.2 An EPIRB unit is not generally required on vessels that are operating less than 20 miles from land and that are equipped with a marine VHF-FM radio. The EPIRB will enable rescuers to quickly locate a disabled vessel by providing a tracking signal to all search and rescue units within range of the unit.

5.3 Prior to departure, check with the Captain of the vessel to ensure that the unit is functioning properly and that the unit has been suitably tested within the last 30 days.

5.4 The operation of most units is usually tested simply by activating the TEST switch and checking for a positive indication from the unit. If no indication is observed, check or replace the battery, and retest. A defective unit should be returned to an authorized service center for repairs.

5.5 A functioning unit should be stowed in a suitable rack, in the inverted position, with the power switch in the automatic position. The unit will float free from the storage rack in the unlikely event the vessel sinks and begin transmitting automatically when it rights itself on the surface.

5.6 If the situation permits, the EPIRB should be brought into the life raft in the event that the vessel must be abandoned; the unit can be activated manually simply by inverting the unit to the upright position.

5.7 Do not test the EPIRB by inverting the unit, as this will send out a false alarm and initiate an unnecessary search and rescue for which you may be held accountable.

# S3NA-419-WI7 Hazardous Weather Operations

The following guidelines are provided as safety considerations to avert the risks of encountering hazardous weather and seas during on-water project operations.

## 1.0 Planning

1.1 Use online resources such as National Oceanic and Atmospheric Administration (NOAA) marine weather forecasts to evaluate current and predicted weather and predicted sea-state information, and available National Data Buoy Center (NDBC) buoy information to cross-check marine forecasts with real-time and hindcast records of offshore sea-state conditions.

1.2 Additional protective measures could include assigning a coworker at the office to watch developing weather reports and radar loops to track incoming weather if there is some uncertainty in the weather at the time of departure.

1.3 On-water operations should be postponed whenever small craft warnings are in effect.

1.4 Despite the best of planning measures, severe weather such as thunderstorms, squall lines, gusty winds, and shifting wind directions with approaching storms or weather fronts can develop quickly and present a safety risk to marine personnel. Therefore, it is important that proper consideration be given to the vessel being selected to support your project and the operational limitations associated with that vessel. The vessel must be sized and configured to weather the worst case sea-state that might be expected in a given day. Factors such as length, freeboard, horsepower, sea-keeping abilities, watertight integrity of enclosed spaces, and inherent flotation should be considered in selecting a vessel for working in exposed waters, either offshore or a windward side of large bodies of water whether in coastal or inland locations.

1.5 While offshore, monitor NOAA weather radio for the latest watches, warnings, or advisories. If weather conditions are predicted to deteriorate, be sure to leave for the return trip back to dock with ample time to avoid hazardous weather conditions.

1.6 If possible, consider revising your project itinerary to reposition the vessel to work within a survey area or group of sampling stations that are closer to shore if weather conditions appear threatening or if wind directions have winds coming off the land and thus near-shore sea-states would be reduced due to the reduced fetch, saving the furthest offshore or most exposed survey areas for better weather.

## 2.0 Sudden Weather Changes

2.1 Dark, threatening clouds usually foretell the approach of severe weather. Other things to watch for are a sudden drop in air temperature, a shift in wind direction, an increase in winds speeds, or an increase in winds that are running counter to the prevailing current direction—a situation that can quickly increase sea states.

2.2 If thunder can be heard, you are at risk of being struck by lightning. Open-vessel platforms (those without adequate enclosed spaces for shelter) shall return to the dock immediately so that personnel can seek refuge. If there is insufficient time to get back to the dock, seek out the nearest shelter (shore side support truck, alternate dockage, or any nearby building along shoreline). As a last resort, personnel should set out an anchor and get as low as possible in the boat. Use boat cushions or other nonconducting materials to insulate the body from metal hulls. For vessels with enclosed spaces, keep below decks (if possible) keeping away from metal objects that are not grounded, and do not touch more than one grounded object at the same time.

2.3 If you find yourself in a rapidly deteriorating sea while in route back to the dock:

2.3.1 Reduce vessel speed enough to maintain control, while still maintaining headway.

2.3.2 Turn on running lights.

2.3.3 Sound fog horn or audible device is there is fog.

2.3.4 Head the bow of the boat at about a 45-degree heading to the wave direction.

2.3.5 Keep bilges free of accumulating water.

2.3.6 Check that gear is secured.

2.3.7 Remain calm and think clearly.

# S3NA-419-WI8 Charters and Subcontractors

## 1.0 Responsibilities

1.1 When chartering or subcontracting uninspected vessels, the Project Manager shall determine the overall suitability of the vessel for the expected task.

1.2 Subcontractors are responsible for:

1.2.1 Providing qualified or Coast Guard licensed marine staff, the appropriately sized vessel, and all required gear to safely support field activities.

1.2.2 Stowing and maintaining all safety and emergency equipment.

1.2.3 Being service ready at the start of all operations. All unsafe gear will be removed from service until unsafe conditions have been corrected:

- Maintaining current Coast Guard inspections of the following items:
  - Hull inspection to ensure seaworthiness of vessel.
  - Main/auxiliary power inspection to ensure safe and operable machinery for vessel propulsion and emergency power.
  - Pressure vessel inspection to ensure that they are structurally sound with operable safety devices.
  - Electrical systems inspection to ensure satisfactory installation of wiring and equipment.
  - Lifesaving systems inspection to ensure satisfactory and adequate means to abandon ship.
  - Fire fighting systems inspection to ensure fixed and portable devices are suitable for the intended space and type of fire.
  - Navigation inspection to ensure adequacy and proper operation of navigation equipment.
  - Pollution prevention inspection to ensure compliance with international regulations and domestic laws.
  - The vessel should hold some form of “letter of designation” that it can legally operate, at a minimum, as a six-passenger charter, and within this designation the vessel must be operated by a properly licensed Captain and competent crew.

# S3NA-503-PR Bloodborne Pathogen Program

## 1.0 Purpose and Scope

1.1 Define the AECOM Program for eliminating or controlling exposure to Bloodborne Pathogens on AECOM projects and activities.

1.2 This procedure shall be implemented on any and all projects where there is a reasonable potential for AECOM Employees and/or subcontractors to be exposed to regulated waste as defined below.

1.3 This procedure applies to all AECOM North America based employees and operations.

## 2.0 Terms and Definitions

2.1 **Blood:** Human whole blood; human blood components such as plasma or platelets; and human blood products such as clotting factors.

2.2 **Bloodborne Pathogens (BBP):** Pathogenic microorganisms that are present in human blood and that can infect and cause disease in persons who are exposed to blood containing these pathogens including but not limited to hepatitis B virus (HBV), human immunodeficiency virus (HIV), hepatitis C, malaria, syphilis, babesiosis, brucellosis, leptospirosis, arboviral infections, relapsing fever, Creutzfeldt-Jakob disease, human T-lymphotrophic virus Type I, and viral hemorrhagic fever.

2.3 **Exposure Control Plan:** A plan that addresses the requirements applicable to specific AECOM projects and activities designed to eliminate or minimize employee exposure. The Exposure Control Plan may be incorporated into the project Health and Safety Plan. The Exposure Control Plan shall include:

2.3.1 Exposure determination.

2.3.2 Evaluation of circumstances surrounding exposure incidents.

2.3.3 Accessibility to all potentially affected employees.

2.3.4 Methods of compliance.

*Note that in the State of California this plan shall also address exposures to airborne pathogens.*

2.4 **Health and Safety Plan (HASP):** A document prepared for a specific project that details the hazards, precautions, emergency planning, medical, and training requirements for that project.

2.5 **Occupational Exposure (Exposed):** Reasonably anticipated skin, eye mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of an employee's duties. Employees will be considered to be potentially exposed, even though they are using the universal precautions specified for the project.

2.6 **Other Potentially Infectious Materials:** Body fluids and tissues including: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, peritoneal fluid, pericardial fluid, amniotic fluid, saliva, and any other body fluid that is visibly contaminated with blood. When it is difficult or impossible to differentiate between body fluids, all body fluids should be treated as if they are potentially infectious.

Note that in the State of California airborne pathogens are also considered infectious materials.

2.7 **Parenteral:** Refers to piercing the skin barrier (cuts, abrasions, human bites).

2.8 **Regulated Waste:** (1) liquid or semi-liquid blood or other potentially infectious materials; (2) contaminated items that would release blood or other potentially infectious materials in a liquid or semi-liquid state if compressed; (3) items that are caked with dried blood or other potentially infectious materials and are capable of being released during handling; (4) objects contaminated with blood that can pierce the skin; and (5) pathological and microbiological wastes containing blood or other potentially infectious materials.

2.9 **Source Individual:** An individual, typically one who has been injured, whose blood or saliva has come in contact with another individual, typically one who has rendered first aid or Cardio Pulmonary Resuscitation (CPR) to the injured party.

2.10 **Universal Precautions:** All body fluids and materials potentially contaminated by body fluids will be considered to be infectious unless the fluids were from the person performing the clean up or decontamination activities. All employees coming in contact with another person's body fluids shall assume that the fluids are infectious and shall wear prescribed Personal Protective Equipment (PPE).

2.11 **Medical Director:** AECOM Medical Consultant Provider.

## 3.0 Attachments

3.1 S3NA-503-FM Employee Vaccination Declination

## 4.0 Procedure

### 4.1 Roles and Responsibilities

#### 4.1.1 AECOM Medical Director

- Will review and maintain all medical records generated as a result of post-exposure follow-up and maintain all medical records related to the follow-up.
- Will, where appropriate, consult with AECOM's local medical providers about follow-up recommendations.

#### 4.1.2 Region SH&E Manager

- Will review project-specific Exposure Control Plans (normally part of the HASP) prior to the initial project mobilization, at least annually for continuing projects, and whenever necessary to reflect modified tasks or procedures that affect occupational exposure to bloodborne pathogens.
- Will consult with the **Medical Director** regarding all bloodborne pathogens exposure incidents.
- Will maintain training records and post-exposure follow-up information.
- Will confirm that site-specific training is conducted for all employees working at sites where regulated wastes were disposed or for employees who may be occupationally exposed while working at a facility that handles regulated wastes.
- Will confirm that either the local first aid and CPR training providers or a member of the SH&E Department conducts BBP training prior to first aid and/or CPR training.
- Will review all incident reports and arrange for post-exposure follow-up with AECOM's local medical provider.
- Will offer recommendations on how to prevent an incident from recurring.

#### 4.1.3 Office Manager

- See that all recommendations made by the **Region SH&E Manager** are implemented.
- Support the **Region SH&E Manager** in their efforts to prevent occupational and non-occupational exposures to bloodborne pathogens.

#### 4.1.4 Employees

- Use all PPE and universal precautions required to prevent exposure to infectious materials.
- Report potential exposure incidents to their supervisor or PM immediately.

### 4.2 Potential Exposure Situations

4.2.1 Because of the nature of AECOM's work, it is very unlikely that employees will come in contact with bloodborne pathogens. However, there are a few activities within AECOM where occupational exposures to blood or other potentially infectious materials are of concern. These activities include:

- Investigations of properties that received regulated wastes.
- Site visits or audits at Treatment Storage and Disposal facilities where medical waste is handled.
- Site visits or audits at medical or health care facilities.
- The provision of first aid or cardiopulmonary resuscitation (CPR) to AECOM, subcontractor, or client personnel.

4.2.2 Although AECOM does offer first aid and CPR training to its employees on a regular basis, providing such aid is not a specified job duty of any AECOM **employee** and, as such, may not technically be considered occupational exposure within the context of the OSHA Bloodborne Pathogens Standard. However, AECOM chooses to provide training, personal protective equipment, and post-exposure medical follow-up to any first aid and/or CPR -trained **employee** who renders first aid in the office or during field activities.

### 4.3 Unforeseen Exposure Situations

4.3.1 Occasionally, potentially infectious material is encountered during a project where none was expected; when this happens, the work shall be stopped, **employee** training conducted, and an exposure control plan prepared prior to resuming activities with potential exposures.

### 4.4 Health and Safety Plan (HASP)

4.4.1 A site-specific HASP shall be developed for any work activities at sites that generate, store, or have received regulated wastes (see Definition). The HASP will specify:

- Work practice controls including isolating potentially contaminated materials and regulated wastes from other materials, labeling containers, barriers, and housekeeping in the project area;
- Universal precautions (PPE) to be used for affected activities;
- Recognition of potentially contaminated materials; and,
- Contact information for the **AECOM Medical Director**.

4.4.2 AECOM personnel shall also be prepared to follow any requirements related to a client's compliance program for bloodborne pathogens. This is particularly important when conducting site visits or audits at medical or health care facilities and TSD facilities where medical waste is handled.

### 4.5 Employee Training

4.5.1 All personnel who will work on projects which involve potential contact with regulated wastes will be required to attend a training class prior to the start of the project and annually for continuing projects.

4.5.2 Either of the following two sources of employee training will be used by AECOM to educate employees on the hazards of exposure to bloodborne pathogens:

- The local chapter of the American Red Cross or other recognized training provider.
- AECOM's in-house training program.

4.5.3 **Training sessions will review the following:**

- Requirements of OSHA's Bloodborne Pathogens Standard
- Review of AECOM's Bloodborne Pathogen Procedure (this document)
- Situations within AECOM that may involve exposure to bloodborne pathogens
- Bloodborne diseases and symptoms of disease
- Means of transmission
- Work practice controls to reduce risk
- Use of personal protective equipment to reduce risk
- Incident reporting

### 4.6 AECOM's post-exposure medical follow-up procedures:

4.6.1 When contracting for CPR and first-aid training sessions, AECOM will request that each session include a section on the hazards associated with exposure to bloodborne pathogens and protective measures that shall be followed when administering first aid, CPR, or other emergency medical care. At the end of the session, employees will be provided with a copy of this Procedure. The Procedure will be reviewed and a question-and-answer session will be conducted at the end of the presentation.

4.6.2 If the training provider cannot provide such training, AECOM will conduct a training session using a video, hand-out materials, lecture, and a question-and-answer session, prior to the start of the first aid or CPR class.

4.6.3 All personnel who will work on projects which involve potential contact with regulated wastes will be required to attend a training class prior to the start of the project and annually for continuing projects. The specific requirements and provisions of the project Exposure Control Plan shall be provided to each AECOM employee and AECOM subcontractor assigned to work at the project site.

4.6.4 AECOM will have little control over employees who have not received first aid or CPR training, but who choose to perform Good Samaritan acts. Any employee who does perform a Good Samaritan act that results in exposure to blood or other potentially infectious materials will, however, be provided with post-exposure medical follow-up as described in this Procedure.

## 4.7 Personal Protective Equipment

4.7.1 All body fluids and materials potentially contaminated by body fluids will be considered to be infectious unless the fluids were from the person performing the clean up or decontamination activities. All employees coming in contact with another person's body fluids shall assume that the fluids are infectious and shall wear prescribed PPE.

4.7.2 The use of personal protective equipment (PPE) to prevent exposure is more appropriate for the types of occupational and non-occupational exposures AECOM **employees** might encounter than is the use of engineering or work practice controls that are more effectively instituted in medical care or laboratory facilities where employees are actually handling blood and other potentially infectious materials.

4.7.3 Personal protective equipment such as Tyvek coveralls, shoe covers, and gloves will be provided to all field team members involved in site activities where regulated wastes may be present. The specific PPE requirements will be identified in the site-specific Health and Safety Plan (HASP). The same type of PPE will also be available, if it is deemed necessary, for AECOM **employees** involved with activities at TSD facilities that handle regulated wastes.

4.7.4 PPE will be provided to affected employees at no cost to the **employee**.

## 4.8 First Aid Kits

4.8.1 All office and portable first aid kits used in the field will be equipped with several pairs of latex gloves, alcohol wipes for emergency hand washing, and a protective CPR shield. Extra supplies will be stocked in each office and in the field office or trailer for field projects that are longer than one month in duration.

## 4.9 Universal Precautions Kits

4.9.1 In those work areas where there is the potential for exposure to infectious materials, a universal precaution kit shall be readily available. The kit shall permit the clean up, neutralization, transportation, and disposal of up to 1 liter of blood or body fluids. The kit shall contain the following items at a minimum:

- Safety shield/mask combination
- Liquid proof apron
- Medical-grade vinyl/nitrile gloves
- Liquid solidifier/deodorizer
- Pickup scoop with scraper
- Red biohazard waste bag with tie
- Germicidal solution with dry wipe
- Antimicrobial hand wipe
- ID tag
- Instructions for use

## 4.10 Personal Hygiene

4.10.1 Special provisions will be made so that hand washing facilities are available on-site for sites that are known to be contaminated with regulated wastes. Alcohol wipes will be available in the event that hand washing facilities are not immediately available.

4.10.2 To reduce the potential for infection, if skin contact with blood or other potentially infectious materials occurs, the exposed area should be washed with non-abrasive soap and water as soon as possible. Hand washing will also help to prevent the transfer of contamination from the hands to other areas of the body or other surfaces that may be contacted later. Even when protective gloves are worn, hands should be washed with non-abrasive soap and running water as soon as possible after the gloves are removed.

4.10.3 The use of an alcohol wipes should not be relied upon as the primary means of personal hygiene. Hands should be thoroughly washed with soap and running water as soon as possible.

4.10.4 If mucous membranes, such as the eyes, come in direct contact with blood or other potentially infectious materials, the area should be washed or flushed with water as soon as possible.

### 4.11 Reporting Exposure Incidents

4.11.1 All incidents in which an **employee** has been exposed to blood or other potentially infectious materials shall be reported to the employee's Supervisor and to the **Region SH&E Manager**. A Supervisors Accident/Incident Investigation Form shall also be completed by the Supervisor and returned to the **Region SH&E Manager**. After reviewing the report, the **Region SH&E Manager** will provide recommendations, when appropriate, for preventing recurrence of the incident.

4.11.2 The following are examples of exposure incidents that shall be brought to the attention of the **Region SH&E Manager so** that prompt and appropriate medical follow-up can be initiated:

- Injury (piercing, puncturing, or cutting of the skin) with a sharp object contaminated with blood or a potentially infectious material.
- Contact of an open cut, skin abrasion, dermatitis, and the mucous membranes of the eyes, mouth, or nose with blood or potentially infectious material. This would include providing unprotected, mouth-to-mouth CPR.
- Touching a contaminated object or surface and transferring the infectious material to your mouth, eyes, nose, or open skin.

### 4.12 Medical Follow-Up to Exposure Incidents

4.12.1 Once notified, the **Region SH&E Manager** will in turn discuss the incident with **AECOM's Medical Director** and/or medical provider and make arrangements for an evaluation. Prompt medical attention is important in the event of an exposure incident. If the incident occurs in the field, the employee will either be asked to visit the local hospital or if he/she chooses, return immediately to the office to visit AECOM's local medical provider.

4.12.2 An attempt will be made to test the affected **employee**, and if applicable, the source individual's blood, for bloodborne pathogens. No testing will be performed without the written consent of the exposed employee or the source individual. If initially, the exposed **employee** or the source individual does not consent to HIV serological testing, but does consent to HBV serological testing, AECOM will make provisions with the local medical provider to preserve the blood sample for at least 90 days in the event that after counseling efforts, the **employee** voluntarily consents to HIV testing.

4.12.3 AECOM will rely on the professional judgment of its **Medical Director** and/or local medical providers in the event of an exposure incident. Evaluations and follow-up procedures will be provided according to the recommendations of the United States Public Health Service (USPHS), current at the time these evaluations and procedures take place. Minimally, a post-exposure evaluation and follow-up will include the following elements:

- Documentation of the route(s) of exposure
- Circumstances under which the exposure incident occurred
- Identification and documentation of the source individual in the case of first aid or emergency medical treatments
- Collection and testing of source individuals and exposed **employee's** blood for HBV and HIV serological status as soon as feasible and upon consent
- Post-exposure vaccination when medically indicated, as recommended by the USPHS
- Counseling, if necessary
- Evaluation of reported illnesses

4.12.4 Any and all follow-up recommendations offered by the physician will be immediately instituted by the **Region SH&E Manager** with the guidance of the **Medical Director** and/or the local medical provider and at no cost to the affected **employee**. Repeat testing, counselling, and follow-up, if recommended, will also be provided at no cost to the employee. AECOM will rely on the **Medical Director** and/or the local medical provider to provide counseling to **employees** concerning infection status, including results of and interpretation of medical tests and advising the employee about the protection of personal contacts.

4.12.5 All medical providers shall submit to **AECOM's Medical Director** and the affected employee a written opinion of the post-exposure evaluation within 15 days of the completion of the evaluation.

4.12.6 All medical records generated as a result of the post-exposure evaluation will be retained in the office of the **Medical Director** under lock and key and will be maintained with the strictest confidentiality.

### 4.13 Hepatitis Vaccination

4.13.1 Prior to performing field investigations where regulated wastes are stored, processed, or known to have been disposed of, AECOM will consult with the **Medical Director** and/or the local medical providers to determine if a hepatitis A or B vaccination is appropriate given the site conditions and the proposed scope of work. Where possible the first Hepatitis B vaccinations will be given prior to working at sites with known, potential exposures.

4.13.2 Although trained AECOM **employees** may provide first aid or CPR for injuries resulting from workplace accidents, AECOM **employees** do not provide medical assistance as part of their job or on a regular basis. Therefore, pre-exposure hepatitis vaccinations will not typically be performed for first-aid or CPR trained individuals.

4.13.3 Post-exposure hepatitis vaccination will be offered to employees involved in an exposure incident within 24 hours of possible exposure.

4.13.4 The vaccinations discussed above shall be provided to AECOM **Employees** at no cost to the **employee**.

### 4.14 Housekeeping

4.14.1 Other than through the provision of first aid or CPR, there is no potential for occupational exposure to blood or other potentially infectious materials within any of the AECOM offices. Therefore, the housekeeping requirements and requirements for warning signs and labels contained in the OSHA Bloodborne Pathogens standard are not applicable to our office operations.

4.14.2 When working at a site where regulated wastes have been disposed of, the specific housekeeping and warning sign requirements will be prescribed by the client and/or in the site-specific HASP.

4.14.3 When working at a client's facility, AECOM will assume the facility is in complete compliance with all the requirements of the Bloodborne Pathogens Standard and will observe all housekeeping requirements, wear required PPE, and acknowledge all warning signs and labels as specified in the client’s plan. If the client does not have an effective plan, AECOM will prepare a plan as part of the project HASP.

### 4.15 Regulated Waste Generated by AECOM

4.15.1 Any regulated waste generated by AECOM as a result of first aid activities or clean up of potentially infectious material will be collected in sealed, watertight containers and disposed of according to the Host Employer's BBP program or transported to a local fire station or hospital for proper disposal.

### 4.16 Material Decontamination

4.16.1 Any areas or equipment that are contaminated by potentially infectious material will be decontaminated using a 10% solution of household bleach.

4.16.2 Procedure and Plan Review

4.16.3 This procedure will be reviewed at least annually and whenever necessary to reflect new or modified tasks and procedures within AECOM which may affect occupational exposure to bloodborne pathogens.

4.16.4 All Exposure Control Plans for projects extending over one year shall be reviewed annually by the **Region SH&E Manager**.

## 5.0 Records

5.1.1 Each Region SH&E Manager will maintain records and provide copies of the records to the Medical Director, related to bloodborne pathogens in accordance with the provisions of the standard and *S3NA-604-PR Medical Records.*

5.1.2 Records maintained in accordance with this Procedure will include bloodborne pathogens exposure incidents, post-exposure follow-up, vaccination status, and training for all employees with potential occupational exposure. Medical records will be maintained in the office of the Medical Director for the term of employment plus 30 years. Training and incident investigation documents shall be maintained by the SH&E department for the term of employment or 3 years whichever is longer.

5.1.3 Employee medical and training records required by this Procedure shall be provided upon request for examination and copying to the subject employee, to anyone having written consent of the subject employee, or to State, Province, or Federal Occupational Safety and Health regulatory agencies.

5.1.4 Employees may request and obtain copies of their medical records from the Medical Director.

5.1.5 If AECOM ceases to do business, AECOM shall notify the OSHA Area Director, at least 3 months prior to the disposal of the medical records and, if required by the Director to do so, transmit them to the OSHA Area Director within that 3-month period.

## 6.0 References

6.1 United States: OSHA 29 CFR 1910.1030 "Occupational Exposure to Bloodborne Pathogens"

6.2 S3NA-003-PR SH&E Training

6.3 S3NA-209-PR Hazard Assessment and Project Planning

6.4 S3NA-604-PR Medical Records

6.5 S3NA-605-PR Medical Surveillance Program

# S3NA-503-FM Employee Vaccination Declination

*(To be signed by any employee who declines to accept Hepatitis B vaccine post-exposure)*

I understand that due to my occupational exposure to blood or other potentially infectious materials, I may be at risk of acquiring Hepatitis B virus (HBV) infection. I have been given the opportunity to be vaccinated with Hepatitis B vaccine at no charge to myself. However, I decline Hepatitis B vaccination at this time. I understand that by declining this vaccine, I continue to be at risk of acquiring Hepatitis B, a serious disease. If in the future I continue to have occupational exposure to blood or other potentially infectious materials and I want to be vaccinated with Hepatitis B vaccine, I can receive the vaccination series at no charge to me.

(Signature of the Employee)

Witness:

Date:

Original: Employee HR Medical files

# S3NA-505-PR Cold Stress Prevention

## 1.0 Purpose and Scope

1.1 To protect workers from the severest effects of cold stress (hypothermia) and cold injury and to identify exposures to cold working conditions under which it is believed nearly all workers can be repeatedly exposed without adverse health effects.

1.2 This procedure applies to all AECOM North America-based employees and operations.

## 2.0 Terms and Definitions

2.1 **Cold Stress:** The production of physiological effects due to cold temperatures and\or wind chill.

2.2 **Equivalent Chill Temperature (ECT):** Also known as Wind Chill (see below)

2.3 **Frostnip:** Superficial cooling of tissues without cellular destruction.

2.4 **Frostbite:** Freezing of tissue, resulting in tissue destruction.

2.5 **Hypothermia:** Condition of reduced core body temperature to 95$^{o}$F (35$^{o}$C) resulting in loss of dexterity, loss of mental alertness, collapse, and possible death.

2.6 **Wind Chill:** The combined effect of air temperature and wind. Also expressed as "equivalent chill temperature" (ECT), wind chill is defined as heat loss resulting from the effects of air temperature and wind velocity upon exposed skin.

## 3.0 Attachments

3.1 S3NA-505-WI1 Temperature Thresholds

3.2 S3NA-505-WI2 Symptoms and Treatment

3.3 S3NA-505-ST Cold Exposure

## 4.0 Procedure

### 4.1 Restrictions

4.1.1 Staff working in extreme cold (wind chill or ECT below 10$^{o}$F or -12$^{o}$C) shall not work alone.

4.1.2 All staff working in extreme cold or snow conditions should understand the following guidelines for preventing and detecting hypothermia and frost bite.

- If you experience frost bite or hypothermia, find shelter and warmth and contact a medical practitioner if symptoms persist.
- Take frequent short breaks in warm dry shelters to allow your body to warm up. Limit time of exposure.
- Schedule work for the warmest part of the day or when the wind is most calm.
- Avoid exhaustion or fatigue because energy is needed to keep muscles warm.
- Because prolonged exposure to cold air or to immersion in cold water at temperatures even well above freezing can lead to dangerous hypothermia, whole-body protection shall be used.

### 4.2 Roles and Responsibilities

#### 4.2.1 Project Managers/field task managers

- Implement cold stress prevention measures as applicable at each work site.
- Develop/coordinate a work-warning regimen, as applicable.
- Confirm cold stress hazard assessments/evaluations were completed for the planned activities.
- Assign personnel physically capable of performing the assigned tasks. Consider acclimation to cold weather when evaluating worker capability.
- Confirm personnel are properly trained to recognize the symptoms of cold stress.

4.2.2 **Region SH&E Managers**

- Conduct/support cold stress assessments/evaluations.
- Conduct/support incident investigations related to potential cold stress-related illnesses.
- Assist project teams develop appropriate work-warming regimens.
- Provide cold stress awareness training.

4.2.3 **Supervisors**

- Identify the tasks that may be most impacted by cold stress and communicate the hazard to the assigned employees.
- Confirm that employees have been trained on the recognition of cold stress-related illnesses.
- Confirm that adequate supplies of warm fluids/drinks are readily available to employees.
- Confirm that a warm/sheltered rest area is available, as applicable.
- Conduct cold stress monitoring, as applicable.
- Implement the work-warming regimen.
- Confirm that first aid measures are implemented once cold stress symptoms are identified.
- Confirm that personnel are physically capable of performing the assigned tasks and are not in a physically compromised condition.

4.2.4 **Employees**

- Observe each other for the early symptoms of cold stress-related illnesses.
- Maintain an adequate intake of available fluids.
- Report to work in a properly vested condition.
- Report all suspected cold stress-related illnesses.

## 4.3 Training

4.3.1 Before they begin work in a cold environment, project staff who might be exposed to cold stress will be informed of the potential for cold stress and how to prevent cold stress. Workers that have not had the training within the twelve prior months shall repeat the training before exposure to cold stress.

4.3.2 Personnel potentially exposed to cold stress will receive training including, but not limited to:

- Sources of cold stress, the influence of protective clothing, and the importance of acclimatization
- How the body loses heat.
- Recognition of cold-related illness symptoms
- Cold stress preventative/corrective measures
- Tthe harmful effects of excessive alcohol consumption in a cold stress environment
- The hazards associated with unstable snow or ice build ups
- First aid procedures for symptoms related to cold stress

## 4.4 Personal Protective Equipment

4.4.1 Wear multiple layers of loose fitting clothing to maintain immobile layers of warm air next to the body.

4.4.2 Avoid cotton, especially blue jeans.

4.4.3 Wear proper clothing, including head coverings and gloves or mittens for cold, wet, and windy conditions.

4.4.4 Use insulated footwear with adequate traction to prevent slips and falls.

4.4.5 Confirm extra blankets or sleeping bags are on-site.

4.4.6 Sunglasses and sunscreen should be used when there is a persistent combination of snow and direct sun.

4.4.7 If shelter is not readily available, consider supplying temporary shelters

4.4.8 Confirm that staff carry fire starter materials ifworking in remote areas..

4.4.9 Pack warm, sweet drinks, and high calorie food for snacks.

### 4.5 General Cold Stress Prevention Measures

4.5.1 In order to prevent hypothermia:

- Wear multiple layers of clothing to maintain immobile layers of warm air next to the body. Avoid cotton, especially blue jeans.
- When active, ventilate excess heat by opening or removing outer layers of clothing to avoid sweating.
  - Start with the mitten or gloves, unless protection from ice, snow, or cold metal surfaces is needed.
  - Next remove head gear and neck wrappings.
  - Then coats/parkas should be opened at the waist and sleeves.
  - Finally, layers of clothing should be taken off.
  - When resting or tired, or colder conditions are encountered, add additional layers of clothing/ close outer layers in the reverse of the above order, or get out of the cold. Have a sweet drink but do not indulge in heavy eating.
- Garments worn to keep out rain and spray should also allow water vapor to escape.
- Take advantage of heat from the sun and stay out of the wind as much as possible.
- Have available emergency shelter providing protection from wind and rain and insulation from the ground.
- Replace wet clothing. If wet clothing cannot be replaced, then cover it with a layer of non-breathing material to prevent evaporation. Place an insulation layer over this non-breathing material.
- Get adequate rest; conserve energy.
- Get adequate nutrition to replenish energy stores; rest after meals.
- Drink adequate fluids to avoid dehydration.
- If any project staff member shows signs of hypothermia, stop and treat him/her.

4.5.2 In order to prevent frost bite:

- Dress to prevent hypothermia and protect the feet and hands.
- Avoid obstruction of circulation by, for example, tight boots or tightly fitting clothing.
- Avoid nicotine, particularly cigarettes, and alcohol.
- Keep ears and nose covered and out of the wind.
- Frostbite of the corneas of the eyes can be prevented by protective goggles.
- Adopt a “buddy system” of constantly watching the faces of others in the party for white skin tissue, which is evidence of frostbite (frostnip).
- Practice constant personal vigilance for signs of trouble in one’s own fingers and toes; when in doubt, investigate thoroughly before it is too late.

4.5.3 Adequate, insulating dry clothing that will help maintain core temperatures above 96.8$^{o}$F (37$^{o}$C) shall be provided to workers if work is performed in air temperatures below 40$^{o}$F (5$^{o}$C). Wind chill cooling rate and the cooling power of air are critical factors. The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.

4.5.4 An Equivalent Chill Temperature (ECT) chart relating the actual dry bulb air temperature and the wind velocity is presented in *S3NA-505-WI1 Temperature Thresholds.* Unless unusual or extenuating circumstances exist, cold injury to other than hands, feet, and head is not likely to occur without the development of the initial signs of hypothermia. Superficial or deep local tissue freezing will occur only at temperatures below 32$^{o}$F (0$^{o}$ C) regardless of wind speed. However, older workers or workers with circulatory problems require special precautionary protection against cold injury. The use of extra insulating clothing and/or a reduction in the duration of the exposure period are among the special precautions that should be considered.

4.5.5 Continuous exposure of skin should not be permitted when the air speed and temperature results in an ECT of –25$^{o}$F (-32$^{o}$ C) or below.

4.5.6 At air temperatures of 40$^{o}$F (5$^{o}$C) or less, it is imperative that workers who become immersed in water or whose clothing becomes wet be immediately removed from the cold environment, provided a change of clothing, and be treated for hypothermia.

4.5.7 If the air velocity at the job site is increased by wind, draft, or artificial ventilating equipment, the cooling effect of the wind should be reduced by shielding the work area or by wearing an easily removable windbreak garment.

4.5.8 Adequate protection, such as general ventilation, shall be incorporated into any warming shelter design to prevent carbon monoxide poisoning.

4.5.9 Operation of internal combustion or similar devices within warming shelters is prohibited.

4.5.10 If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work should be modified or suspended until adequate clothing is made available or until weather conditions improve.

4.5.11 Walking and working surfaces shall be cleared of ice and snow to prevent slips and falls.

4.5.12 Supplies such as PPE, fuels, enclosures, de-icing, traction aids, warm drinks, and batteries will be specified by the SH&E Manager and/or the Project Manager. These supplies will be inspected at least weekly during cold weather projects and replaced when necessary.

## 4.6 Cold Stress Prevention Measures for the Hands

4.6.1 Special protection of the hands is required to maintain manual dexterity for the prevention of accidents including, but not limited to the following:

- If fine work is to be performed with bare hands for more than 10 to 20 minutes in an environment below 60°F (15° C), special provisions should be established for keeping the workers' hands warm. For this purpose, warm air jets, radiant heaters (fuel burner or electric radiator), or contact warm plates may be utilized. Metal handles of tools and control bars should be covered by thermal insulating material at temperatures below 30°F (-1° C).
- If the air temperature falls below 60°F (15° C) for sedentary work, 40°F (5° C) for light work, or 20°F (-6° C) for moderate work, and fine manual dexterity is not required, workers should use gloves.

4.6.2 To prevent contact frostbite, workers should wear anti-contact gloves:

- When cold surfaces below 20°F (-6° C) are within reach, each worker should be warned to prevent inadvertent contact by bare skin.
- If the air temperature is 0°F (-18° C) or less, workers should protect their hands with mittens. Machine controls and tools for use in cold conditions should be designed so that they can be handled without removing the mittens.

4.6.3 Provisions for additional total body protection are required if work is performed in an environment at or below 40°F (5° C). The workers should wear cold protective clothing appropriate for the level of cold and physical activity.

4.6.4 Additional Cold Stress Prevention Measures For work practices at or below 10°F (-12° C) ECT, the following will apply:

- The worker should be under constant protective observation (buddy system or supervision).
- The work rate should not be so high as to cause heavy sweating that will result in wet clothing. If heavy work is being performed, rest periods should be taken in heated shelters and opportunities to change into dry clothing should be provided.
- New employees should not be required to work full time in the cold during the first days of employment until they become acclimated to the working conditions and required protective clothing.
- The weight and bulkiness of clothing should be included in estimating the required work performance and weights to be lifted by the worker.
- The work should be arranged in such a way that sitting still or standing still for long periods is minimized. Unprotected metal chair seats should not be used. The worker should be protected from drafts to the greatest extent possible.
- Workers should be instructed in safety and health procedures, which should address:
  - Proper rewarming procedures and appropriate first aid treatment.
  - Proper clothing practices.
  - Proper eating and drinking habits.
  - Recognition of impending frostbite.

- Recognition of signs and symptoms of impending hypothermia or excessive cooling of the body even when shivering does not occur.
- Safe work practices.

4.6.5 Eye protection for workers employed outdoors in a snow and/or ice-covered terrain should be supplied. Special safety goggles to protect against blowing ice crystals and ultraviolet light and glare (which can produce temporary conjunctivitis and/or temporary loss of vision) should be required when there is an expanse of snow coverage causing a potential eye exposure hazard.

4.6.6 Workers handling evaporative liquid (gasoline, alcohol, or cleaning fluids) at air temperatures below 40°F should take special precautions to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling. Special note should be taken of the particularly acute effects of splashes of “cryogenic fluids” or those liquids with a boiling point that is just above ambient temperature.

4.6.7 Trauma sustained in freezing or subzero conditions requires special attention, because an injured worker is predisposed to cold injury. Special provisions should be made to prevent hypothermia and freezing of damaged tissue in addition to providing for first aid treatment.

### 4.7 Work-Warming Regimen

4.7.1 If work is performed continuously in the cold at an equivalent chill temperature (ECT) at or below -15°F (–26°C), heated warming shelters (tents, cabins, rest rooms, etc.) should be made available nearby. The workers should be encouraged to use these shelters at regular intervals; the frequency will depend on the severity of the environmental exposure.

4.7.2 The onset of heavy shivering, minor frostbite (frostnip), the feeling of excessive fatigue, drowsiness, irritability, or euphoria are indications for immediate return to the shelter.

4.7.3 When entering the heated shelter, the outer layer of clothing should be removed and the remainder of the clothing should be loosened to permit sweat evaporation or a change of dry work clothing provided.

4.7.4 A change of dry work clothing should be provided as necessary to prevent workers from returning to the cold environment with wet clothing.

## 5.0 Records

5.1 Training records will be maintained by the SH&E Department

5.2 Exposure assessments will be documented in the project files.

## 6.0 References

6.1 See attachment S3NA-505-WI1 Temperature Thresholds.

# S3NA-505-WI1 Temperature Thresholds

## 1.0 Purpose and Scope

1.1 The following table gives apparent temperatures (wind chill) for various combinations of wind and air temperature, as well as guidelines to the danger of skin exposure.

**Table 1. Wind Chill Chart (C)**

| Actual Temp (°C) | Wind Speed in km/hour | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **8** | **16** | **24** | **32** | **40** | **48** | **56** | **64** | **72** | **80** |
| | Ambient Temperature (°C) | | | | | | | | | |
| 0 | -2 | -8 | -11 | -14 | -16 | -17 | -18 | -19 | -19 | -20 |
| -5 | -7 | -14 | -18 | -21 | -23 | -25 | -26 | -27 | -28 | -28 |
| -10 | -12 | -20 | -25 | -28 | -31 | -33 | -34 | -35 | -36 | -36 |
| -15 | -18 | -26 | -32 | -35 | -38 | -40 | -42 | -43 | -43 | -44 |
| -20 | -23 | -32 | -38 | -43 | -46 | -48 | -50 | -51 | -52 | -52 |
| -25 | -28 | -38 | -45 | -50 | -53 | -56 | -57 | -59 | -59 | -60 |
| -30 | -33 | -45 | -52 | -57 | -61 | -63 | -65 | -67 | -67 | -68 |
| -35 | -39 | -51 | -59 | -64 | -68 | -71 | -73 | -75 | -75 | -76 |
| -40 | -44 | -57 | -65 | -71 | -75 | -79 | -81 | -83 | -83 | -84 |
| -45 | -49 | -63 | -72 | -78 | -83 | -86 | -89 | -90 | -91 | -92 |
| -50 | -54 | -69 | -79 | -85 | -90 | -94 | -96 | -98 | -99 | -100 |

*Note: A. Little Danger: if less than one hour of exposure to dry skin.*
*B. Danger: Exposed flesh freezes within one minute.*
*C. Great Danger: Flesh may freeze with in 30 seconds.*

*Source: *Threshold Limit Values (TLV™) and Biological Exposure Indices (BEI™) booklet; published by ACGIH, Cincinnati, Ohio.*

**Table 2. Equivalent Chill Temperature Chart (F)**

| Estimated Wind Speed (mph) | Actual Temperature Reading ($^{o}$F) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **50** | **40** | **30** | **20** | **10** | **0** | **-10** | **-20** | **-30** | **-40** |
| | Equivalent Chill Temperature ($^{o}$F) | | | | | | | | | |
| Calm | 50 | 40 | 30 | 20 | 10 | 0 | -10 | -20 | -30 | -20 |
| 5 | 48 | 37 | 27 | 16 | 6 | -5 | -15 | -26 | -36 | -47 |
| 10 | 40 | 28 | 16 | 4 | -9 | -24 | -33 | -46 | -58 | -70 |
| 15 | 36 | 22 | 9 | -5 | 18 | -32 | -45 | -58 | -72 | -85 |
| 20 | 32 | 18 | 4 | -10 | -25 | -39 | -53 | -67 | -82 | -96 |
| 25 | 30 | 16 | 0 | -15 | -29 | -44 | -59 | -75 | -88 | -104 |
| 30 | 28 | 13 | -2 | -18 | -33 | -48 | -63 | -79 | -94 | -109 |
| 35 | 27 | 11 | -4 | -20 | 35 | -51 | -67 | -82 | -98 | -113 |
| 40 | 26 | 10 | -6 | -21 | -37 | -53 | -69 | -85 | -100 | -116 |
| Wind speeds >40 mph have little additional effect | **LITTLE DANGER** | | | | **INCREASING DANGER** | | | **GREAT DANGER** | | |
| | Trenchfoot and immersion foot may occur at any point on this chart. | | | | | | | | | |

**Table 3. Work-Warming Schedule Guidelines**

| Air Temp. (Sunny Sky) $^oF$ | No Noticeable Wind | | 5 mph Wind | | 10 mph Wind | | 15 mph Wind | | 20 mph Wind | | 25 mph Wind | | Air Temp. (Sunny Sky) $^oC$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Max. Work Period | Breaks | Max. Work Period | Breaks | Max. Work Period | Breaks | Max. Work Period | Breaks | Max. Work Period | Breaks | Max. Work Period | Breaks | |
| above $5^o$ | Normal Work Schedule | | Normal Work Schedule | | Normal Work Schedule | | Normal Work Schedule | | Normal Work Schedule | | Normal Work Schedule | | above $-15^o$ |
| $5^o$ to $-1^o$ | | | | | | | | | | | 100 min | 2 | $-15^o$ to $-17^o$ |
| $0^o$ to $-4^o$ | | | | | | | | | 100 min | 2 | 75 min | 2 | $-18^o$ to $-20^o$ |
| $-5^o$ to $-9^o$ | | | | | | | 100 min | 2 | 75 min | 2 | 55 min | 3 | $-21^o$ to $-22^o$ |
| $-10^o$ to $-14^o$ | | | | | 100 min | 2 | 75 min | 2 | 55 min | 3 | 40 min | 4 | $-23^o$ to $-25^o$ |
| $-15^o$ to $-19^o$ | | | 100 min | 2 | 75 min | 2 | 55 min | 3 | 40 min | 4 | 30 min | 5 | $-26^o$ to $-28^o$ |
| $-20^o$ to $-24^o$ | 100 min | 2 | 75 min | 2 | 55 min | 3 | 40 min | 4 | 30 min | 5 | Cease Work | | $-29^o$ to $-31^o$ |
| $-25^o$ to $-29^o$ | 75 min | 2 | 55 min | 3 | 40 min | 4 | 30 min | 5 | Cease Work | | | | $-32^o$ to $-34^o$ |
| $-30^o$ to $-34^o$ | 55 min | 3 | 40 min | 4 | 30 min | 5 | Cease Work | | | | | | $-35^o$ to $-37^o$ |
| $-35^o$ to $-39^o$ | 40 min | 4 | 30 min | 5 | Cease Work | | | | | | | | $-38^o$ to $-39^o$ |
| $-40^o$ to $-44^o$ | 30 min | 5 | Cease Work | | | | | | | | | | $-40^o$ to $-42^o$ |
| $-44^o$ & below | Cease Work | | | | | | | | | | | | $-43^o$ & below |

Modified from ACGIH 2002 Threshold Limit Values for Chemical Substances and Physical Agents.

Note 1: Schedule describes the maximum continuous duration of work and number of 10-15 minute breaks to be observed during any 4-hour work period and assumes that period will be followed by an extended warm-up period (e.g., lunch). Allowed breaks should be taken in a warm environment.

Note 2: Schedule applies to moderate to heavy work performed by acclimated workers wearing appropriate layered clothing. For light to moderate work apply the schedule for conditions one step lower. For unacclimated workers apply the schedule for conditions two steps lower. These modifications are additive.

Note 3: For work under 25%–50% overcast/clouds, apply the schedule for conditions one step lower. For work at night or under greater then 50% overcast/clouds, apply the schedule for conditions two steps lower. These modifications are additive with any applicable modifications from Note 2.

Note 4: For wind speeds in excess of 25 mph, cease all nonemergency work when temperatures fall below $5^oF$.

# S3NA-505-WI2 Symptoms and Treatment

## 1.0 Cold Stress-related Illnesses

### 1.1 Frostbite

1.1.1 Frostbite is a localized cold injury characterized by freezing of the tissues with ice crystal formation.

1.1.2 This injury is almost always limited to the upper and lower extremities or to such appendages as the ears or nose.

1.1.3 Conditions conducive to frostbite include sub-zero temperatures, hypothermia (most important predisposing factor), dehydration, obstruction of the blood supply to the extremities (by constricting clothing, especially on the feet or at the wrists or ankles), contact with cold metal, contact with organic liquids (such as gasoline or solvents that have been left outdoors in sub-zero temperatures), use of substances that cause vasoconstriction (such as smoking tobacco), or other injury or shock.

1.1.4 Symptoms of frostbite include:

- Pain in the involved tissue is the earliest symptom.
- Sudden and complete cessation of cold or discomfort in affected fingers or toes, often followed by a pleasant feeling of warmth.
- Subsequently the only symptom may be the absence of any sensation in the frozen part.
- Paleness in the affected tissues.
- Firm or hard tissues.
- Purple tissue, if a large area, such as an entire hand or food, is frostbitten.

1.1.5 If exposure occurs in temperatures that are below freezing (32ºF or below), frostbite or trench foot (immersion foot) may accompany or complicate the symptoms of hypothermia. Frostbite is the freezing of living tissues with a resultant breakdown of cell structure. Symptoms due to frostbite may include, but is not limited to:

- Superficial redness of the skin
- Slight numbness
- Blisters
- Obstruction of blood flow (ischemia)
- Blood clots (thrombosis)
- Skin discoloration due to insufficient oxygen in the blood (cyanosis)

1.1.6 Frostbite may occur if the skin comes into contact with objects with a surface temperature below freezing, such as metal tool handles. Trench foot is caused by continuous exposure to cold combined with persistent dampness or immersion in water. Injuries in this case include permanent tissue damage due to oxygen deficiency, damage to capillary walls, severe pain, blistering, tissue death, and ulceration.

1.1.7 Additionally, cold exposures may either induce or intensify vascular abnormalities. These include chilblain (a swelling or sore), Raynaud's disease, acrocyanosis (blueness of hands and feet) and thromboangiitis (inflammation of the innermost walls of blood vessels with accompanying clot formation). Workers suffering from these ailments should take particular precautions to avoid chilling.

### 1.2 Hypothermia

1.2.1 Hypothermia is a lower than normal body temperature that occurs when outer cold cools the body faster than the body can produce heat to stay warm.

1.2.2 Hypothermia can be caused by exposure to wind, cold, and/or moisture. The combination of wind, cold, and moisture can be deadly.

1.2.3 Early warning signs of hypothermia:

- Feeling of being cold and tired.
- Heavier breathing and increased pulse rate.
- Tendency to keep moving (e.g., stamping feet, rubbing hands, continued walking/pacing).
- Goose bumps, holding arms tightly wrapped around the body, hunching of shoulders.

- Shivering.

1.2.4 Hypothermia damages both the body's internal temperature mechanisms (hypothalamus) and the peripheral mechanisms to prevent heat loss (vasoconstriction and perspiration.) These effects may last up to three years after the initial hypothermia episode. Symptoms of hypothermia may include, but are not limited to:

- Pain in the extremities.
- Severe shivering and numbness.
- Low core body temperature.
- Drowsiness and muscular weakness.
- Apathy.
- Mental confusion.
- Loss of consciousness.
- Shock.
- Decreasing pulse and breathing rate.

## 2.0 Recommended Treatment for Cold Stress-related Illnesses

### 2.1 Frostbite

2.1.1 Wrap the victim in woolen blanket and keep dry until he or she can be brought inside.

2.1.2 Remove the victim from the cold environment.

2.1.3 Do not rub, chafe, or manipulate frozen parts.

2.1.4 Place the victim in warm water (102ºF to 105ºF) and make sure the water remains warm. Test the water by pouring it on the inner surface of your forearm. Never thaw affected body parts if the victim has to go back out into the cold; refreezing can cause significant tissue damage.

2.1.5 Do not use hot water bottles or a heat lamp, and do not place the victim near a hot stove.

2.1.6 Do not allow the victim to walk if his or her feet are affected.

2.1.7 Have the victim gently exercise the affected parts once they are thawed.

2.1.8 Seek immediate medical attention for thawing of serious frostbite.

### 2.2 Hypothermia

2.2.1 Bring the victim into a warm room or shelter as quickly as possible.

2.2.2 Give artificial respiration and stop any bleeding, if necessary.

2.2.3 If the victim cannot be moved (spinal injury, etc.), carefully place newspapers, blankets, or some other insulation between the victim and the ground.

2.2.4 Remove all wet clothing.

2.2.5 Provide an external heat source, because the body cannot generate its own heat. Wrap the victim in prewarmed blankets, place him or her in the liner of a portable hypothermia treatment unit, put the torso (not the extremities) into a tub of warm water, or use body-to-body contact to rewarm the body core. These measures will slowly reopen the peripheral circulation, minimizing the possibility of after-shock or after-drop (the flowing of cooled, stagnated blood from the limbs to the heart), which may cause ventricular fibrillation, cardiac arrest, or death.

2.2.6 Do not allow the victim to sleep.

2.2.7 Give warm, sweet drinks. Do not give alcohol or pain relievers.

2.2.8 Keep the victim still. Do not try to walk.

2.2.9 Do not rub numb skin.

2.2.10 Get medical attention as soon as possible.

# S3NA-505-ST Cold Exposure

The following Occupational Health and Safety regulations apply directly to cold and snow hazards:

| Jurisdiction | Regulation |
|---|---|
| **United States** | |
| **OSHA** | Title 29, Code of Federal Regulations, Sections 1910.1027 and 1926.1127 |
| **Canada** | |
| **Alberta** | n/a |
| **British Columbia** | OHS Regulation (1997) Sect 7.33 – 7.38 |
| **Manitoba** | Workplace Health and Safety Regulation (217/2006) Sect 4.12, 4.14 |
| **New Brunswick** | OHS Regulation (91-191) Sect 44 |
| **Newfoundland/Labrador** | OHS Regulation (C.N.L.R. 1165/96) Sect 10 |
| **Nova Scotia** | n/a |
| **NWT/NU Territories** | n/a |
| **Ontario** | O. Reg. 851 Sect 39, 129 |
| **Prince Edward Island** | OHS Regulations (EC180/87) Sect 42.1 |
| **Quebec** | OHS Regulation (R.R.Q., c. S-2.1, r.19.01 O.C. 885-2001) Schedule 4 |
| **Saskatchewan** | OHS Regulation (R.R.S., c. O-1, r. 1) Sect 70<br>Cold Conditions Guidelines for Outside Workers |
| **Yukon Territory** | Occupational Health Regulations (O.I.C. 1986/164) Sect 9 |

# S3NA-506-PR Compressed Gases

## 1.0 Purpose and Scope

1.1 This procedure provides the requirements for using, handling, storing, transporting, disposition and/or decommissioning compressed gas cylinders in accordance with 29 CFR 1910.

1.2 This procedure applies to all AECOM North America based employees and operations.

## 2.0 Terms and Definitions

2.1 **Compressed Air (Non-Breathable)**: Air that is at a pressure greater than that of the atmosphere. Compressed air shall not be used for cleaning purposes except where reduced to less than 30 psi and then only with effective chip guarding and personal protective equipment**.** Utilized for tools, equipment, and mechanical machinery and cleaning purposes as described in this procedure.

2.2 **Compressed Gas:** Any material or mixture in a pressure vessel having:

- An absolute pressure exceeding 40 pounds per square inch (PSI) at 70°F (25 pounds per square inch gauge); or
- An absolute pressure exceeding 104 Psia at 130°F, regardless of the pressure at 70°F.

2.3 **Cylinder**: Pressure vessel designed for pressures higher than 40 Psia and having a circular cross section.

2.4 **Pneumatics**: The use of pressurized air to affect mechanical motion for machinery, equipment and tools.

2.5 **Psi**: Pounds per square inch.

2.6 **Psia**: Pounds per square inch absolute (i.e., pressure in a container that would appear on an ordinary gauge plus the local atmospheric pressure [14.696 psi at sea level]), psig- pounds per square inch gauge.

2.7 **Psig**: Pounds per square inch gauge. The pressure in a vessel or container as registered on a gauge attached to the container. This reading does not include the pressure of the atmosphere outside the container.

2.8 **Disposition**: Recycling, treatment, or disposal of a compressed gas cylinder and/or its contents.

2.9 **Decommission**: The removal of a compressed gas cylinder from service by rendering it permanently unusable.

## 3.0 Attachments

3.1 S3NA-506-FM Cylinder Inspection

3.2 S3NA-506-ST Compressed Gases

3.3 S3NA-506-WI Compressor Safety Card

## 4.0 Procedure

### 4.1 Roles and Responsibilities

#### 4.1.1 Project Manager

- Implement these procedures during all activities involving compressed gases.
- Seek consultation with the SH&E Department when unknown compressed gas cylinders are encountered.
- Confirm staff has received the appropriate training as it relates to compressed gases/compressed gas cylinders.
  - Confirm a hazard assessment/evaluation of the activities involving compressed gases has been completed.
  - Contact the SH&E Department prior to any compressed gas cylinder operation.

### 4.1.2 Region SH&E Manager

- Review and authorize all compressed gas cylinder operations.
- Conduct/support compressed gas hazard assessments/evaluations.
- Provide awareness training to project teams regarding hazards of encountered compressed gases.
- Support the identification/disposition of unknown compressed gas cylinders.
- Support the development of a site-specific cylinder plan.

### 4.1.3 Supervisor

- Immediately report any leaking/suspected leaking compressed gas cylinder(s) to the SH&E Department and implement the appropriate emergency action(s).
- Immediately report the discovery of any unknown compressed gas cylinder(s) to the SH&E Department and cordon off the area in all directions a minimum of 50 feet.
- Confirm that all compressed gas cylinders are properly inspected, stored, and, secured.
- Confirm that all compressed gas cylinders are handled in a safe manner, protecting both the person and cylinder.
- Confirm that all compressed gas cylinder manifolds and connections are properly made and inspected.
- Contact local emergency services prior to the start of any compressed gas cylinder operation.

### 4.1.4 Employee

- Immediately report any leaking/suspected leaking compressed gas cylinder(s) to your immediate supervisor.
- Immediately report the discovery of any unknown compressed gas cylinders to your immediate supervisor.
- Properly handle all compressed gas cylinders.
- Staff shall be supervised by personnel experienced in the operation of compressed gas tools and equipment.

## 4.2 Air Compressor Operations

4.2.1 Air compressor equipment should be operated only by authorized and trained personnel.

4.2.2 The air intake should be from a clean, outside, fresh air source. Screens or filters can be used to clean the air.

4.2.3 Air compressors should never be operated at speeds faster than the manufacturer’s recommendation.

4.2.4 Equipment should not become overheated.

4.2.5 Moving parts, such as compressor flywheels, pulleys, and belts that could be hazardous should be effectively guarded.

4.2.6 Keep the air supplied tools clean and dry. Dust, moisture, and corrosive fumes can damage tools.

4.2.7 Keep tools clean, lubricated, and maintained according to manufacturer’s instructions.

4.2.8 Only use attachments and accessories recommended by the manufacturer.

4.2.9 Review the manufacturer's instruction before using a tool.

4.2.10 Post warning signs where pneumatic tools are used.

4.2.11 Set up screens or shields in areas where nearby workers may be exposed to flying fragments, chips, dust, and excessive noise.

4.2.12 Be aware of proper handling and ergonomics while using the tool.

4.2.13 Reduce physical fatigue by supporting heavy tools with a counter-balance wherever possible.

## 4.3 Air Hoses

4.3.1 Use the proper hose and fittings of the correct diameter.

4.3.2 Use hoses specifically designed to resist abrasion, cutting, crushing and failure from continuous flexing.

4.3.3 Choose air-supply hoses that have a minimum working pressure rating of 1035 kPa (150 psig) or 150% of the maximum pressure produced in the system, whichever is higher.

4.3.4 Check hoses regularly for cuts, bulges and abrasions. Tag and replace, if defective.

4.3.5 Blow out the air line before connecting a tool. Hold hose firmly and blow away from yourself and others.

4.3.6 Make sure that hose connections fit properly and are equipped with a mechanical means of securing the connection (e.g., chain, wire, or positive locking device).

4.3.7 Install quick disconnects of a pressure-release type rather than a disengagement type. Attach the male end of the connector to the tool, NOT the hose.

4.3.8 Do not operate the tool at a pressure above the manufacturer's rating.

4.3.9 Turn off the air pressure to hose when not in use or when changing power tools.

4.3.10 Do not carry a pneumatic tool by its hose.

4.3.11 Do not use compressed air to blow debris or to clean dirt from clothes.

4.3.12 All pipes, hoses, and fittings shall have a rating of the maximum pressure of the compressor. Compressed air pipelines should be identified (psi) as to maximum working pressure.

4.3.13 Air supply shutoff valves should be located (as near as possible) at the point-of-operation.

4.3.14 Air hoses should be kept free of grease and oil to reduce the possibility of deterioration.

4.3.15 Avoid trip hazards. Hoses should not be strung across floors or aisles where they are liable to cause personnel to trip and fall. When possible, air supply hoses should be suspended overhead, or otherwise located to afford efficient access and protection against damage.

4.3.16 Hose ends shall be secured to prevent whipping if an accidental cut or break occurs.

4.3.17 Pneumatic impact tools, such as riveting guns, should never be pointed at a person.

4.3.18 Before a pneumatic tool is disconnected (unless it has quick disconnect plugs), the air supply shall be turned off at the control valve and the tool bled.

4.3.19 Shop air used for cleaning should be regulated to15 psi unless equipped with diffuser nozzles to provide lesser pressure.

4.3.20 Goggles, face shields or other eye protection shall be worn by personnel using compressed air for cleaning equipment.

4.3.21 Static electricity can be generated through the use of pneumatic tools. This type of equipment shall be grounded or bonded if it is used where fuel, flammable vapors or explosive atmospheres are present.

4.3.22 The following are hazards associated with the use of compressed air tools and equipment:

- Poorly designed tool (wrist strain)
- Vibration (vibration-induced white finger)
- Noise (hearing loss)
- Dust (respiratory problems)

4.3.23 The following hazards have the potential to cause serious bodily injury when working with compressed air:

- Incorrect tool selection
- Use of damaged tool
- Improper, inadequate, or no guards
- Rotating shaft (entanglement)
- Wheel breakage (grinder)
- Flying chips
- Whipping of the hose
- Accidental start up
- Compressed air entering the body

- Dropped tool
- Tripping over hose

## 4.4 Compressed Air Equipment Maintenance

4.4.1 Only authorized and trained personnel should service and maintain air compressor equipment.

4.4.2 Exposed, non current-carrying, metal parts of compressor should be effectively grounded.

4.4.3 High flash point lubricants should not be used on compressors because of its high operating temperatures that could cause a fine or explosion.

4.4.4 Equipment should not be over lubricated.

4.4.5 Gasoline or diesel fuel powered compressors shall not be used indoors.

4.4.6 Equipment placed outside but near buildings should have the exhausts directed away from doors, windows and fresh air intakes.

4.4.7 Soapy water of lye solutions can be used to clean compressor parts of carbon deposits, but kerosene or other flammable substances should not be used. Frequent cleaning is necessary to keep compressors in good working condition.

4.4.8 The air systems should be completely purged after each cleaning.

4.4.9 During maintenance work, the switches of electrically operated compressors should be locked open and tagged to prevent accidental starting.

4.4.10 Portable electric compressors should be disconnected from the power supply before performing maintenance.

## 4.5 Compressed Gas Cylinder Requirements

4.5.1 Cylinders are not to be used unless they bear Department of Transportation (DOT) markings showing that they have been tested as required by DOT regulations.

4.5.2 Cylinders shall never be dropped, struck, or permitted to strike each other violently. Cylinders may be moved by tilting and rolling them on their bottom edges.

4.5.3 Valve protection caps shall always be kept on cylinders when they are being moved or stored, and until ready for use.

4.5.4 Do not lift cylinders by the valve protection cap.

4.5.5 Cylinder valves are to be kept closed except when gas is being used or when connected to a permanent manifold. Valves of empty cylinders shall be closed.

4.5.6 Cylinders shall never be used as rollers or supports, or for any purpose other than carrying gas.

4.5.7 Threads on regulator connections or other auxiliary equipment shall be the same as those on the cylinder valve outlet.

4.5.8 When withdrawing cylinder content, open the cylinder valve slowly. Point the valve opening away from yourself and other persons.

4.5.9 Before a regulator is removed from a cylinder, close the cylinder valve and release all pressure from the regulator. This procedure also serves as a check to confirm that the main cylinder valve is completely closed.

4.5.10 Never hammer the valve wheel in attempting to open or close the valve.

4.5.11 No person, except the owner of the cylinder or person authorized by the owner, shall refill a cylinder (*Exceptions to this includes the filling self-contained breathing apparatus cylinders with compressed air or the filling of the [Foxboro] Organic Vapor Analyzer (OVA) hydrogen cylinders*). Disposable cylinders shall not be refilled with any material after use of the original contents.

4.5.12 Cylinders of compressed gas shall be stored in areas where they are protected from external heat sources such as flame impingement, intense radiant heat, electric arc, or high-temperature steam lines.

4.5.13 Cylinders are to be stored in an assigned area, with full and empty cylinders stored separately. Empty cylinders shall be marked empty.

4.5.14 Stored fuel gases and oxygen cylinders are to be separated by at least 20 feet, or by a fire wall at least 5 feet high that has a fire-resistance rating of at least ½ hour.

4.5.15 Oxygen, nitrogen, helium, or freon cylinders shall only be stored or transported in an upright or horizontal position. Acetylene cylinders shall always be kept in an upright position. All horizontally-placed cylinders are to be secured by chocks or ties to prevent rolling.

4.5.16 Cylinders are to be secured to a fixed object by chain or equivalent fastening device whenever they are placed in an upright position. The protective cap is not to be removed or the cylinder valve opened until the cylinder is secured.

4.5.17 Repair of leaks shall never be attempted on a pressurized system. System pressure should be reduced to atmospheric pressure as rapidly as possible, and the supervisor notified immediately.

4.5.18 Compressed gas cylinders shall be legibly marked for the purpose of identifying the gas content with either the chemical or the trade name of the gas. Such marking is to be done by means of stencilling, stamping or labelling, and shall not be readily removable. Whenever practical, the marking is to be located on the shoulder of the cylinder. Positive identification of the gas in any cylinder is required before connecting cylinders for use.

4.5.19 Gas cylinders moved by hoist shall be handled in suitable cradles or job-made “skip” (materials) boxes. Any slings used for this purpose shall be specifically designed for that cylinder handling.

4.5.20 Cylinders shall not be placed where they might form part of an electrical circuit.

4.5.21 Transfer of compressed gases (including acetylene) from one cylinder to another, or mixing of gases in a cylinder, is prohibited.

4.5.22 Oxygen cylinders are never to be stored near:

- Highly combustible materials, especially oil and grease
- Reserve stocks of acetylene or other fuel gas cylinders
- Any other substance likely to cause or accelerate fire

4.5.23 Compressed oxygen is <u>never</u> to be used:

- As breathing air;
- To purge pipelines, tanks, or any confined area;
- To supply a head-pressure tank;
- In pneumatic tools;
- In oil preheating burners;
- To start internal combustion engines;
- For ventilation;
- For cleaning clothing; and
- In any other way as a substitute for compressed air.

4.5.24 Use of a cylinder's contents for purposes other than those intended by the supplier is prohibited.

4.5.25 Cylinders of compressed natural gas or propane equipped with a pressure relief device shall always be positioned in a manner that this device remains above the liquid level (i.e., if stored or installed horizontally on a forklift, relief device is positioned at the top).

## 4.6 Special Precautions for Compressed Gas Cylinders Containing Hydrogen

4.6.1 Inside buildings, cylinders of hydrogen should be separated from oxygen cylinders by a minimum distance of 20 feet or by a barrier of non-combustible material at least 5 feet high having a fire resistance rating of at least one half hour.

4.6.2 Conspicuous signs should be posted in hydrogen storage areas forbidding smoking, open flames or the use of lights or lighting not approved for use in flammable areas.

4.6.3 Although not required for gaseous hydrogen systems having a total hydrogen content of less than 400 cubic feet, it is recommended that hydrogen storage areas are labeled, "Hydrogen-Flammable Gas-No Smoking-No Open Flame" or equivalent.

### 4.7 Inspection of Compressed Gas Cylinders

4.7.1 Prior to formally accepting any delivered compressed gas cylinders, a visual inspection of each cylinder will be documented as specified below. In addition, all compressed gas cylinders stored at an AECOM facility will be routinely inspected.

- Visually inspect the cylinder (See *S3NA-506-FM Cylinder Inspection).*
- Verify that all the required markings are on the cylinder.
- If required, determine when the cylinder was last hydrostatically-tested.
- Inspect the safety relief devices, if required.
- If any defects are noted during the inspection, the cylinder should be refused on delivery and a new delivery requested (notify AECOM Procurement agent or Purchasing Department).

4.7.2 Where compressed gas cylinders are stored at an AECOM facility, a qualified person will be designated to confirm cylinder activities comply with the requirements in this procedure. Inspection entails the evaluation of the integrity of the cylinder as well as the serviceability of any attached manifold and valve fittings. Remote cylinder inspection is recommended for worker and public safety. The inspection of any cylinder will be conducted by a qualified person. See Attachment *S3NA-506-FM Cylinder Inspection*.

### 4.8 Cylinder Inspection Procedures

4.8.1 All cylinder inspection procedures will adhere to the procedures identified in CGA P-22, The Responsible Management & Disposition of Compressed Gases & Their Containers (most current edition). For valve or fitting identification, the information contained in CGA V-1, Compressed Gas Association Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections (most current edition). At a minimum, the inspection process will include the following procedures:

- Observe the cylinder from a safe distance to identify any visual markings or other information.
- Inspect the cylinder size, shape, and general condition (if visible, include the valve system/stem in the inspection process).
- If the cylinder or valve system appears to be in poor condition or has lost structural integrity, do not approach the cylinder. Observations indicating a cylinder is in poor condition may include:
  - Leaking
  - Hissing sound
  - Odor in vicinity of the cylinder
  - Rusty components
  - Bulging side wall or end
  - Corroded valve system

4.8.2 If the cylinder is determined to be in poor condition, cordon the area off and limit access to necessary personnel only.

4.8.3 Wear applicable PPE and approach the cylinder with the appropriate direct reading air monitoring instrument (do not approach from the ends of the cylinder), then determine the airborne contaminant concentrations in the immediate area.

4.8.4 Document cylinder information (i.e., visible markings, labels, placards, etc.).

### 4.9 Ground Transport of Compressed Gas Cylinders

4.9.1 AECOM will transport (drive/haul) quantities of compressed gases which do not exceed Materials of Trade (MOT) quantities, whereas <u>the transport of placardable quantities is prohibited without the proper DOT licenses/credentials and consultation with the SH&E Department.</u>

4.9.2 Compressed gas cylinders in portable service are to be conveyed by suitable trucks, to which they are securely fastened. All gas cylinders in service shall be securely held in substantial racks or secured to other rigid structures so that they will not fall or be knocked over.

### 4.10 Air/Common Carrier Transport

4.10.1 All shipping of compressed gases via air/common carrier including instrument gases, regardless of quantity, shall be conducted by a qualified and trained HazMat Shipper (Level 1-2 Shipper), and shall conducted under the oversight of a designated DOT/International Air Transport Association (IATA) shipping specialist.

4.10.2 No compressed gas cylinder, regardless of contents or quantity, will be shipped via an external carrier vendor (i.e., UPS, FedEx, etc.) without the authorization of:

- **Region SH&E Manager**
- DOT/IATA shipping specialist

### 4.11 Cylinder Disposition & Decommissioning Activities

4.11.1 All cylinders shall be inventoried, staged, and inspected.

4.11.2 Prior to the commencement of cylinder activities, local emergency response agencies (i.e., Fire Department, Medical, and Emergency Response, if separate) shall be contacted and activities coordinated with the local agencies.

4.11.3 Air monitoring is mandatory during cylinder operations.

4.11.4 A Regional SH&E Manager shall be contacted during the planning stages of a cylinder effort in order to determine whether a site-specific cylinder plan is required.

4.11.5 A copy of the DOT Emergency Response Guidebook (most current edition) and applicable Compressed Gas Association, Inc. (CGA) guidelines shall be on site during activities.

### 4.12 Cylinder Color Coding Determination

4.12.1 The color coding of compressed gas cylinders is governed by the CGA, which has assigned specific colors to categories or classes of chemicals/substances.

4.12.2 While recently manufactured cylinders reflect the color coding guidance established by the CGA, older cylinders may not reflect this nomenclature. It is also possible for cylinders to have been repainted a different color from their original.

4.12.3 Cylinder contents should never be determined by the color of the cylinder alone.

4.12.4 The following table provides general guidance on the standard color coding scheme and potential contents associated with those colors.

| Standard Color (Color of Cylinder) | Class of Material |
|---|---|
| Yellow | *Flammable Materials*. All materials known ordinarily as flammables or combustibles. |
| Brown | *Toxic and Poisonous Materials*. All materials extremely hazardous to life or health under normal conditions, such as toxics or poisons. |
| Blue | *Anesthetics and Harmful Materials*. All materials productive of anesthetic vapors and all liquid chemicals and compounds hazardous to life and property but not normally productive of dangerous quantities of fumes or vapors. |
| Green | *Oxidizing Materials*. All materials, which readily furnish oxygen for combustion and fire producers that react explosively or with the evolution of heat in contact with many other materials. |
| Gray | *Physically Dangerous Materials*. All materials, not dangerous in themselves, which are asphyxiating in confined areas or which are generally handled in a dangerous physical state of pressure or temperature. |
| Red | *Fire Protection Materials*. All materials provided in piping systems or in compressed gas cylinders exclusively for use in fire protection. |

Note: Old cylinders that predate the CGA standard color scheme may not adhere to the color schemes shown above; therefore, additional characteristics such as color bands or identifying decals should also be evaluated. Also, the CGA *Handbook of Compressed Gases*, (most current edition) should be consulted for further information.

### 4.13 Air Monitoring Requirements

4.13.1 Air monitoring requirements are dependent upon the specific substances contained within the cylinders and will be specified within the individual HASP prepared prior to commencement of field activities. Air monitoring parameters may include, but are not limited to:

- Explosivity (i.e., lower explosive limit [LEL])
- Chemical-specific substance (e.g., chlorine, ammonia, arsine, etc.)

4.13.2 Action levels will be identified in the site-specific HASP.

### 4.14 Cylinder Staging

4.14.1 Staging involves the organization, and sometimes consolidation, of cylinders that have similar contents or characteristics.

4.14.2 The staging of cylinders will occur in a remote location at the site in order to minimize the potential injury or property damage from an accidental release or emergency decompression (if the integrity of the cylinder is in question, it should not be moved).

4.14.3 Safe distances will be based on the evacuation distances provided in DOT's Emergency Response Guidebook (most current edition).

4.14.4 When multiple cylinders containing different substances are present, the distance should be based on the greatest evacuation distance required by the substances present.

### 4.15 Cylinder Disposition Operations

4.15.1 Disposition refers to the recycling, treatment, or disposal of a compressed gas cylinder and/or its contents.

4.15.2 Recovery and recycling of materials are preferred over any other method of disposition. Cylinder disposition activities shall be approved by the Regional SH&E Manager.

4.15.3 An effort should be made to recover and recycle the contents of a cylinder; however, if recovering or recycling the contents is not possible, then other options include:

- Venting to the Atmosphere
- Flaring
- Neutralization
- Detonation

4.15.4 Under no circumstances will poisonous, toxic, or ozone-depleting substances be vented to the atmosphere. Only cylinders containing flammable gases should be detonated, as the flammable contents will be consumed in the subsequent explosion.

4.15.5 If the cylinder valve has been determined to be inoperable, then the available options for disposition are limited to having an outside vendor perform the remote opening and sampling of the cylinder, or detonation of the cylinder where the cylinder contents are consumed in the subsequent explosion (flammable gases only).

### 4.16 Venting to the Atmosphere

4.16.1 Cylinders that contain non-flammable, non-toxic materials can be vented to the atmosphere. All venting activities will be performed in accordance with the following procedures:

- Atmospheric venting will be accomplished at a remote location and in compliance with all applicable environmental air regulatory requirements.
- Atmospheric venting activities will be completed in a Level B Ensemble (unless otherwise specified in the site-specific HASP and cylinder plan).
- Venting activities will be dependent upon a wind direction that does not carry the outgas plume in the direction of an adjacent public structure.
- The cylinder will be properly grounded to confirm a static charge is not generated, potentially resulting in ignition of a flammable gas.
- All tools used on the cylinder will be non-sparking.
- Low-pressure discharging will not exceed 15 pounds per square inch gauge (psig).

- Once discharging has started, all workers will retreat to the exclusion zone (minimum 100 feet) around the remote location until the discharging process is complete.

## 4.17 Flaring

4.17.1 Flaring activities involve the combustion of the cylinder contents through the discharge of a low-intensity flame. Flaring activities will be performed in accordance with the following procedures:

- Flaring will be accomplished at a remote location and in compliance with all applicable environmental air regulatory requirements.
- Flaring activities will be completed in a Level B Ensemble (in addition, the flaring team members will don Nomex fire-retardant forearm-length gloves and other fire-retardant clothing as specified in the site-specific cylinder plan).
- Flaring activities will be dependent upon a wind direction that does not carry the combustion plume in the direction of any offsite structure or activity, or into uncontrolled (public access) areas.
- The cylinder will be properly grounded to confirm a static charge is not generated, potentially resulting in ignition of a flammable gas.
- All tools used on the cylinder will be non-sparking.
- Low-pressure discharging will not exceed 15 pounds per square inch gauge (psig).
- A hot work permit shall be completed prior to the start of flaring activities (See *S3NA-418-PR Welding, Cutting, and Other Hot Work*).
- No other cylinders will be within 35 feet of the cylinder being flared.
- Flaring activities will use a low-pressure discharge and maintain a small, low-intensity flame.
- A firewatch will be established, with a worker stationed outside the exclusion zone with a fire extinguisher (20A:100B:C) during flaring activities (i.e., fire watch). During the work the worker assigned to the firewatch will have no other duties.
- The flare will be positioned so that it is not pointing toward any flammable materials, personnel, or equipment in the immediate area.

## 4.18 Neutralization

4.18.1 Neutralization refers to the on-site neutralization of the cylinder contents through a controlled chemical reaction process. Specialized equipment may be necessary based on the chemical involved, as well as reaction by-products, catalysts, or physical conditions (i.e., temperature, acidic, basic, etc.). Neutralization activities will be performed in accordance with the following procedures:

- Neutralization is the required disposition method for cylinders containing acid gases, as well as many alkaline gases.
- The neutralization process shall be approved by a professional engineer (e.g., chemical) or based on a published chemical-specific neutralization methodology.
- Liquid levels in the reaction vessels will be maintained at least 12 inches below the top of the vessel.
- Based on the specific chemical reaction, the temperature of the reaction vessel and its contents will be monitored continuously and controlled accordingly.
- Pressure levels will be maintained within acceptable limits to prevent the reaction from accelerating, unwanted by-product formation, or the break-through of the chemical intended to be neutralized.
- Personnel will wear the PPE identified within the site-specific HASP and cylinder plan.

## 4.19 Detonation

4.19.1 Detonation refers to the use of explosives to open and subsequently consume the contents of the cylinder by the heat generated during the explosion. Detonation activities will be performed in accordance with the following procedures:

4.19.2 A detonation plan shall be submitted to and approved by the Regional SH&E Manager prior to the commencement of cylinder detonation activities.

4.19.3 The detonation of compressed gas cylinders will be completed under the guidance of experienced ordnance and explosives (OE) professional who is licensed in the use of explosives (see *S3NA-514-PR OE and UXO Operations*).

4.19.4 A sufficient amount of explosives will be used to consume the entire contents of the cylinder (flammable gases only).

4.19.5 A blast pit will be excavated where all detonations will take place.

4.19.6 The OE professional will determine the blast hazard zone/potential debris impact zone, and this area will be evacuated prior to the detonation.

4.19.7 The OE professional will sound a warning signal (e.g., horn or equivalent) three times to indicate that a detonation is imminent and confirm all personnel have evacuated the blast hazard zone prior to detonation.

4.19.8 Personnel will be on standby outside the blast hazard zone with fire extinguishers (minimum rating of 20A:100B:C).

## 4.20 Cylinder Decommissioning Operations

4.20.1 Decommissioning refers to the removal of a compressed gas cylinder from service by rendering it permanently unusable.

4.20.2 Prior to decommissioning, cylinder contents will be verified, removed from the cylinder, and the cylinder purged with an inert gas (e.g., nitrogen, carbon dioxide, etc.).

4.20.3 All identifying marks or decals will be removed from the cylinder.

4.20.4 The Regional SH&E Manager shall be contacted prior to the decommissioning of compressed gas cylinders that contain or previously contained:

- Ethylene oxide
- Arsine
- Diborane
- Hydrogen selenide
- Cyanogen chloride
- Amines
- Hydrogen sulfide
- Acetylene
- Methyl mercaptan

4.20.5 Additional safety precautions may be necessary due to highly reactive residues left behind by these substances.

4.20.6 The recommended methods of decommissioning include:

- Burning/torch-cutting an elongated hole into the side of the cylinder (S3NA-418-PR Welding, Cutting and Other Hot Work)
- Torch-cutting the cylinder in half (See S3NA-418-PR Welding, Cutting and Other Hot Work)
- Crushing the cylinder

## 4.21 General Use of Compressed Air or Gas

4.21.1 Compressed air or other compressed gases are not to be used to blow dirt, chips, or dust from clothing while it is being worn. Compressed air used for other types of cleaning (other than clothing/personnel) is to be limited to 30 psig.

4.21.2 The use of blown compressed air is to be controlled, and proper personal protective equipment or safeguards utilized, to protect against the possibility of eye injury to the operator or other persons.

4.21.3 Compressed air or gases are not to be used to empty containers of liquids.

4.21.4 Compressed gases are not to be used to elevate or otherwise transfer any hazardous substance from one container to another unless the containers are designed to withstand the operating gas pressure with a safety factor of at least four.

### 4.22 Personal Protective Equipment (*S3NA-208-PR-Personal Protective Equipment Program*)

4.22.1 The inspection of cylinders containing unknown substances will be performed in a Level A (PPE) ensemble as a minimum, while cylinders containing known substances, and in good condition, will be inspected in an appropriate ensemble designated within the site-specific Health and Safety Plan (HASP).

4.22.2 Where the use of a Level A or B ensemble is anticipated, the SH&E Department shall be contacted during the pre-task planning to determine the appropriate Level ensemble components, and personnel involved in the activity. <u>The use of a Level A PPE ensembles are required to be approved by the Regional SH&E Manager.</u>

4.22.3 PPE includes, but is not limited to:

4.22.3.1 Eye and face protection

4.22.3.2 Steel toed work boots

4.22.3.3 Hearing protection

4.22.3.4 Gloves

4.22.3.5 Respiratory equipment, as required

### 4.23 Training

4.23.1 On-site orientation to the use and hazards of the equipment shall be completed for all staff handling or coming into contact with compressed air tools and equipment or compressed gas cylinders.

## 5.0 Records

5.1 None

## 6.0 References

6.1 29 CFR 1910.101 Handling of Compressed Gas Cylinders

6.2 Compressed Gas Association Pamphlet P-1-1965

6.3 S3NA-506-FM Cylinder Inspection

6.4 S3NA-418-PR Welding, Cutting, and Other Hot Work

6.5 DOT’s Emergency Response Guidebook

6.6 S3NA-208-PR-Personal Protective Equipment Program

# S3NA-506-FM Cylinder Inspection

| | | | |
|---|---|---|---|
| **Basic Cylinder Information** | | | |
| Serial Number: | Cylinder Size: | | |
| Pressure Rating: | Current Pressure: | | |
| Vendor/Owner: | Contents: | | |
| Date of Receipt: | Date of Inspection: | | |
| Inspected by (*Name*): | | | |

| **Condition** | **Yes** | **No** |
|---|---|---|
| DOT container specification number present on cylinder? | | |
| Proper DOT shipping name, ID # and hazard class on cylinder? | | |
| Manufacturer's name and appropriate hazard warnings present? | | |
| Serial number of cylinder and inspectors official mark present? | | |
| Most recent hydrostatic test date marked and within 5 years? | | |
| Cylinder valve and neck ring free of oil, grease or other foreign matter? | | |
| Valve threads clean and in good condition? | | |
| Pressure rating of cylinder not exceeded? | | |
| Cylinder surface is free of cracks, and dents, gouges, weld defects, etc.? | | |
| Cylinder surface is free of arc burns and fire burns? | | |
| Cylinder cap is present and threaded in place? | | |
| Cylinder surface, particularly bottom, is free of excessive corrosion, and pitting? | | |

This checklist will be used by employees who accept the delivery of compressed gas cylinders at an office, laboratory, or project location to document the condition of the cylinder upon receipt. In offices where cylinders are stored, used or shipped to project locations on a regular basis, the qualified person designated to oversee cylinder operations will use this checklist to perform routine cylinder inspections and create a historical file on the condition of each cylinder.

# S3NA-506-ST Compressed Gases

| Jurisdiction | Regulation |
|---|---|
| **United States** | |
| **OSHA** | 49 CFR (Transportation), Parts 100-185 Hazardous Materials Regulations |
| | 29 CFR 1910 (General Industry) Subpart H Hazardous Materials |
| | 29 CFR 1926 (Construction) Subpart J .350 Gas Welding and Cutting |
| **DOT** | Emergency Response Guidebook (latest edition) |
| **Compressed Gas Association, Inc. (CGA)** | CGA Guidelines and CGA Handbook of Compressed Gases (latest editions) |
| **Canada** | |
| **Alberta** | OHS Code (2009) Sect 171 |
| **British Columbia** | OHS Regulation (1997) Sect 4.41 |
| **Manitoba** | Workplace Health and Safety Regulation (217/2006) Sect 27.1 – 27.3 |
| **New Brunswick** | OHS Regulation (91-191) Sect 74 – 79 |
| **Newfoundland/Labrador** | OHS Regulation (C.N.L.R. 1165/96) Sect 75 |
| **Nova Scotia** | OHS Regulation (N.S. Reg. 44/99) Sect 45 – 49 |
| **NWT/NU Territories** | General Safety Regulations (R.R.N.W.T. 1990, c. S-1), Safety Act (SI-013-92) Sect 155 – 162 |
| **Ontario** | O. Reg. 213/91 Sect 6, 42<br>O. Reg. 851 Sect 49 |
| **Prince Edward Island** | OHS Regulations (EC180/87) Sect 37.18 – 37.23 |
| **Quebec** | OHS Regulation (R.R.Q., c. S-2.1, r.19.01 O.C. 885-2001) Sect 77, 78, 325 – 328<br>Safety Code for the Construction Industry (R.R.Q. 1981, c. S-2.1, r. 6) Sect 3.13.4 – 3.13.10 |
| **Saskatchewan** | OHS Regulation (R.R.S., c. O-1, r. 1) Sect 371, 372 |
| **Yukon Territory** | OHS Regulations (O.I.C. 2006/178) Sect 4.05, 4.06, 8.20, 8.21 |

The following standards apply to compressed gas tools and equipment:

| Association | Standard |
|---|---|
| **Canadian Standards Association (CSA)** | CAN/CSA Standard-Z275.3-M86 (R2004), Occupational Safety Code for Construction Work in Compressed Air |
| **OSHA** | 29 CFR 1926 (Construction) Subpart I .300-307 Tools-Hand and Power |

# S3NA-506-WI Compressor Safety Card

## 1.0 Objective / Overview

1.1 Compressors should be used with extreme caution in order to prevent personal injury.

1.2 When using a compressor it's important to follow the manufacturer's instructions to avoid injuring someone or damaging your compressor.

1.3 Allow only trained, authorized personnel to operate the compressor. Along with training, other safety measures include: proper maintenance of equipment and personal protective equipment.

## 2.0 Safe Operating Guidelines

2.1 Follow manufactures recommended operating instructions, every compressor is not the same. Maintain adequate ventilation.

2.2 Gas and Diesel powered generators emit carbon monoxide (CO). Never operate a fuel-powered compressor in an enclosed building without proper ventilation.

2.3 Turn the compressor off to refuel. Gasoline and its vapors may ignite if they come into contact with hot components or an electrical spark, store fuel in a properly designed container in a secure location.

2.4 Operators shall perform a pre-operational check of all air hoses, couplings, and connections to determine if leakage or other damage exists. Tag unsafe equipment and take out of service immediately.

2.5 Decompress air from the compressor prior to removing any caps or air equipment attachments such as jackhammers, drills, etc.

2.6 Keep oil and flammable material clear of air fittings and joints.

2.7 Make sure connections are secure to avoid a hose coming loose during use.

2.8 To avoid a shock, make sure that your hands are dry and you're standing in a dry place whenever you operate an electrically powered compressor.

2.9 Use only UL-listed, three-prong extension cords. Be sure the extension cord is the proper size (wire-gauge) to handle the electric load that will be plugged into it.

2.10 Have a Class A:B:C fire extinguisher readily available at all times.

## 3.0 Potential Hazards

3.1 Burns from contact with the hot muffler or engine

3.2 Shocks/electrocution

3.3 Noise exposure

3.4 Inhaling exhaust gases, CO

3.5 Contact with pressurized air

## 4.0 Training Requirements

4.1 Review of Applicable SOPs.

4.2 Demonstrated knowledge on the use of the compressor.

4.3 Review of manufacturers operating guidelines.

## 5.0 Personal Protective Equipment (Level D PPE)

5.1 Leather Gloves

5.2 Hearing Protection

5.3 Long Sleeve Shirt (e.g., to shield from burns, etc.)

# S3NA-507-PR Hazardous Materials Communication / WHMIS

## 1.0 Purpose and Scope

1.1 Provides a Hazard Communication Program so that AECOM employees are informed of the hazards of the chemicals to which they may be exposed in the course of their work by way of container labeling and other forms of warning, material safety data sheets (MSDS), and employee training.

1.2 This procedure applies to all AECOM North America based employees and operations.

1.3 The program applies to the use of any hazardous substances which are known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency.

## 2.0 Terms and Definitions

Additional definitions can be found in the Hazardous Material Regulations (HMR), the Transportation of Dangerous Goods (TDG) Regulations, and the International Air Transport Association (IATA) Dangerous Goods Regulation (DGR).

2.1 **Acute Effect:** An adverse effect on the human body with immediate onset of symptoms.

2.2 **Article:** A manufactured item: (1) which is formed to a specific shape or design during manufacture; (2) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and, (3) which does not release or otherwise result in exposure to, a hazardous chemical, under normal conditions of use.

2.3 **Carcinogen:** Those chemicals appearing in any of the following reference sources are established as carcinogens for hazard communication purposes:

- National Toxicology Program (NTP) Annual Report on Carcinogens.
- International Agency for Research on Cancer (IARC) Monographs, Volumes 1-34. Note: The Registry of Toxic Effects of Chemical Substances published by NIOSH indicates whether a substance has been found by NTP or IARC to be a potential carcinogen.

2.4 **Chemical Name:** The scientific designation of a substance in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry or the system developed by the Chemical Abstracts Service.

2.5 **Chronic Effect:** An adverse effect on the human body with symptoms which develop slowly over a long period of time or which frequently recur.

2.6 **Combustible Liquid:** Any liquid having a flash point at or above 100°F (37.8°C) but below 200°F (93.3°C), except any mixture having components with flash points of 200°F (93.3°C), or higher, the total volume of which makes up 99% or more of the total volume of the mixture.

2.7 **Common Name:** Any designation or identification such as code name, code number, trade name or brand name used to identify a substance other than by its chemical name.

2.8 **Container:** Any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank or the like that contains a hazardous chemical. For purposes of this Safety Operating Procedure (SOP) and Occupational Safety and Health Administration (OSHA) standard, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle are not considered to be containers.

2.9 **Establishment:** Any separate and distinct AECOM office, laboratory or other company facility.

2.10 **Exposure:** Any situation arising from work operations where an employee may ingest, inhale, absorb through the skin or eyes or otherwise come into contact with a hazardous substance.

2.11 **Flammable:** A substance that falls into one of the following categories:

- **Flammable Aerosol**: An aerosol that when tested by the method described in 16 CFR 1500.45, yields a flame projection exceeding 18 inches at full valve opening or flashback (a flame extending back to the valve) at any degree of valve opening;
- **Flammable Gas**: A gas that at ambient temperature and pressure:
  - Forms a flammable mixture with air at a concentration of 13% of volume or less; or
  - Forms a range of flammable mixtures with air wider than 12% by volume, regardless of the lower limit.
- **Flammable Liquid**: Any liquid having a flash point below 100°F (37.8°C), except any mixture having components with flash points of 100°F (37.8°C) or higher, the total of which make up 99% or more of the total volume of the mixture.
- **Flammable Solid**: A solid, other than a blasting agent or explosive as defined in 8 CCR 5237(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change or retained heat from manufacturing or processing or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard.
  - A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

2.12 **Flash Point:** Minimum temperature of a liquid at which it gives off sufficient vapors to form an ignitable mixture with the air near the surface of the liquid or within the container used.

2.13 **Hazardous Chemical:** Those chemicals appearing in any of the following reference sources are established as hazardous chemicals for hazard communication purposes.

- 29 CFR Part 1910, Subpart Z, Toxic and Hazardous Substances, OSHA.
- Hazardous Products Act, R.C.S. 1985, c. H-3, section 2, Canada
- For operations within the state of California, the list of hazardous substances prepared by the California Director of Industrial Relations pursuant to Labor Code Section 6382. The concentrations and footnotes, which are applicable to the list, shall be understood to modify the same substance on all other source lists or hazard determinations set forth in § 8 CCR 5194(d)(3)(B) and (d)(5)(D).

2.14 **Hazardous Substance:** A hazardous chemical or carcinogen, or a product or mixture containing a hazardous chemical or carcinogen provided that:

- The hazardous chemical is 1% or more of the mixture or product or 2% if the hazardous chemical exists as an impurity in the mixture; or
- The carcinogen is 0.1%or more of the mixture or product.
- Manufacturers, importers and distributors will be relied upon to perform the appropriate hazard determination for the substances they produce or sell.

2.15 The following materials are not covered by the Hazard Communication Standard:

- Any hazardous waste as defined by the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 USC 6901 et seq.) when subject to regulations issued under that act by the Environmental Protection Agency.
- Tobacco or tobacco products
- Wood or wood products. Note: Wood dust is not exempt since the hazards of wood dust are not “self-evident” as are the hazards of wood or wood products
- Consumer products (including pens, pencils, adhesive tape) used in the work place under typical consumer usage
- Articles (i.e. plastic chairs)
- Foods, drugs, or cosmetics intended for personal consumption by employees while in the work place

- Foods, drugs, cosmetics in retail store packaged for retail sale
- Any drug in solid form used for direct administration to the patient (i.e., tablets or pills)

2.16 **Hazardous Substance Inventory (HSI) / WHMIS Log:** A listing of all chemicals stored or used at an office or project site. Note that the list may be imbedded in a project Health and Safety Plan.

2.17 **Immediate Use:** Means that the hazardous chemical will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.

2.18 **MSDS:** A Material Safety Data Sheet prepared pursuant to state and federal regulations, OSHA Form 174 and Canada regulations (Controlled Products regulations, schedule 1).

2.19 **MSDS Administrator:** The individual or group designated by the Office Manager to maintain the establishment-specific inventory list or log and the MSDS binder required if that establishment uses or stores hazardous substances.

2.20 **NFPA:** A system of categories, colors and numbers was created to provide basic hazard information. It enables firefighters and other emergency personnel to easily decide whether or not to evacuate an area or proceed with emergency control operations. The three principal categories of identification are Health, Flammability and Instability. A numerical range of “0 to 4” indicates the severity of the hazard. A “4” indicates the most severe and a “0” indicates a minimal hazard.

2.21 **Mixture:** Any solution or intimate admixture of two or more substances which do not react chemically with each other**.**

2.22 **Reactivity:** A measure of the tendency of a substance to undergo chemical reaction with the release of energy.

2.23 **Solubility:** The ability of substance to blend and mix uniformly with another.

2.24 **Specific Gravity (density):** Ratio of the weight of a substance to the weight of the same volume of another substance. As used in this directive, specific gravity or density refers to the weight of substance as compared to the weight of an equal volume of water.

2.25 **Vapor Density:** The weight of a vapor-air mixture resulting from the vaporization of a volatile liquid at equilibrium temperature and pressure conditions, as compared with the weight of an equal volume of air under the same conditions.

2.26 **WHMIS:** The Workplace Hazardous Materials Information System (WHMIS) is Canada's national hazard communication standard. The key elements of the system are cautionary labeling of containers of WHMIS "controlled products", the provision of material safety data sheets (MSDSs) and worker education and training programs.

## 3.0 Attachments

3.1 None

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Region SH&E Managers** will:

- Audit their regional offices to assure that they maintain an establishment-specific Hazardous Substance Inventory (HSI).
- Audit their regional offices to assure that if an establishment-specific HSI is required, that MSDSs are available for each substance listed on the HSI.
- Provide interpretation of MSDSs and hazard information for WHMIS labels/NFPA labels and other information to assist in training employees.
- Provide hazard communication training to AECOM employees and file documents of this training in the Corporate SH&E office.

- Review MSDS for adequacy of completion to meet the OSHA and Canadian standard and returning them to supplier, if necessary.

4.1.2 **Office Managers** will:

- Have an operations-specific, written hazard communication program which at least describes how the requirements of this Procedure and the US OSHA and Canadian Hazard Communication requirements for labels and other forms of warning, material safety data sheets, and employee information and training will be met.
- Appoint an MSDS administrator for their establishment if they store or use hazardous substances.
- Confirm, if required, that the MSDS Administrator maintains an HSI for their establishment.
- Confirm that MSDS are available for all substances listed on their establishment's HSI.
- Confirm that a copy of this Procedure and the site-specific MSDS are available to all employees. Employees shall be instructed in the location of this Procedure and the MSDS.
- Confirm that all employees in their office affected by the HAZCOM standard are provided with the appropriate training, including new employees.

4.1.3 **Project Managers (field task managers, supervisors)** will:

- Confirm that all employees under their supervision have received the initial and periodic training required by this SOP prior to assigning employees to tasks involve the use of, or potential exposure to, hazardous substances.
- Notify employees of hazardous substances covered by this SOP that are used in their work area.
- Determine the potential fire, toxic, or reactivity hazards which are likely to be encountered in the handling or utilization of a hazardous substance and will communicate this information to their affected employees, before any are permitted to work with it.
- Confirm that an MSDS is available for each hazardous substance used, or potentially encountered, in the work areas or on the projects that are under their supervision.
- Notify subcontractors (working for AECOM) of any hazardous substances that are used or stored by AECOM to which the subcontractor's employees may be exposed.
- Notify clients or property owner/operators of chemicals brought onto their property by AECOM or AECOM's subcontractors.
- Request MSDSs from all subcontractor organization for the relevant chemicals they bring onto an AECOM controlled site.

4.1.4 **Employees** will:

- Confirm that they have received appropriate hazard communication training prior to working with materials that fall under the standard.
- Only work with materials for which they have been instructed on how to find an MSDS and how to work with that material safely.
- Provide a copy of all MSDSs received to the MSDS Administrator at their facility.
- Verify that an MSDS is available in their work area for each hazardous substance that they use.
- Confirm that containers of hazardous substances that they use are properly labelled.

4.2 All employees have a right to, and should, know the properties and potential hazards of substances to which they may be exposed.

4.3 Should AECOM assign employees that do not read and speak English to tasks with chemical exposures, communications will be provided in the language understood by that employee.

### 4.4 Hazardous Waste Exemption

4.4.1 In the U.S., hazardous wastes are excluded from the state and federal Hazard Communication standards. However, AECOM employees who handle or are otherwise exposed to hazardous wastes are covered by the requirements of the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard at 29 CFR 1910.120 – Hazardous Waste Operations And Emergency Response. This standard requires that:

- Employees receive 40-hour initial and 8-hour annual SH&E training; and that
- Information on the hazards of hazardous wastes be documented in a site-specific Health and Safety Plan (HASP) and communicated to all employees in site-specific briefing on-site training required by the standard.

4.4.2 Therefore, AECOM HAZWOPER projects are not required to comply with the requirements of this SOP as they relate to the hazardous wastes that are present at those project sites.

4.4.3 AECOM's Health And Safety Plan (HASP) requirements are specified in *S3NA-509-PR Hazardous Waste Operations and Emergency Response.*

### 4.5 Hazardous Substance Inventory

4.5.1 Establishment-Specific Hazardous Substance Inventory or WHMIS Log

- If an AECOM establishment uses or stores additional hazardous substances, an establishment-specific HSI must be maintained at that establishment.
- If it is determined that an office-specific HSI is needed, the AECOM **Office Manager** shall assure that one is developed and maintained by someone appointed as the establishment's MSDS Administrator.
- The content of the office-specific written inventory shall be updated as new hazardous substances are procured for, or removed from, the establishment and shall be verified by the **Region SH&E Manager** through regular inspections of the establishment.
- In order to meet the 30-years-after-employment-termination record retention requirement, the office-specific HSIs shall be treated as a permanent record.

### 4.6 Material Safety Data Sheets

4.6.1 Establishment-Specific MSDS Inventory

- If it is determined that an AECOM establishment is required to maintain an establishment-specific inventory ,MSDSs for the specific hazardous substances must be maintained on file at that establishment.
- The **Region SH&E Manager** shall audit the local office program for MSDS request and maintenance and report deficiencies to the appropriate management level, as necessary, to assure compliance with this SOP.

4.6.2 Field Project Sites and Client Facilities

- The **Project Manager** and/or the **Site Safety Officer** shall access or obtain, and maintain copies of MSDS from:
  - All AECOM subcontractors bringing chemicals onto the project site; and
  - The client, for all of the client's chemicals to which AECOM or AECOM subcontract employees are potentially exposed.

4.6.3 Employee Access to MSDSs

- MSDSs should be maintained at the local establishment that uses that hazardous substance. Copies of the MSDS should be made available to the employee upon request to the office's MSDS Administrator.

4.6.4 Field Access to MSDSs

- When hazardous substances are brought into the field, the user must assure that a copy of the MSDS for that substance accompanies it and is available at the field location where it is to be used.

4.6.5 MSDSs for AECOM Products

- It is unlikely that AECOM activities would create a chemical for which a new MSDS were needed. If such a chemical were created, the Corporate SH&E Department shall work with the appropriate operations groups to draft, review, and publish the new MSDS.

4.6.6 Content of the Material Safety Data Sheet

- As a minimum, the MSDS must contain the following information:
    - The name, address, and telephone number of the source of the product or material, preferably those of the manufacturer
    - The trade name and synonyms of the product or material
    - Chemical names of hazardous ingredients, including, but not limited to, those in mixtures
    - An indication of the percentage, by weight or volume, which each ingredient of a mixture bears to the whole mixture
    - Physical data pertaining to the product or material, including boiling point (in °F); vapor pressure (in mm of mercury); vapour density of gas or vapour (air = 1); solubility in water (in percent by weight); specific gravity of material (water = 1); percentage volatile by volume (at 70 °F); evaporation rate for liquids (either butyl acetate or ether may be taken as 1); and appearance and odour
    - Fire and explosion hazard data pertaining to the product or material, including flash point (in °F); flammable limits (in percent by volume in air); suitable extinguishing media or agents; special fire fighting procedures; and unusual fire and explosion hazard information
    - Health hazard data pertaining to the product or material, including exposure limits, effects of overexposure and medical conditions aggravated by exposure, and emergency and first-aid procedures
    - Reactivity data, including stability, incompatibility, hazardous decomposition products, and hazardous polymerization
    - Procedures to be followed and precautions to be taken in cleaning up and disposing of materials leaked or spilled
    - Special protection information, including use of personal protective equipment, such as respirators, eye protection, and protective clothing, and ventilation or other control measures
    - Special precautionary information about handling and strong
    - Any other general precautionary information
- MSDSs that do not contain this information shall be returned to the distributor or manufacturer to be updated.

4.6.7 Trade Secrets

- Some hazardous substance suppliers may claim the information requested on MSDSs is proprietary and not provide the information to AECOM.
- When MSDSs supplied to the AECOM Regional SH&E Manager indicate that proprietary information has been withheld, the Regional SH&E Manager will either obtain the necessary information to make a hazard assessment or reject the material for use within AECOM.

## 4.7 Labeling

4.7.1 Containers of hazardous substances used or stored in each AECOM establishment must be labeled, tagged or marked with the following information:

- Identification of the hazardous substance(s)

- Appropriate hazard warnings
- Name and address of the manufacturer, importer or other responsible parties
- Safe Handling Instructions
- Statement that an MSDS is available for the product

4.7.2 Labels on containers shall not be removed or defaced. Labels or other forms of warning shall be legible, in English and French (Canada), and prominently displayed on the container.

4.7.3 Any failure to have the appropriate labeling information on a container at any time will be cause to suspend use of the product until the container is properly labeled.

4.7.4 Carcinogen Labeling

- Chemicals which have been indicated as positive or suspect carcinogens by either OSHA, ACGIH, the International Agency for Research on Cancer (IARC) (World Health Organization), or the National Toxicology Program (NTP) will be considered to be carcinogenic for purpose of the HCS. Those chemicals identified as being “known to be carcinogenic” by NTP must have carcinogen warnings on the label and information on the MSDSs.

4.7.5 Stationary Process Containers

- If there is stationary process equipment within a work area, signs, placards, process sheets, batch tickets, operating procedures, or other such written materials may be used in lieu of fixed labels on the containers, as long as the alternative method conveys the appropriate hazard information. The written materials shall be readily accessible to the employees in the work area.

4.7.6 Portable Containers

- Portable containers of hazardous substances need not be labelled when the substance is transferred from labelled containers and is intended for immediate use of the employee who performs the transfer.
- Containers of hazardous substances transferred from labelled containers and not intended for the immediate use of the employee performing the transfer shall be labelled with the chemical name and a hazard warning label in accordance with the National Fire Protection Association’s (NFPA) 704M Hazard Identification System shall be attached.

### 4.8 Chemical Storage

4.8.1 Hazardous chemicals are to be stored in their original, labeled containers with the lids securely closed and taped if possible. Flammable and combustible materials must be stored in fire impervious cabinets in designated stockroom areas. Chemicals must be stored in compliance with instructions provided on their labels, MSDS, or the manufacturer’s specifications.

4.8.2 All hazardous chemicals must be stored in a manner that prevents spillage and leakage from exposing people or the environment to the chemical.

4.8.3 Hazardous chemicals shall not be stored with foods or beverages. Food and beverages shall not be consumed in areas where hazardous chemicals are used or stored.

### 4.9 Chemical Use in Offices

4.9.1 In general, hazardous substances should not be taken into office areas, conference rooms, or break areas. If this general requirement is infeasible, contact the SH&E Department for guidance.

4.9.2 General exceptions to this rule are the following:

- Liquid paper
- Toner
- Cleaners
- Isobutylene calibration gas
- pH calibration solutions for instruments

4.10 **Employee Information and Training**

4.10.1 Each AECOM **employee** who handles or is exposed to hazardous substances must be provided information and training on hazardous substances in their work area.

- At the time of their initial assignment
- Whenever a new hazard is introduced into their work area

4.10.2 As a minimum, the training requirements apply to AECOM personnel in the following job categories:

- All personnel who perform field work that involves the use of, or potential exposure to, hazardous substances
- Laboratory Employees

4.11 **Initial Training Content**

4.11.1 The Initial Training will provide instruction in the following:

- Methods and observations that may be used to detect the presence or release of a hazardous substance in the work area (such as personal monitoring, visual appearance or odor of hazardous substances being released, etc.);
- The physical and health hazards of substances in the work area and measures and procedures AECOM has implemented to protect employees; and
- The details of this hazard communication program (SOP), including an explanation of the labeling system and the MSDS, and how he/she can obtain and use appropriate hazard information.

4.11.2 The Initial Training will also inform the employee of the following:

- Any operations in their work area in which hazardous substances are present
- Location and availability of this written hazard communications program (SOP)
- Their right to personally receive information regarding hazardous substances to which they may be exposed
- Their right to have their physician receive information regarding hazardous substances to which they may be exposed
- Their right against discharge or other discrimination (in California) due to the employee's exercise of rights afforded pursuant to provisions of the California Hazardous Substances Information and Training Act

4.12 **Periodic Training and Training for Non-Routine Tasks**

4.12.1 Additional training will be provided to employees who have received initial training whenever:

- A new hazardous substance is introduced into their work area
- A new or revised MSDS is received, which indicates significantly increased risks to employee health as compared to those stated on the previous MSDS
- Non-routine tasks are performed, which will potentially result in exposure to hazardous substances, or exposure under circumstances, which were not addressed during initial training

4.12.2 Supervisors, in coordination with their **Region SH&E Manager**, shall provide such training through an explanation of the information on the contents of the MSDS for that substance.

4.12.3 When training their employees, supervisors shall explain:

- Any health hazards associated with use of the substance or mixture
- Proper precautions for handling
- Necessary personal protective equipment or other safety precautions to prevent or minimize exposure

- Emergency procedures for spills, fire, disposal, and first aid

4.12.4 For most projects involving field work, this periodic training requirement will be facilitated through the implementation of the site specific HASP that has been developed for the project.

### 4.13 Documentation of Initial and Periodic Training

4.13.1 All training required by this SOP shall be documented at the time it is performed by having the employee sign a copy of a training attendance sheet.

### 4.14 Chemical Usage

4.14.1 Prior to using any chemical, a Task Hazard Analysis (THA) shall be completed by the employees assigned to use the chemical. The analysis will identify the hazards associated with the tasks to be performed and prescribe the Personal Protective Equipment (PPE) to be used.

### 4.15 Office Specific Written Program

4.15.1 Each office or location using or storing hazardous materials will develop a written office/ location-specific Hazard Communication/WHMIS Program. If the local office decides to implement the requirements of the standard in any way that differs from this procedure, they shall verify the changes with the SH&E department, document the changes, and communicate the differences to all affected employees.

4.15.2 For Canadian operations, all relevant MSDS must be current (no more than 3 years old) and readily available (in French and English) for all hazardous materials.

### 4.16 Canada-specific

4.16.1 Consumer products are exempt from supplier labels and MSDS requirements. Some cleaning solvents may be packaged as consumer products and these must be labeled in accordance with the Consumer Product Act requirements.

4.16.2 In addition to the labelling of storage containers in the workplace, the contents of process piping (including valves), process vessels and reaction vessels are required to be identified through the use of colour coding, labels, placards or other modes of identifications that must be communicated to workers through training programs. It is very important for employees to be aware of and understand Client labelling requirements for these types of process systems.

## 5.0 Records

5.1 None

## 6.0 References

6.1 None

# S3NA-508-PR Hazardous Materials Handling, Shipping, and Manifesting

## 1.0 Purpose and Scope

1.1 Prescribes the minimum requirements for shipping samples, hazardous materials (HZM) and dangerous goods. It is designed to provide a framework for compliance with the requirements of the U.S. Department of Transportation (DOT) Hazardous Materials Regulations (HMR)published under 49 CFR or Transport Canada Transportation of Dangerous Goods Regulations (TDG Regulations) published under Amendment 6 (SOR/2008-34) for shipment of hazardous materials/dangerous goods by land, and the International Air Transportation Association (IATA) Dangerous Goods Regulations (DGR) for shipping dangerous goods by air.

1.2 Applies to all AECOM North America based staff and operations.

## 2.0 Terms and Definitions

A complete list of definitions can be found in their entirety in the HMR, the TDG Regulations, and the IATA DGR. The below represents those terms most likely to affect AECOM's operations.

2.1 **Agency Letter:** A letter approved by both AECOM's Legal Department and the client and that authorizes AECOM to act as its agent for the purpose of arranging for the transport and/or disposal of waste, and indeminifies AECOM's liability when acting"As an Agent of [client's name]".

2.2 **Carrier:** A person engaged in the transportation of passengers or property by land, water, or air either as a common, contract, private carrier, or civil aircraft.

2.3 **Dangerous goods:** Articles or substances which are capable of posing a risk to health, safety, property or the environment and which are shown in the list of dangerous goods in the TDG Regulations and/or IATA regulations or which are classified according to the TDG Regulations and/or IATA regulations. Generally synonymous with hazardous materials.

2.4 Delegations of Authority **(DOA):** The framework of authority within which AECOM (North America) carries out its day-to-day operations.

2.5 **Generator:** The party that created the hazardous waste; hazardous waste generators are divided into categories based on the amount of waste they produce each month.

2.6 **Hazardous materials (HzM):** A substance or material which has been determined by the U.S. Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials.

2.6.1 Hazardous materials may include, but are not limited to: batteries, adhesives, paints, compressed gases, nuclear density meters, laboratory reagents, field samples, soil and sand siftings, hazardous wastes, and materials used for bench scale and pilot plant operations. While most environmental samples (both water and soil) do not meet the definition of hazardous material, extreme care must be taken to properly classify materials. HzM Classifications are as follows:

- Class 1 Explosives
- Class 2 Gases
- Class 3 Flammable Liquid
- Class 4 Flammable Solid, Spontaneously Combustible, and Dangerous When Wet
- Class 5 Oxidizer, Organic Peroxide
- Class 6 Poison (Toxic), Poison Inhalation Hazard, Infectious Substance
- Class 7 Radioactive

- Class 8 Corrosive
- Class 9 Miscellaneous Hazardous Material

2.7 **Hazardous Waste (HzW):** A “solid waste” which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (1) Pose a substantial present or potential hazard to human health or the environment when impropoerly treated, stored or disposed of, or otherwise mismanaged; or (2) cause or contribute to an increase in mortality, or an increase in irreversible or incapacitating illness. Four types of hazardous waste exists:

- Listed Waste: Wastes that USEPA has determined are hazardous. The lists include the F-list (waste from common manufacturing and industrial processes), K-list (wastes from specific industries), and P- and U-lists (wastes from commercial chemical products).
- Characterized Wastes: Wastes that do not meet any of the listings above but that exhibit ignitability, corrosivity, reactivity, or toxicity.
- Universal Wastes: Batteries, pesticides, mercury-containing equipment and lamps.
- Mixed Wastes: Waste that contains both radioactive and hazardous waste components.

2.8 **Hazardous Waste Manifest System:** A set of forms, reports, and procedures designed to seamlessly track hazardous waste from the time it leaves the generator facility where it was produced, until it reaches the off-site waste management facility that will store, treat, or dispose of the hazardous waste.

2.9 **HzM employee:** A person who is employed by AECOM who in the course of employment directly affects dangerous goods/hazardous materials transportation safety. This term includes employees who prepare hazardous materials for transportation, or are responsible for safety of transporting hazardous materials.

2.10 **HzM employer:** A person who uses one or more of its employees in connection with transporting dangerous goods/hazardous materials in commerce, causing hazardous materials to be transported or shipping in commerce.

2.11 **HMR:** Hazardous Material Regulation

2.12 **IATA:** International Air Transport Association.

2.13 **ICAO:** International Civil Aviation Organization

2.14 **Manifest:** A paper document that contains information on the type and quantity of the waste being transported, instructions for handling the waste, and signature lines for all parties involved in the disposal process, which must be signed by each party that handles the waste.

2.15 **Materials of Trade (MOT) :** A hazardous material, other than a hazardous waste, that is carried on a motor vehicle:

- For the purpose of protecting the health and safety of the motor vehicle operator or passengers;
- For the purpose of supporting the operation or maintenance of a motor vehicle (including its auxiliary equipment); or
- By a private motor carrier in direct support of a principal business that is other than transportation by motor vehicle.

2.16 **NAPL:** Non-aqueous phase liquid

2.17 **Offeror:** Any person who performs functions including selecting packaging, physical transfer of hazardous materials, classifying hazardous materials, preparing shipping papers, signing hazardous material certifications on shipping papers (as agent for), marking or placarding vehicles or packagings, or providing placards to carriers.

2.18 **Reportable Quantity (RQ):** The spill- or incident-related quantity of a material listed in the applicable Federal, State, or Provinicial regulations requiring a formal report.

2.19 **Serious Hazardous Materials Incident:** Anytime a material is found outside of its containment and has the potential to harm people or the environment.

2.20 **Shipper:** see Carrier

2.21 **Transporter:** An entity that moves hazardous waste from one site to another by highway, rail, water, or air.

# 3.0 Attachments

3.1 S3NA-508-WI1 Hazardous Materials Shipping Guidelines

# 4.0 Procedure

## 4.1 General Requirements

4.1.1 Employees designated as HzM DOT Level 1 or 2 Shippers are the only individuals authorized to physically transport or prepare documents to ship HzM via a carrier.

4.1.2 Specific technical names must be used on shipping documents (i.e., Shipper's Declaration for Dangerous Goods); never use an acronym (i.e., LNAPL) as the technical name.

4.1.3 Shipments of HzM must be placed in appropriate containers to prevent any leaks or releases of the HzM.

4.1.4 All HzM shipments via a carrier must be reported to INFOTRAC prior to shipment.

4.1.5 AECOM staff are not authorized to physically transport HzM quanitities, in a motor vehicle, in excess of the MOT limits.

4.1.6 AECOM staff are only authorized to sign a client's Hazardous Waste Manifest if:

- The necessary approvals have been obtained per the DOA (North America);
- The client could not logistically sign the manifest given they were not on the site;
- An Agency Letter was signed by the client and approved by the Legal Department; and
- AECOM staff completed the required training.

4.1.7 AECOM will never be identified as the GENERATOR on a client's Hazardous Waste Manifest.

4.1.8 Never sign a client's Hazardous Waste Manifest as AECOM, sign "As an Agent of [client name]".

## 4.2 Roles and Responsibilities

4.2.1 **Project Managers** will be responsible for the following:

- Verifying the potential to ship HzM via a carrier during the planned scope of services and if confirmed, identify the appropriately trained individuals are available to support the HzM shipment.
- Prior to authorizing an AECOM employee to sign a client's Hazardous Waste Manifest, the Project Manager will:
  - Verify with the Office of Risk Management that the necessary DOA approvals are in-place;
  - Obtain an Agency Letter approved by both the client and AECOM's Legal Department.
- Prior to assignment, confirm that employees are properly trained to perform their job-specific assignments.
- Filing copies of all HzM shipping documents in the project files.
- Providing for the appropriate storage of the HzM in the office or other necessary location.

4.2.2 **Supervisors** will be responsible for the following:

- Verifying that the HzM to-be shipped is prepared/packaged by the designated DOT Level 1 or 2 Shipper.
- Immediately reporting any incident, spill, release, mishandling, mislabelling, etc. related to a HzM shipment to AECOM's Incident Reporting Line.

4.2.3 **Employees** will be responsible for the following:

- Shipping or transporting HzM as authorized.
- Signing a client's Hazardous Waste Manifest as authorized.
- Immediately reporting any incident, spill, release, mishandling, mislabelling, etc. related to a HzM shipment to the Supervisor.

4.2.4 **DOT Level 1 Shippers** will be responsible for the following:

- Identifying, with the support of a DOT Level 2 Shipper, the appropriate HzM shipping requirements (i.e., packaging, labelling, regulated status, and shipping documents).
- Preparing the necessary HzM shipping documents.
- Contacting a DOT Level 2 Shipper if uncertain of the shipping requirements.
- Maintaining the appropriate training as required by the HMR, TDG, and IATA.

4.2.5 **DOT Level 2 Shippers** will be responsible for the following:

- Serving as the HzM shipping Subject Matter Expert for the Geography, Region, or other business unit , as appropriate.
- Supporting information requests from DOT Level I Shippers.

4.2.6 **Americas SH&E Director** will be responsible for the following:

- Contracting a 24-hour emergency response service with a telephone number that will be answered by a person either with information on the hazards of the shipment or with immediate access to such a person.
- Maintaining the annual renewal of AECOM's U.S. DOT Hazardous Materials Registration.
- Posting AECOM's Hazardous Materials Registration on myAECOM.

4.2.7 **Americas SH&E Training Director** will be responsible for the following:

- Defining the training to be required of employees involved in HZM shipping and facilitate the delivery of that training.

4.2.8 **Region SH&E Managers** are responsible for the following:

- Provide resources to employees involved in shipping hazardous materials.
- Approving the designation of a DOT Level 2 Shipper.
- Supporting the delivery of HzM shipping and Hazardous Waste Manifest training.

4.2.9 **Region Counsel** will be responsible for the following:

- Reviewing and approving the Agency Letter authorizing AECOM to sign a client's Hazardous Waste Manifest "As an Agent of [client's name]".
- Updating the template Agency Letter to address additional liabilities, as necessary.
- Providing the template Agency Letter to Project Managers, as requested.

4.2.10 **Office of Risk Management** will be responsible for the following:

- Supporting Project Managers in understanding the applicable DOA requirements as it pertains to signing a client's Hazardous Waste Manifest "As an Agent of [client's name]".

## 4.3 Training

4.3.1 **Employees** involved in shipping hazardous materials/dangerous goods (e.g., packaging, preparing paperwork, loading and/or unloading, and transporting hazardous materials) are required to have documented training prior to shipping activities. Training requirements are based on the type of materials shipped (e.g., calibration/compressed gases, laboratory reagents, field samples, hazardous wastes, etc.) and employee responsibility.

4.3.2 **DOT Level 1 Shipper *Performance Training*:** The specific content of this 4-hour training will vary depending on the country in which you are performing work (Canada vs. US) and is focused on proper procedures for packaging, labeling and shipping HzM/HzW over land and sea. This training has a three year renewal requirement.

4.3.3 **DOT Level 2 Shipper *Performance Training*:** A comprehensive 2-day HzM shipping training course typically completed in an in-person seminar.

4.3.4 **IATA *Performance Training*:** This training supplements Level 1 training and provides additional information for the proper shipment of HzM/HzW via air transportation. This training has a two year renewal requirement.

4.3.5 **Resource Conservation and Recovery Act (RCRA) Part B Awareness Training (US Project Sites):** Applicable to employees shipping HzW, including listed wastes, from US project sites. General RCRA Awareness training can be completed through online vendors. Additional project-specific training regarding HzW generation, project site roles and responsibilities, HzW management and shipment will need to be coordinated between the Project Manager and Client. Training may also include procedures for signing waste documents, i.e. profiles and characterization forms, where permitted by client contracts. Training will be provided in accordance with Permits, Consent Orders or other Regulatory Agency-issued agreements regarding project site HzW generation. This training has an annual renewal requirement.

## 5.0 Records

5.1 Bill of Lading

5.2 Shipper's Declaration for Dangerous Goods

5.3 Agency Letter

5.4 Hazardous Waste Manifest

## 6.0 References

6.1 None

# S3NA-508-WI1 Hazardous Materials Shipping Guidelines

## 1.0 Purpose and Scope

1.1 The following information outlines the generally accepted guidelines for preparing a HzM or Dangerous Goods package for shipment in compliance with the requirements of the U.S. Department of Transportation (DOT) Hazardous Materials Regulations (HMR)published under 49 CFR or Transport Canada Transportation of Dangerous Goods Regulations (TDG Regulations) published under Amendment 6 (SOR/2008-34) for shipment of hazardous materials/dangerous goods by land, and the International Air Transportation Association (IATA) Dangerous Goods Regulations (DGR) for shipping dangerous goods by air. However, this information is not implied or to be construed as a replacement for the regulatory requirements, rather this information is intended to help an individual better understand the necessary steps and formulate questions surrounding the shipment of HzM and/or Dangerous Goods.

### 1.2 Shipping

1.2.1 Select the best way to ship the hazardous material based on the quantity, hazard(s), and mode of transportation (e.g., air, land, water). Since more restrictive requirements apply to air shipments, ground shipment (e.g., use of a lab courier service) is encouraged for shipping HzM.

1.2.2 Most (if not all) package shipments (Common Carriers such as Federal Express, UPS, etc.) are transported by air. Air transportation of hazardous materials is regulated by IATA. AECOM will occasionally ship HzM internationally (e.g., Puerto Rico is considered an international destination by Federal Express). AECOM **employees** must follow the IATA DGR for any air transportation of hazardous materials.

### 1.3 Ground transportation of HzM may use either HMR or TDG Regulations protocols

1.3.1 Specific packaging and shipping instructions apply to all dangerous goods shipments. These instructions vary by chemical/product and are different for passenger aircraft and cargo aircraft.

1.3.2 Carrier-specific requirements can be obtained from the Internet or by calling the carrier’s customer service line.

1.3.3 The process for offering HzM for shipment includes:

- Determine the proper shipping name, hazard class, labeling requirements, and packing group.
- Determine and comply with the proper packaging instructions.
- Choose the proper package based on the packaging instruction and the type and quantity of material being shipped.
- Ensure package contents are compatible.
- Package, mark and label according to applicable regulations and instructions.
- Prepare shipping papers and complete the bill of lading or shipper’s declaration for dangerous goods, according to applicable regulations and according to the carrier’s specific requirements.
- Include on the shipping documents the shipper’s certification, emergency response information and telephone number.
- Include with the shipment a copy of the applicable emergency response information with shipping papers for responders to use in emergency situations. This information includes, but is not limited to, appropriate pages from the DOT Emergency Response Guidebook (ERG) and/or Material Safety Data Sheets (MSDS).

1.3.4 AECOM personnel participating in shipping HzM are required to provide a 24-hour emergency response telephone number that must be answered by a person either with information on the hazards of the shipment or with immediate access to such a person. AECOM has selected INFOTRAC® (http://www.infotrac.net/) to provide 24-hour emergency response support service. All HzM shipping papers which list INFOTRAC® for 24-hour emergency response must list AECOM's account number **74984**.

1.3.5 Determine the placard or placards required for the materials being offered for transportation, provide placards and affix as required.

1.3.6 Notify the carrier of the proper shipping name, hazard class and total quantity of each hazardous material being offered for transportation, and make a final check for compliance with regulations and instructions before tendering the shipment to the carrier. All HzM shipping papers and dangerous goods airbills must be typed.

# S3NA-509-PR Hazardous Waste Operations and Emergency Response Activities

## 1.0 Purpose and Scope

1.1 Provides requirements for AECOM operations pertaining to hazardous waste and emergency response (HAZWOPER) services.

1.2 This procedure applies to all AECOM North America-based employees and operations.

1.3 In Canada there is no direct federal or provincial counterpart to HAZWOPER; however, as due diligence and in compliance with applicable provincial duty of care/general duty clauses, staff working in Canada will comply with this procedure.

## 2.0 Terms and Definitions

2.1 **Emergency Response**: A response effort by employees from outside the immediate release area or by other designated responders (i.e., mutual-aid groups, local fire departments, etc.) to an occurrence that results, or is likely to result, in an uncontrollable release of a hazardous substance. Responses to incidental release of hazardous substances where the substance can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area or by maintenance personnel are not considered to be emergency responses within the scope of the HAZWOPER standard. Responses to releases of hazardous substances where there is no potential safety or health hazard are not considered to be emergency responses.

2.2 **Health and Safety Plan**: A document prepared for each project that contains site-specific information including the Emergency Response Plan for the project.

2.3 **Incident Command System (ICS)**: ICS is a standardized on-scene incident management concept designed specifically to allow responders to adopt an integrated organizational structure equal to the complexity and demands of any single incident or multiple incidents without being hindered by jurisdictional boundaries. In the ICS the first person responding to an incident becomes the Incident Commander and turns that title and duties over to more qualified responders as they arrive on scene.

2.4 **First Responder**: First responders are individuals who are likely to witness or discover a hazardous substance release, injury, fire, or other incident and who have been trained to initiate an emergency response sequence by notifying the proper authorities of the release. They would take no further action beyond first aid, initial control of the incident, and notifying the authorities and others of the incident.

2.5 **Hazardous Materials Specialist**: Hazardous materials specialists are individuals who respond with and provide support to hazardous materials technicians. Their duties parallel those of the hazardous materials technician; however, those duties require a more directed or specific knowledge of the various substances they may be called upon to contain. The hazardous materials specialist would also act as the site liaison with federal, state, local, and other government authorities in regards to site activities.

2.6 **Hazardous Materials Technician**: Hazardous materials technicians are individuals who respond to releases or potential releases for the purpose of stopping the release. They assume a more aggressive role than a first responder in that they will approach the point of release in order to plug, patch, or otherwise stop the release of a hazardous substance.

2.7 **Incident Commander**: The Incident Commander (IC) is responsible for all aspects of the response, including developing incident objectives and managing all incident operations. The title and responsibilities are typically assumed by a qualified IC from the client or public sector.

2.8 **Hazardous Waste**: Hazardous waste is waste that is dangerous or potentially harmful to our health or the environment. Hazardous wastes can be liquids, solids, gases, or sludges. They can be discarded commercial products, like cleaning fluids or pesticides, or the byproducts of manufacturing processes. Hazardous waste are divided into

2.8.1 Listed wastes (http://www.epa.gov/osw/hazard/wastetypes/listed.htm),

2.8.2 Characteristic wastes (http://www.epa.gov/osw/hazard/wastetypes/characteristic.htm),

2.8.3 Universal wastes (http://www.epa.gov/osw/hazard/wastetypes/universal/index.htmwastes), and

2.8.4 Mixed wastes

2.8.5 Specific procedures determine how waste is identified (http://www.epa.gov/osw/hazard/wastetypes/wasteid/index.htm), classified, listed, and delisted.

2.9 **Hazardous Materials:** A hazardous material is any item or agent (biological, chemical, physical) that has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors. Additionally a hazardous material may be defined as any substance or chemical which is a "health hazard" or "physical hazard," including chemicals that are carcinogens, toxic agents, irritants, corrosives, sensitizers; agents that act on the hematopoietic system; agents that damage the lungs, skin, eyes, or mucous membranes; chemicals that are combustible, explosive, flammable, oxidizers, pyrophorics, unstable-reactive, or water-reactive; and chemicals that in the course of normal handling, use, or storage may produce or release dusts, gases, fumes, vapors, mists, or smoke that may have any of the previously mentioned characteristics. This may be caused when released by spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, disposing into the environment, by being transported or moved, and items or chemicals that are "special nuclear source" or byproduct materials or radioactive substances.

## 3.0 Attachments

3.1 S3NA-509-FM1 Direct Reading Instrument Monitoring Log

3.2 S3NA-509-FM2 Instrument Calibration Log

3.3 S3NA-509-FM3 Personal Sampling Data Sheet

3.4 S3NA-509-FM4 Emergency Information and Hazard Assessment

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Region Operations Managers** and **District Managers** shall be responsible for the following:

- Provide support to the implementation of Health and Safety Plans and Emergency Action Plans.

4.1.2 **Project managers** shall be responsible for the following:

- Prepare or request a HASP for every AECOM project.
- Verify that all personnel working on the project are qualified.
- Request client's emergency response procedures.
- Appoint a **Site Safety Officer (SSO)** for each project.
- Communicate the site-specific emergency response details to all employees assigned to a field project.
- Confirm that the necessary communications equipment for the project is available.
- Confirm that an accident/incident investigation is performed and a report is filed.

4.1.3 **Region SH&E Managers** shall be responsible for the following:

- Provide technical guidance for the development and implementation of Health and Safety Plans and Emergency Action Plans.
- Prepare emergency action plans as part of project HASPs and emergency reference sheets.
- Interface with the local emergency responders when necessary.
- Interface with clients regarding facility emergency response procedures.

4.1.4 **Site Safety Officer** is responsible for the following:

- Verify that a HASP is available for the project.
- Communicate the site-specific emergency response details to all **employees** assigned to a field project.
- Stop work and initiate emergency response procedures as required.
- Account for all AECOM and subcontractor employees after site evacuation.
- Conduct pre-entry briefing and daily tailgate meetings and review facility and site-specific emergency procedures.
- Brief on-site and off-site responders in the event of an emergency.

4.1.5 **Employees**

- Maintain HAZWOPER training.
- Follow the HASP and emergency procedures prepared for the project.
- Initiate emergency response via verbal communications or the alarm system if first to encounter the emergency.

4.1.6 All personnel (e.g., AECOM **employees**, general laborers, equipment operators, chemists, supervisors, etc.) performing activities at hazardous waste sites that expose or potentially expose them to hazardous wastes and health hazards are considered HAZWOPER site workers and must meet the training and medical surveillance requirements specified in 29 CFR 1910.120(e) and (f), respectively. Additional training may be required based on site activities including related exposures and risks (e.g., confined space entry, excavations, fall protection, other materials [lead], etc.). These additional training requirements are to be outlined in the project- or site-specific health and safety plan (HASP).

## 4.2 Personnel Qualifications—Medical Surveillance and Training

4.2.1 HAZWOPER-qualified employees will participate in the following medical surveillance and training requirements.

4.2.2 Medical Surveillance

- Specific HAZWOPER medical examination protocols have been developed by **AECOM's Corporate Medical Provider (CMP)** to meet the requirements of 29 CFR 1910.120(f). To be medically qualified to perform HAZWOPER work, **employees** receive the following medical examinations:
    - Initial (Baseline) Examination—The initial examination is part of pre-employment requirements and must be completed (with results received) prior to the employee's start of work date.
    - Annual Examination—HAZWOPER-qualified **employees** will complete a medical examination once each year. Medical qualification expires on the anniversary date of the last examination completed. There will be no "grace period" exemptions beyond this date without the express approval of the **Region SH&E Manager**. At the recommendation of the **SH&E Department**, the **CMP** may approve an alternate examination frequency at periods of up to two years (biennial) in cases in which the worker's exposures to environmental contaminants are infrequent and typically well below any occupational exposure limits (e.g., senior management personnel).
    - Termination Examination—When reassigned to non-HAZWOPER duties, or at the conclusion of employment at AECOM, HAZWOPER-qualified personnel will be provided with the opportunity to receive a termination medical examination.
    - Special Examinations—The SH&E Department and the CMP will jointly determine the need for special examinations because of
        - Unusual exposure conditions.
        - In response to possible overexposures.
- The **CMP** will determine the medical protocol elements for each of these examinations based on exposure information provided by the **SH&E Department**. The **CMP** will evaluate the results of each employee's examination and will provide a written statement of medical clearance

clearly stating medical compliance with the HAZWOPER regulatory standard (29 CFR 1910.120(f)) and approval of the employee to perform unrestricted HAZWOPER activities. for initial and annual examinations, the **CMP** will also evaluate the **employee** for the use of air purifying and supplied air respiratory protection. The written evaluation from these examinations will indicate the **CMP's** approval/limitations on the employee's use of respiratory protection.

4.2.3 AECOM Training

- All personnel assigned to work at a hazardous waste site must participate in training meeting the requirements of 29 CFR 1910.120(e).
- Initial 40-Hour Training—Before being assigned to a HAZWOPER site, AECOM employees must complete 40 hours of off-site training meeting the requirements of 29 CFR 1910.120(e)(3)(i). At the conclusion of training, personnel will receive a written certification of course completion, signed by the instructor, that indicates the course of instruction (40-hour HAZWOPER) and training dates. A copy of this certification must be provided to the employee's SH&E Coordinator. **Employees** are responsible for maintaining their own copy of this certificate and for presenting it to the site supervisor when working on any HAZWOPER site.
- In addition to the initial 40-hour training, the **employee** must receive three days of actual supervision by a trained experienced supervisor.
  - Available Training Sources:
    - On-site training provided by the SH&E Department.
    - Outsourced training providers approved by the SH&E Department.
- Refresher 8-Hour Training—To remain qualified to perform on-site HAZWOPER work activities, each AECOM **employee** will complete 8 hours of HAZWOPER refresher training meeting the requirements of 29 CFR 1910.120(e)(8) at yearly intervals following completion of Initial 40-hour training. At the conclusion of training, personnel will receive a written certification of course completion, signed by the instructor, that indicates the course of instruction (8-hour HAZWOPER Refresher) and the training date. A copy of this certification must be provided to the employee's SH&E Coordinator. **Employees** are responsible for maintaining their own copy of this certificate and for presenting it to the site supervisor when working on any HAZWOPER site.
  - Available Training Sources:
    - Internet-based training approved by **SH&E Department**
    - On-site training provided by the **SH&E Department**
    - Outsourced training providers approved by the **SH&E Department**
- Supervisor 8-Hour Training—Any AECOM employee acting in a management capacity for HAZWOPER activities (e.g., project management personnel, field managers/foremen, site safety officers, etc.) must complete an additional 8 hours of HAZWOPER Supervisor training meeting the requirements of 29 CFR 1910.120(e)(4). Although this training is required only once, supervisors must maintain their overall HAZWOPER qualification through annual completion of refresher training. At the conclusion of Supervisor 8-Hour Training personnel will receive a written certification of course completion, signed by the instructor, that indicates the course of instruction and the training date. A copy of this certification must be provided to the employee's SH&E coordinator. **Employees** are responsible for maintaining their own copy of this certificate and for presenting it to the senior site supervisor when working on any HAZWOPER site.
  - Available Training Sources:
    - On-site training provided by the **SH&E Department**
    - Outsourced training providers approved by the **SH&E Department**
- 24-Hour HAZWOPER Training—Site support contractors and site visitors may qualify to substitute 24-hour HAZWOPER training in place of 40-hour training, as specified in 29 CFR 1910.120(e)(3)(ii). Personnel potentially qualifying for this alternative training include:
  - Site support personnel who will not work in any Exclusion Zone areas.
- Subcontractors and site visitors whose duties will not entail significant exposure to site contaminants defined as not working in any areas where airborne contaminant concentrations

exceed one-half of any applicable occupational exposure limit, and no contact or exposure to materials with site contaminant concentrations exceeding natural background levels.The **Region SH&E Manager** or **SH&E department** designee must approve the substitution of 24-hour training for initial 40-hour training. Persons qualifying for 24-hour training must provide written certification of course completion prior to beginning work on site. Persons completing 24-hour training must complete 8 hours of annual refresher training at the required interval to maintain eligibility for on-site work and must provide proof of this training (as necessary to demonstrate retraining) prior to beginning work on site.

4.2.4 Subcontractor Personnel

Any subcontractor organization whose employees will support AECOM operations at a HAZWOPER site will:

- Provide the **AECOM Project Manager** with a copy of their written HAZWOPER medical surveillance and training program requirements. The elements of the program(s) must be similar to those for AECOM's own program, as detailed above.
- Provide the **Project Manager** with written certification of a physician's approved medical clearance for each employee who will work on the site. Certification can be demonstrated by:
  - A copy of the physician's signed medical clearance for each **employee** (preferred), or
  - A letter identifying the medical status and clearance expiration date of every **employee**, signed by the company's safety director or an officer of the company.
  - A copy of the each employee's training certifications, which will include:
    - The initial 40-hour training certificate (24-hour training may be substituted with SH&E department approval).
    - The most current Refresher training certificate (must be current within the previous one-year period).
    - A copy of the Supervisor training certificate for each person serving in a site supervisory capacity (e.g., **field managers/foremen, site safety officers,** etc.).

## 4.3 Project SH&E Documentation—Health and Safety Plans

4.3.1 The project SH&E documentation prepared for HAZWOPER activities is referred to as a site-specific Health and Safety Plan (HASP), and must meet the requirements presented in 29 CFR 1910.120(b)(4).

4.3.2 The required plan elements include:

- A description of the work location, the site history, and a summary of any information available concerning site hazards (including both physical hazards and contamination conditions).
- A summary of the work activities to be performed under AECOM's scope of activities.
- A safety and health risk or hazard analysis for each on-site task that will be performed. Identified risks must include both chemical and physical hazards to which personnel may be exposed during the conduct of the work task.
- Protective measures for each work task to prevent or mitigate the potential hazards identified in the hazard analyses.
- Personal protective equipment (PPE) requirements for each work task.
- Frequency and types of air monitoring, personal monitoring, and environmental sampling techniques and instrumentation to be used.
- Site control measures.
- Decontamination procedures.
- An emergency response plan, *S3NA-509-FM4 Emergency Information and Hazard Assessment*, addressing actions to be taken in the event of each type of credible incident that might result during the performance of planned work activities, including minor and major injuries, and chemical release and fire. Response plans must address the means for coordinating the evacuation of all on-site personnel in the event of a catastrophic incident.

4.3.3 Responsibility for development of each AECOM HASP will be coordinated between the **Project Manager** and the **Region SH&E Manager** or **SH&E Department** designee as part of project initiation. Regardless of where the HASP is developed, it will be reviewed and approved by the **SH&E Department** prior to submission to any agency outside of AECOM.

### 4.4 Contractors and Subcontractors

4.4.1 The health and safety of any contractor's or subcontractor's employees is solely the responsibility of that contractor or subcontractor, who shall evaluate the hazards and potential hazards to their own employees and shall adhere to their own Health and Safety Plan.

4.4.2 In addition, all AECOM subcontractors' Health and Safety Plans will, at a minimum conform to the requirements of the AECOM Health and Safety Plan. The AECOM Health and Safety Plan does not, nor is it intended to, address procedures of contractors or subcontractors during their site activities.

### 4.5 Field Emergency Response Plans

4.5.1 AECOM employees are not expected to take action or to participate in rescues or responses to chemical releases beyond the initial discovery of the release and immediate mitigation actions such as closing a valve, placing absorbents, and notifying the client and or public emergency response system (911.) If AECOM employees are to participate in the response to a chemical release beyond the initial reaction, there must be a contractual provision for this response and the employees must be specifically trained for this response. This document is designed to provide guidelines on how to prepare a written plan that will ensure prompt and proper response to an emergency situation that arises during field investigations and to outline the duties of AECOM employees during a field emergency and the associated training requirements.

4.5.2 Site specific health and safety plans that are prepared to comply with the HAZWOPER standard (29 CFR 1910.120) must address emergency response. This standard specifically outlines the elements that must be contained in an emergency response plan. However, the definition of emergency response, as written in 29 CFR 1910.120, focuses on emergencies involving the uncontrolled release of hazardous substances. Under 29 CFR 1910.120, an employer can opt to evacuate employees from the danger area when such an emergency occurs. AECOM does not expect its employees to actively assist in the handling of uncontrollable chemical releases that may occur during the implementation of field programs. As such, and as provided by the HAZWOPER standard, AECOM is exempt from the emergency response plan requirements of the standard as long as it provides an emergency action plan within the HASP that complies with 29 CFR 1910.38 (a). Therefore, all emergency response plans required under 29 CFR 1910.120 will be written to comply with 29 CFR 1910.38 (a).

4.5.3 The HAZWOPER standard does not prohibit AECOM employees from performing limited response activities. AECOM employees can provide response assistance by placing absorbent pillows or vermiculite around a small, contained spill that occurs during sampling efforts. AECOM's SH&E SOP 203—*Spill Containment Program*, describes the specific procedures that AECOM will follow when responding to an incidental chemical spill.

4.5.4 Field Project Preparation

- Every HASP that is prepared by AECOM will contain an emergency response section in which the required elements of an emergency action plan will be contained. For all projects that do not require a HASP, an emergency reference sheet will be prepared; minimally, the sheet will list the telephone numbers of the local emergency responders and the local hospital and provides directions to the local hospital. When AECOM is working at an operating facility, the emergency response procedures of the facility will be appended to the HASP or the emergency reference sheet.
- There are two types of emergency situations that AECOM personnel must be prepared for and that must be addressed in the emergency action plan. These include:
  - Emergencies related to the operations of our clients at the facility where AECOM is working.
  - Emergencies related to our own on-site activities/investigations.
- AECOM employees are typically not expected to take action or participate in responses to chemical releases beyond the initial discovery of the release and immediate mitigation actions such as closing a valve, placing absorbents, and notifying the client and or public emergency response system (911.)

- AECOM **employees** are not to accept the role of Incident Commander without specific authority from the **Region SH&E Manager** and the General Operations Manager responsible for the project. Assuming the role of the Incident Commander requires training beyond the scope of this Procedure.

4.5.5 Client Facility Emergency Response Procedures

- AECOM implements field programs on active properties, including manufacturing facilities. These facilities have typically developed an emergency response plan that is specific to facility-related emergencies. If AECOM is working at an operating facility, emergency procedures established by the facility must be followed in the event of a facility catastrophe. AECOM personnel must be aware of and familiar with the alarm signals used at the facility to alert personnel to an emergency. AECOM personnel must also know where to assemble in the event of a facility evacuation as the facility must be able to account for all personnel, including subcontractors such as AECOM in the event of an evacuation.
- The first priority in AECOM's preparation of a project emergency action plan is to ensure that the responsibilities under the client's emergency response plan are fully understood. Because of the nature of their business, many of our clients have in-house fire brigades, medical staff, and hazardous materials teams that can assist AECOM in the event of an emergency related to our field activities. In many instances, our clients prefer or require that subcontractors seek emergency assistance through their facility first before calling outside responders to the site.
- A copy of the facility's procedures must be made available to AECOM so that the information can be incorporated into the HASP or attached to the emergency reference sheet. If this information is not available to AECOM prior to arriving on site, the SSO must meet with client representatives upon arrival to the facility to review procedures in the event of an emergency related to plant operations.

4.5.6 Emergency Action Plan

- As a minimum, each emergency action plan must contain the following topics as required by 29 CFR 1910.38 (a):
  - Procedures and contact information for reporting emergencies to public service responders and on-site (client or host employer) emergency control centers.
  - Emergency escape procedures and emergency escape route assignments.
  - Procedures to be followed by employees who remain to operate critical site operations before they evacuate.
  - Procedures to account for all employees after emergency evacuation is complete.
  - Rescue and medical duties for those employees who are to perform them.
  - Preferred means of reporting fires and other emergencies.
  - PPE to protect employees from expected exposures and potential exposures during an emergency.
  - Names of persons or departments who can be contacted for further information (i.e. emergency reference sheet).
  - Availability of medical surveillance for workers who might have been exposed to chemicals, bloodborne pathogens, or other biological agents as a result of project work or emergency response.
- In addition, each plan must establish the specific alarm system that will be used on site to warn employees of an AECOM emergency. The chosen alarm signals should not conflict with alarm signals already in place at the facility.

4.5.7 Escape Routes and Procedures

- Prior to the commencement of on-site activities, the **SSO** must determine how AECOM employees will evacuate each AECOM work area of the site. Two or more routes that are separate or remote from each other for each work area must be identified. Multiple routes are necessary in case one is blocked by fire or chemical spill. These routes must not overlap because, if a common point were obstructed, all intersecting routes would be blocked.

- Prominent wind direction should also be considered when designating escape routes and assembly areas. Escape routes and assembly areas should be upwind of the site whenever possible.
- Upon arrival to the site, the **SSO** must verify that the selected routes are appropriate for evacuation. During an emergency, the quickest and most direct route should be selected. However, when working at an operating facility, the established escape routes of the facility should be used whenever possible. In the event of a facility-related emergency, all AECOM employees must meet at the facility's assembly area so that the client can verify that AECOM has evacuated the property.

4.5.8 Accounting Method for All Employees after Evacuation

- The **SSO** is responsible for determining that all AECOM employees have been successfully evacuated from the work area(s). It is the responsibility of each AECOM subcontractor to verify that all of its employees evacuated the site and to report this information to the AECOM **SSO**. All employees must meet at the designated assembly area. A headcount is an acceptable way to determine complete evacuation when the field team is of a small size. The site log-in book should be referenced when attempting to account for more than 10 people. In the event of a facility-related emergency, the **SSO** must notify facility representatives that all AECOM employees and AECOM subcontract employees have successfully evacuated the work area(s). The **SSO** must notify emergency responders if any employee is unaccounted for and where on the site they were last seen.
- In the event of a project-related emergency, the SSO will provide off-site emergency responders or on-site HAZMAT teams or fire brigades (Incident Commander) with all available knowledge about the emergency situation upon their arrival to the scene.

4.5.9 Employees Who Remain to Operate Critical Site Operations Before They Evacuate

- All equipment and operations are required to cease in accordance with the established alarm signal procedures. The only exception will be related to health and safety. The **SSO** must determine at the time of the emergency if health and safety will be jeopardized by immediate stoppage of any particular piece of equipment. If such a determination is made, personnel involved in critical operations must be minimized. Once it is determined that the operation is no longer needed or the threat to the operators is imminent, operations will cease and the operators will immediately evacuate.

4.5.10 Rescue and Medical Duties

- Only currently trained individuals will administer first aid or CPR. If the injury is life threatening, the Emergency Medical System (EMS) should be called (911). Depending on the procedures established for the project, the SSO would contact an emergency responder directly or notify the facility representatives for medical assistance. If the employee needs medical attention that can not be provided on-site, the SSO shall escort the individual to the local hospital identified on the emergency reference sheet and shall remain with the person until release or admittance is determined. The escort will relay all appropriate medical information to the Project Manager and Regional SH&E Manager.

4.5.11 Preferred Means of Reporting

- Unless facility representatives specifically indicate that they prefer AECOM personnel to notify them first of an emergency, the **SSO** will directly contact the appropriate emergency responders listed on the emergency reference sheet.

4.5.12 Alarm Signals

- An emergency communication system must be in effect at all sites. The most simple and effective emergency communication system in many situations will be direct verbal communications. However, verbal communications must be supplemented any time voices cannot be clearly perceived above ambient noise levels and any time a clear line of sight can not be easily maintained among all AECOM personnel because of distance, terrain, or other obstructions.
- Portable two-way radio communications may be used when employees must work out of the line of sight of other workers.
- When verbal communications must be supplemented, the following emergency signals shall be implemented using handheld portable air horns, whistles, or similar devices. Signals must be

capable of being perceived above ambient noise by all employees in the affected portions of the workplace.

- One Blast: General Warning—A relatively minor and localized, yet important, on-site event. An example of this type of an event would be a minor chemical spill where there is no immediate danger to life or health yet personnel working on the site should be aware of the situation so that unnecessary problems can be avoided. If one horn blast is sounded, personnel must stop all activity and equipment on-site and await further instructions from the SSO.
- Three Blasts: Medical Emergency—A medical emergency for which immediate first aid or emergency medical care is required. If three horn blasts are sounded, all first aid and/or CPR trained personnel should respond as appropriate. All other activity and equipment should stop and personnel should await further instructions from the **SSO**.
- Three Blasts Followed by One Continuous Blast: Immediate Threat to Life and Health—A situation that could present an immediate danger to life and health of personnel onsite. Examples include fires, explosions, large hazardous chemical release, severe weather-related emergencies, or security threats. If three horn blasts followed by a continuous blast are sounded, all activity and equipment must stop. All personnel must evacuate the site and meet in the designated assembly area where the **SSO** will account for all employees. The **SSO** will arrange for other emergency response actions if necessary. Information concerning the need to follow decontamination procedures during an emergency evacuation will be addressed in the emergency action plan.
- The **SSO** or his designate will acknowledge the distress signal with two short blasts on the air-horn or whistle.
- One Continuous Blast Following Any of the Above: All Clear/Return to Work—Personnel who sound the initial alarm are required to send an all clear signal when the emergency is over.

4.5.13 Emergency Reference Sheet

- An emergency reference sheet (see *S3NA-509-FM4 Emergency Information and Hazard Assessment*) must be prepared for projects not requiring a HASP. Each emergency reference sheet must list the following:
  - Emergency phone numbers for local police, fire, and ambulance service.
  - In-house facility extensions for reporting an emergency (applies to operating facilities only).
  - Phone number and address of closest hospital with an emergency room to the site.
  - Directions to the hospital from the site.
  - Map highlighting the site-to-hospital route.
  - Phone number for the Poison Control Center.
  - Names and phone numbers of AECOM representatives and facility representatives.

4.5.14 On-site and Off-site Communications

- Regardless of the size or location of AECOM's field projects, it is extremely important that both on-site and off-site communications be maintained so that in the event of an emergency employees can contact each other or place a phone call immediately with the appropriate responder(s).
- Walkie-talkies are required when members of the field team are working in separate areas of the site and verbal communications are no longer effective because of distance. A walkie-talkie must be available for each team that is working in a separate area of the site.
- When AECOM is working at an occupied facility, access to a telephone may not be a problem. When AECOM is working on abandoned properties or when there is no access to a phone, a cellular telephone must be brought to the work location.

4.5.15 Evacuation

- Although emergency evacuation procedures are included in AECOM's initial 40-hour HAZWOPER training, emergency procedures at each site will be different. Therefore, employees must be instructed about the specifics of the emergency procedures developed for the site during the site-specific pre-entry briefing that must be held daily prior to the commencement of field activities. Update training is required anytime escape routes or procedures change. An evacuation drill will be conducted for projects that are scheduled for one month or longer. Visitors and untrained employees shall not be allowed into the project area until they receive a safety briefing including evacuation alarms and procedures.

4.5.16 First Responder

- First responders shall have sufficient training or have had sufficient experience to objectively demonstrate competency in the following areas:
  - An understanding of what hazardous substances are, and the risks associated with them in an incident.
  - An understanding of the potential outcomes associated with an emergency.
  - The ability to recognize the presence of hazardous substances and physical hazards in an emergency.
  - An understanding of the role of the first responder.
  - The ability to realize the need for additional resources and to make appropriate notifications to the communication center.

4.5.17 First Responder HAZWOPER Operations Level

First responders at the operations level are individuals who respond to releases or potential releases of hazardous substances as part of the initial response to the site for the purpose of protecting nearby persons, property, or the environment from the effects of the release. They are trained to respond in a defensive fashion without actually trying to stop the release. Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures. First responders at the operational level shall have received at least eight hours of training or have had sufficient experience to objectively demonstrate competency in the following areas in addition to those listed for the awareness level and the employer shall so certify:

- Knowledge of the basic hazard and risk assessment techniques.
- Know how to select and use proper personal protective equipment provided to the first responder operational level.
- An understanding of basic hazardous materials terms.
- Know how to perform basic control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available with their unit.
- Know how to implement basic decontamination procedures.
- An understanding of the relevant standard operating procedures and termination procedures.

4.5.18 Hazardous Materials Technician

Hazardous materials technicians shall have received at least 24 hours of training equal to the first responder operations level and in addition have competency in the following areas and the employer shall so certify:

- Know how to implement the employer's emergency response plan.
- Know the classification, identification, and verification of known and unknown materials by using field survey instruments and equipment.
- Be able to function within an assigned role in the Incident Command System.
- Know how to select and use proper specialized chemical PPE provided to the hazardous materials technician.
- Understand hazard and risk assessment techniques.
- Be able to perform advance control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available with the unit.
- Understand and implement decontamination procedures.
- Understand termination procedures.
- Understand basic chemical and toxicological terminology and behavior.

4.5.19 Hazardous Materials Specialist

Hazardous materials specialists shall have received at least 24 hours of training equal to the technician level and in addition have competency in the following areas and the employer shall so certify:

- Know how to implement the local emergency response plan.
- Understand classification, identification, and verification of known and unknown materials by using advanced survey instruments and equipment.
- Know the state emergency response plan.
- Be able to select and use proper specialized chemical PPE provided to the hazardous materials specialist.
- Understand in-depth hazard and risk techniques.
- Be able to perform specialized control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available.
- Be able to determine and implement decontamination procedures.
- Have the ability to develop a site safety and control plan.
- Understand chemical, radiological, and toxicological terminology and behavior.

## 4.6 Personal Protective Equipment (PPE) Ensembles

4.6.1 Defined HAZWOPER PPE ensembles are specified for general use on all AECOM HAZWOPER operations. The project HASP may specify modifications to these requirements to meet site-specific conditions.

4.6.2 Level D Ensemble

- The Level D ensemble provides a minimal level of skin protection (primarily against physical rather than chemical hazards) and no respiratory protection. Level D PPE is the minimum work uniform which will be used on HAZWOPER sites. Its use is appropriate when there is no significant potential for encountering hazardous substances or health hazards while working in controlled work areas.
- Level D Equipment List
  - Hard hat
  - Eye protection
  - Safety-toe work boots
  - Shirts with sleeves and long pants (shorts are unacceptable for use)
  - Hearing protection (as required)

4.6.3 Modified Level D Ensemble

- The Modified Level D ensemble provides moderate skin protection against contact with hazardous substances, but no respiratory protection. Its use is appropriate where there is a moderate-to-low potential for skin contact with known hazardous substances and health hazards, but no significant inhalation hazard is anticipated. The Modified Level D ensemble will consist of the Level D ensemble, supplemented by the addition of one or more of the following items:
- Modified Level D Equipment List
  - Chemical-resistant disposable outer coveralls
  - Chemical-resistant outer gloves taped to outer coveralls[1]
  - Chemical-resistant inner gloves[1]
  - Chemical-resistant safety-toe boots (taped to outer coveralls)

4.6.4 Level C Ensemble

1 Selection of specific glove types/materials will be provided in the project HASP based on consideration of the contaminants and the physical conditions of the work.

- The Level C ensemble provides moderate skin protection against contact with hazardous substances and moderate respiratory protection. Its use is appropriate where there is the potential for skin contact with known hazardous substances and health hazards, together with a limited and well-defined potential for exposure via inhalation.
- Level C Equipment List
  - Full-face air-purifying respirator (APR) equipped with cartridge types as designated in the project HASP2
  - Chemical-resistant disposable outer coveralls
  - Chemical-resistant outer gloves taped to outer coveralls3
  - Chemical-resistant inner gloves3
  - Hard hat
  - Safety-toe boots taped to coveralls; the use of boot covers (e.g., booties) or chemical-resistant boots may be specified
  - Hearing protection (as required)

4.6.5 Level B Ensemble

- The Level B ensemble provides both the highest level of inhalation exposure protection and considerable skin contact protection. Its use is appropriate where there are significant known or suspected hazardous substances and health hazards, involving both skin and inhalation exposure (up to and including Immediately Dangerous to Life or Health [IDLH] conditions) or where adverse atmospheric conditions cannot be mitigated by use of air purifying respirators (e.g., oxygen deficient atmospheres or chemicals with poor warning properties). The use of Level B PPE requires prior approval by the Regional SH&E Manager.
- Level B Equipment List
  - Supplied air respirator (SCBA or air line system with Grade D or better breathing air)
  - Chemical-resistant disposable outer coveralls
  - Chemical-resistant outer glove taped to outer coveralls3
  - Chemical-resistant inner gloves3
  - Hard hat
  - Chemical resistant safety-toe boots taped to coveralls
  - Hearing protection (as required)

4.6.6 Level A Ensemble

- The Level A ensemble provides the highest level of both respiratory and skin protection, up to and including protection against skin contact with vapor-phase contaminants. The use of Level A PPE requires prior approval by the Americas SH&E Director.
- Specific Level A ensemble components will be determined on a case-by-case basis by the SH&E Department.

## 4.7 Employee Exposure Monitoring

4.7.1 Exposure monitoring at HAZWOPER sites will be conducted to determine explosive and oxygen levels, monitor and control employee exposures to airborne contaminants, and to determine and regulate controlled work area boundaries (e.g., support zone, contamination reduction zone, and exclusion zone) for the protection of non-HAZWOPER workers and the general public.

4.7.2 Direct Reading Exposure Monitoring Requirements

- Explosive levels, oxygen levels, and airborne contaminants present potential hazards to HAZWOPER personnel working within controlled work areas and to non-HAZWOPER workers and the general public present outside the controlled work areas. On-site exposure monitoring

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2 Selection of specific cartridges will be made by the SH&E Department (or Competent Person – Respiratory Protection as designated by the DSM) based on contaminants present. A cartridge change-out frequency will also be specified in the HASP based on the manufacturer's cartridge performance data.

3 Selection of specific glove types/materials will be provided in the project HASP based on consideration of the contaminants and the physical conditions of the work.

will be utilized to assess the magnitude of these hazards and to provide indications of any necessary control procedures to mitigate unacceptable hazards. *S3NA-509-FM1 Direct Reading Instrument Monitoring Log* will be used to record all monitoring efforts using direct reading instruments and will remain part of the project file.

- Specific exposure monitoring requirements will be established in individual HASPs and will be implemented by the project team(s) subject to the following requirements:
  - Direct reading instrumentation will be used in accordance with the following table:

| Direct Reading Instrument | Example Trade Names | Use |
|---|---|---|
| Flame Ionization Detector (FID) | OVA | Detection of select organic vapors |
| Photo ionization detector (PID) | miniRAE, Micro-TIP | Detection of select organic vapors |
| Portable gas chromatograph | OVA | Detection of select organic vapors |
| Explosive meter | MSA ALTAIR, QRAE II, BW GasAlert | Determine explosiveness (as a percent of the Lower Explosive Limit [LEL]) |
| Oxygen monitor | MSA ALTAIR, QRAE II, BW GasAlert | Determine oxygen concentration (in percent) |
| Single gas meters (mono-tox)<br>• Hydrogen sulfide<br>• Carbon monoxide<br>• Oxides of nitrogen<br>• Cyanide | | Determine airborne concentrations of selected contaminants (in parts per million) |
| Colorimetric Detector Tubes | Drager | Determine airborne concentrations of selected contaminants (in parts per million) |
| Aerosol monitor | Mini-RAM | Determine airborne particulate concentration (in milligrams per cubic meter) |

- Selected instruments will be capable of discriminating contaminant concentrations to concentrations of at least one-half of the HASP-specified exposure limit. All direct-reading instrumentation will be calibrated daily as directed by the manufacturer. S3NA-509-FM2 Instrument Calibration Log will be used to record instrument calibrations.

4.7.3 Work Area Exposure Monitoring

- Work area exposure monitoring will include breathing zone readings for the maximum exposed worker(s).
- Results will be used to determine adequacy of PPE (especially respiratory protection). Specific criteria for upgrade/downgrade will be established in the HASP.

4.7.4 Perimeter Exposure Monitoring

- Perimeter air samples will be collected when the potential exists for airborne contaminants to migrate off-site.
- Perimeter exposure monitoring will be conducted at locations downwind from the project activities at a minimum (also upwind if the potential exists for offsite contamination to migrate onto the site).
- Sample results will be recorded in a log book or on the sample log form provided in *S3NA-509-FM3 Personal Sampling Data Sheet*

- Records will indicate individual name, SSN (last 4 digits is acceptable), and job/operation at the time of sample collection.
- Samples sent out for independent laboratory analysis will follow chain of custody requirements.
- Exposure results will be posted on site and explained in a safety briefing.
- **Employees** will receive a written statement of results within 15 days of receipt from the laboratory.
- Results of all personal exposure monitoring will be provided to the **SH&E department** for inclusion in the employee medical records.

## 5.0 Records

5.1 All forms and documents generated during a HAZWOPER project will be maintained in the project file.

## 6.0 References

6.1 Federal Emergency Management Agency—FEMA: Incident Command System www.fema.gov

6.2 29 CFCR 1910.120, Hazardous Waste Operations and Emergency Response

6.3 29 CFR 1910.38, Emergency Action Plans

# S3NA-509-FM1 Direct Reading Instrument Monitoring Log

Project: Job No.:

Date: Operator:

Instrument: Calibration:
(Amt, Component, Date)

Sampling Technique:

Sample Interval:

Background Reading:

Action Level/Response:

| Time | Location | Reading (units) | Detection Limits (Scale) |
|---|---|---|---|
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# S3NA-509-FM2 Instrument Calibration Log

| Instrument Information | |
|---|---|
| Instrument Name: | Manufacturer: |
| Serial Number: | Last Service Date: |
| Parameter(s): | Calibration Gas: |
| Calibration Procedure: | |

| Daily Calibration Results | |
|---|---|
| Date: | Calibration Result: |
| Name: | Signature: |
| Notes: | |
| Date: | Calibration Result: |
| Name: | Signature: |
| Notes: | |
| Date: | Calibration Result: |
| Name: | Signature: |
| Notes: | |
| Date: | Calibration Result: |
| Name: | Signature: |
| Notes: | |

Project: Job No.:

Date: Operator:

Instrument: Calibration:

# S3NA-509-FM3 Personal Sampling Data Sheet

Client: Method:

Site Location: Job No.: Sampling Media:

| Sample ID. | Pump No. | Air Flow Calibration (L/min) | | | Start Time | Stop Time | Total Time | Volume (Liters) | Sampler's Initials | Date | Results | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Pre | Post | Average | | | Minutes | | | | Amount (mg) | Conc. ppm , $mg/m^3$ | (Location of sampling, Employee name, SSN) |
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# S3NA-509-FM4 Emergency Information and Hazard Assessment

## EMERGENCY INFORMATION AND HAZARD ASSESSMENT

### EMERGENCY REFERENCES

**Ambulance:** 911

**Fire:** 911

**Police:** 911

**Medical Services/Regional Hospital** (including a map is advisable):

**Poison Control Center:** http://www.aapcc.org/poison4.htm

**Emergency Muster Point:**

In case of a site/facility emergency, please meet at:

The escape route from the site and an emergency muster point will be determined and provided to all workers during the project mobilization.

**Client Contacts:**

Office: Cell:

**AECOM Project Representatives:**

Office: Mobile:

**AECOM Medical Records and Medical Consultant**
WorkCare
Anaheim, CA 94502
Telephone: 800-455-6155

# S3NA-510-PR Hearing Conservation Program

## 1.0 Purpose and Scope

1.1 Establishes procedures to ensure that personal noise exposure remains within acceptable limits and establishes the requirements of an acceptable hearing conservation program.

1.2 This procedure applies to all AECOM Americas-based employees and operations.

## 2.0 Terms and Definitions

2.1 **Decibel (dB):** Logarithmic unit of measurement of sound level.

2.2 **Action Level:** An eight-hour, time-weighted average of 85 decibels measured on the A-scale, slow response, or equivalently; a noise dose of 50 percent.

2.3 **Standard Threshold Shift (STS):** When one's hearing threshold has changed (relative to the baseline audiogram) an average of 10 dB or more at 2000, 3000, or 4000 Hz in either ear).

2.4 **Noise Reduction Rating (NRR):** The measure, in decibels, of how well a hearing protector reduces noise, as specified by the Environmental Protection Agency.

## 3.0 Attachments

3.1 S3NA-510-FM Site-Specific Hearing Conservation Program

3.2 S3NA-510-WI Hearing Protection Guidelines

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Region SH&E Managers** or their designate

- Provide access to initial and refresher hearing conservation training.
- Inform employees of noise monitoring results when full-shift noise exposure is at or above the action level.
- Designate areas and tasks where employees' exposure is at or above the action level.
- Conduct noise monitoring, as applicable, and support hazardous noise assessment/evaluation efforts.

4.1.2 **Project or Office Managers**

- Implement the hearing conservation program.
- Confirm that a hazardous noise assessment/evaluation has been conducted.
- Confirm that a hazardous noise assessment/evaluation is conducted when a change in equipment, procedures, or personnel may increase employee exposure to noise.
- Implement engineering controls to reduce noise levels when such measures are considered feasible and when required by regulation.
- Purchase, monitor, and replenish for employees' use a supply of hearing protection devices with a minimum Noise Reduction Rating (NRR) of 26 dBA.
- Confirm that individuals included in the program receive training and that the training meets the criteria outlined in this program.
- Investigate and implement corrective action to all reports of non-conformance with this procedure, including reports of standard threshold shifts or employees' failure to wear hearing protectors in designated areas.

4.1.3 **Supervisors**

- Maintain an awareness of the noise levels in work areas for which he/she is responsible.
- Place warning signs in areas where sound levels would require the use of hearing protectors.
- Request that a hazardous noise assessment/evaluation be conducted when a change in equipment, procedures, or personnel may increase employee exposure to noise.
- Confirm that all employees are aware of the requirements for hearing protection for any designated area or task.
- Enforce the use of hearing protection by employees in designated areas and for designated tasks.

### 4.1.4 Employees

- Comply with the requirements of the Hearing Conservation program.
- Wear hearing protection devices in designated areas or for designated tasks.
- Inspect and maintain hearing protection devices.
- Report any suspected change in noise levels of work area to supervisor.
- Report any signs or symptoms experienced that could be the result of overexposure to noise to supervisor.
- Participate in audiometric testing and hearing protection training when required.

## 4.2 Requirements

4.2.1 The requirements of this procedure apply to all locations/facilities/projects where employee noise exposure may equal or exceed 50 percent of the allowable noise dose or Permissible Exposure Limit (PEL). Table 1 provides information relative to the current PEL for noise exposure expressed as a time-weighted average.

**Table 1. Permissible Exposure Limit**

| SOUND LEVEL (dBA) | TIME (hours) |
|---|---|
| 85 | 8 |
| 90 | 4 |
| 95 | 2 |
| 100 | 1 |
| 105 | 0.5 |
| 110 | 0.25 |
| 115 | 0.125 |

4.2.2 Table 2 provides information relative to the Action Level (or 50 percent allowable noise dose) expressed as a time-weighted average. The action levels outlined in the table below and PELs described in Table 1 are calculated without regard to the protection afforded by the use of hearing protectors.

**Table 2. Action Levels for Hearing Conservation Program**

| SOUND LEVEL (dBA) | TIME (hours) |
|---|---|
| 85 | 4 |
| 90 | 2 |
| 95 | 1 |
| 100 | 0.5 |
| 105 | 0.25 |
| 110 | 0.125 |
| 115 | 0.0625 |

## 4.3 Training Program

4.3.1 All employees with potential exposure above the action levels established in Table 2 of this procedure or who otherwise utilize any type of hearing protector will participate in a hearing conservation training program.

4.3.2 The initial and subsequent annual hearing conservation training will address, at a minimum, the following topics:

- The effects of noise on hearing, recognizing hazardous noise, and symptoms of overexposure to hazardous noise.
- When and/or where hearing protectors are required to be worn.
- The purpose of hearing protectors.
- The advantages, disadvantages, and effectiveness of various types of protectors.
- Instructions on how to select, use, fit, and care for hearing protectors.
- The purpose of audiometric testing, including an explanation of the test procedures.
- Hearing Conservation Program requirements and responsibilities.

4.3.3 Hearing protection training is conducted biannually for all affected employees or more frequently for employees who do not properly use hearing protectors or otherwise fail to comply with this policy.

## 4.4 Audiometric Testing

4.4.1 All AECOM personnel with exposure greater than the action level may be enrolled in the medical surveillance program and undergo a baseline audiogram within 6 months of the first exposure. Thereafter, annual audiograms will be compared with the baseline exam.

4.4.2 Enrolled employees will receive audiograms during their exit physicals.

4.4.3 When a Standard Threshold Shift (STS), as identified by the AECOM Medical Consultant, is noted between the last valid baseline and the annual audiogram, the following steps will be taken:

- A retest will be conducted within 30 days to confirm the STS. The employee will not be exposed to workplace/hobby noise for 14 hours or will be provided with adequate hearing protection prior to testing.
- If the STS persists, ear protection will be upgraded to one with a greater NRR. The minimum NRR will be 26 dBA.
- The employee will be counselled and AECOM will obtain information regarding the employee's possible noise exposure away from the workplace or existing ear pathology.
- Qualified medical personnel will review the audiograms. This group will determine the need for a medical referral.
- The employee will be notified in writing by either the SH&E Department or the AECOM Medical Provider of the STS, within 21 days of determination, as required by regulation.
- The employee's supervisor will be notified of the shift in hearing threshold.

4.4.4 If the employee who has experienced a STS is exposed to 85 dBA for eight hours or 80 dBA for 12 hours, mandatory use of ear protection is required.

## 4.5 Monitoring of Noise Levels

4.5.1 As deemed necessary by an SH&E Professional, or a Project Safety Plan AECOM will periodically monitor personal and area noise levels using noise dosimetry and/or sound level meters.

## 4.6 Hearing Protectors

4.6.1 Selection of appropriate hearing protectors must be based on actual or anticipated exposure levels. At a minimum, hearing protectors must provide a level of protection that brings actual or anticipated exposure below the PEL established for the time period shown in the table above. Additional information relative to hearing protector use is as follows:

- Hearing protection will be mandatory for all employees exposed to 85 dBA for eight hours.

- Hearing protection will be mandatory for all employees working in any area that has not been evaluated for noise exposure and the ambient noise level in the area is such that you must raise your voice to have a normal conversation with someone less than four feet from you and/or when within 25 feet of an operating piece of heavy equipment.
- Hearing protection will be mandatory for all employees who work on or near heavy equipment unless personal dosimetry or other techniques have been used to document actual exposure.
- Hearing protectors will be made available to all employees at no cost to the employees who may be exposed to 85 dBA for eight hours.
- Hearing protection will be mandatory for all employees exposed to 85 dBA for any period of time and who have experienced an STS.

## 5.0 Records

5.1.1 Noise exposure measurement records will be retained for three years at the project/facility.

5.1.2 Audiogram records will be retained in the employee's medical records as per AECOM's Medical Surveillance Procedure for a period as directed by regulation or AECOM's Medical Provider.

5.1.3 Employee training session documentation will be retained for the duration of employment.

## 6.0 References

6.1 29 CFR 1910.95 Occupational Noise Exposure

6.2 Canadian Standards Association (CSA) Standard Z94.2-M1984

6.3 American National Standards Institute (ANSI) S3.19-1974.

6.4 S3NA_003_PR SH&E Training

6.5 S3NA_208_PR Personal Protective Equipment

6.6 S3NA_605_PR Medical Surveillance

# S3NA-510-WI Hearing Protection Guidelines

## 1.0 Comparison

| Comparison of Hearing Protection | |
|---|---|
| **Ear Plugs** | **Ear Muffs** |
| ***Advantages:***<br>• small and easily carried<br>• convenient to use with other personal protection equipment (can be worn with ear muffs)<br>• more comfortable for long-term wear in hot, humid work areas<br>• convenient for use in confined work areas | ***Advantages:***<br>• less attenuation variability among users<br>• designed so that one size fits most head sizes<br>• easily seen at a distance to assist in the monitoring of their use<br>• not easily misplaced or lost<br>• may be worn with minor ear infections |
| ***Disadvantages:***<br>• requires more time to fit<br>• more difficult to insert and remove<br>• require good hygiene practices<br>• may irritate the ear canal<br>• easily misplaced<br>• more difficult to see and monitor usage | ***Disadvantages:***<br>• less portable and heavier<br>• more inconvenient for use with other personal protective equipment<br>• more uncomfortable in hot, humid work area<br>• more inconvenient for use in confined work areas<br>• may interfere with the wearing of safety or prescription glasses; wearing glasses results in breaking the seal between the ear muff and the skin and results in decreased hearing protection |

## 2.0 Care and Use

2.1 Follow the manufacturer's instructions.

2.2 Check hearing protection regularly for wear and tear.

2.3 Replace ear cushions or plugs that are no longer pliable.

2.4 Replace a unit when head bands are so stretched that they do not keep ear cushions snugly against the head.

2.5 Disassemble ear muffs to clean.

2.6 Wash ear muffs with a mild liquid detergent in warm water, and then rinse in clear warm water. Sound-attenuating material inside the ear cushions must not get wet.

2.7 Use a soft brush to remove skin oil and dirt that can harden ear cushions.

2.8 Squeeze excess moisture from the plugs or cushions and then place them on a clean surface to air dry.

# S3NA-510-FM Site-Specific Hearing Conservation Program

## Site (Project)

## 1.0 Monitoring

As per regulation, noise monitoring will be conducted by the following procedure:

Such monitoring will consist of (*check those that apply*):

☐ Noise Dosimetry ☐ Sound Level Meter Survey

Specific instrumentation to be used is (make/model):

| Make | Model |
|---|---|
| | |
| | |
| | |

and will be calibrated at a frequency of and documented in the .

Monitoring strategy is as follows (*list all equipment and activities on site that may involve sound pressure levels above 80 dBA and an explanation of the strategy to document actual exposures*):

| Area/Equipment | Monitoring Strategy |
|---|---|
| | |
| | |
| | |
| | |
| | |

Where areas or equipment are not clearly identified, all monitoring will be documented utilizing an illustrated layout (*attach form developed for the specific site*). Monitoring frequency will be in accordance with the strategy outlined above and when the following changes in site conditions/activities occur:

| |
|---|
| 1. |
| 2. |
| 3. |
| 4. |
| 5. |

## 2.0 Employee Notification

All site employees exposed above the regulated action level (85 dBA – 8 hour TWA) will be notified of the monitoring results by (*insert name/title*) at an interval not to exceed after completion of monitoring.

Notification shall be written, with a copy to the SH&E Department. Documentation of employee notifications and corresponding signatures of notified employees will be kept in the site health and safety logbook/files.

## 3.0 Observation of Monitoring

All employees affected by the monitoring, or a designated employee representative, shall be given the opportunity to observe noise monitoring procedures. This will be achieved by:

| |
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## 4.0 Audiometric Testing Program and Requirements

AECOM personnel who perform field activities where noise exposure above action levels is expected are required to participate in an audiometric testing program. Additionally, any subcontractors performing work on AECOM projects where noise levels exceeding action level will be required to provide documentation that they participate in an audiometric testing program that meets the applicable regulations. Documentation of participation in the testing program will be maintained by and will be located at .

## 5.0 Hearing Protectors and Estimating Attenuation

A selection of suitable hearing protectors will be made available to all employees who are expected to have 8-hour TWA noise exposures above 85 dBA. The types anticipated to be available include:

| Protection Type | Attenuation |
|---|---|
| | |
| | |
| | |
| | |

Hearing protector attenuation will be evaluated by for specific noise environments according to the following method prior to determining their suitability for use:

| |
|---|
| 1. |
| 2. |
| 3. |

The following site personnel will be required to wear hearing protectors during specific activities and the results of site-specific monitoring conducted in accordance with this procedure. (*This section can be completed after monitoring, if necessary*).

| Employee Name | Activity Type | Type of Protection |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

Hearing protectors will be properly fitted by upon initial distribution to site workers.

Training in the use and care of hearing protectors shall be conducted by during the initial site-specific health and safety training. Training contents shall meet the requirements set forth in this procedure and the applicable regulations.

Hearing protectors will be distributed by from the storage location at the .

## 6.0 Access to Information and Training Materials

All information required by regulation to be made available to the employees will be posted by (*insert name/title*) at the .

Local Occupational Health and Safety Regulations will also be kept on site.

## 7.0 Recordkeeping

Records required by AECOM's Hearing Conservation Program and Regulations shall be completed by and shall be maintained at the and placed on permanent file at the for the minimum duration required by the standard. Employees can access their individual records by contacting .

All records required by this section will be transferred to any employee's successive employer if AECOM ceases to do business.

## 8.0 Approvals

Project Manager: Date:

SH&E Representative: Date:

# S3NA-513-PR Lead

## 1.0 Purpose and Scope

1.1 Control occupational exposures to lead to the lowest level practicable.

1.2 This procedure applies to all AECOM North America-based employees and operations.

## 2.0 Terms and Definitions

2.1.1 **Action Level (AL):** An airborne lead concentration of 30 micrograms per cubic meter of air (30 µg/m$^3$) (or more stringent as per the local regulations), calculated as an 8-hour time weighted average (TWA), irrespective of mitigation provided by any respiratory protection that might be used.

2.1.2 **Demolition:** The wrecking or taking out of any load-supporting structural members and any related razing, removing, or stripping of lead products.

2.1.3 **HAZWOPER:** Any on-site contamination investigation or clean-up activities subject to the operational requirements of *S3NA-509-PR Hazardous Waste Operations and Emergency Response*.

2.1.4 **Lead Containing Material:**

- Structural or decorative components containing lead in excess of 1% by weight.
- Paint or other surface coatings that contain lead equal to or in excess of 1.0 milligram per centimeter squared (1.0 mg/cm$^2$) or 0.5% by weight.
- Bulk materials containing lead in excess of 0.1% or for soils any lead-in-soil concentration in excess of 1,000 mg/kg.
- "Lead" means metallic lead, all inorganic lead compounds, and organic lead soaps. Excluded from this definition are all other organic lead compounds.

2.2 **Permissible Exposure Limit (PEL)**: The maximum exposure concentration to which an individual may be exposed to for an 8-hour time weighted average (TWA) without experiencing adverse health effects. For normal work shifts (8 hours or less), the PEL for lead is 50 micrograms per cubic meter of air (50 µg/m$^3$), or more stringent as per local regulations.

2.3 **Renovation:** The modifying of any building component that does not impact structural supports.

## 3.0 Attachments

3.1 None

## 4.0 Procedure

### 4.1 SH&E Department Responsibilities

4.1.1 Provide technical assistance in the identification of lead-containing materials and the evaluation of lead exposure hazards as requested by management personnel.

4.1.2 Review and approve all lead exposure hazard assessments prior to the start of work activities.

4.1.3 Review and approve all lead exposure mitigation plans and exposure monitoring activities to ensure compliance with federal, state, and local regulations.

4.1.4 Monitor compliance with the various aspects of this procedure and provide technical assistance regarding implementation of the requirements set forth in this procedure.

4.2 **Project Managers' (field task managers, supervisors) Responsibilities**

4.2.1 Confirm that the presence of lead-containing materials at AECOM work sites is identified (where reasonably possible) prior to commencing field activities, that prior to initiating any task involving disturbance of or contact with lead-containing materials (or immediately upon identification of previously unknown lead-containing materials) a lead exposure task hazard assessment is developed and approved by the **SH&E Department**, and that the applicable requirements are observed for each task where the lead exposure assessment indicates that the airborne lead concentrations can exceed the Action Level or other significant lead exposure hazards are present.

4.2.2 Confirm that employees developing work procedures and/or conducting work activities involving lead-containing materials possess any required state specific registrations or certifications.

4.2.3 Confirm that employees assigned to perform any work activities involving lead-containing materials have been trained in the job-specific hazards of lead exposure, have received proper medical surveillance, and are trained and properly fit tested in the use of any designated respiratory protection devices.

4.2.4 Provide the training program as initial training prior to the time of job assignment or prior to the start up date for this requirement, whichever comes last.

4.2.5 Provide the training program at least annually for each employee who is subject to lead exposure at or above the action level on any day.

4.3 **Employee Responsibilities**

4.3.1 Do not disturb or handle any lead-containing materials without appropriate personal protective equipment (PPE), training in the job-specific hazards of lead exposure, medical monitoring, and respirator fit test.

4.3.2 Immediately notify the **Project Manager** of the presence or suspected presence of previously unidentified lead containing materials in the workplace, and cease all work activities involving disturbance or contact with the materials until further direction is received.

4.4 **Activity-Specific Requirements**

The following operation-specific requirements pertain to activities where the presence of lead-containing materials is identified, suspected, or recognized as a significant operational occurrence.

4.4.1 HAZWOPER Activities

Lead may be present at HAZWOPER sites as a soil or groundwater contaminant or as a building material. If such contamination is noted, the following requirements must be observed:

- The site-specific health and safety plan (HASP) must provide a specific analysis of the lead exposure hazard for each task involving the disturbance or handling of lead-contaminated materials.
- If any potential is identified for worker lead exposures to exceed the AL, then specific lead exposure control and monitoring procedures must be developed for the work activity and included in the HASP.
- If workers may be exposed in excess of the AL, they must complete baseline medical monitoring and lead awareness training.

4.4.2 Demolition or Renovation Activities

The past widespread use of lead-containing materials in buildings is widely recognized as the source of a significant exposure hazard for personnel performing demolition and renovation activities. Accordingly, the following requirements will be observed:

- Prior to commencement of demolition or activities, a thorough inspection and sampling program will be completed throughout the demolition area to identify the presence of lead-containing materials.
- Where feasible, lead-containing materials will be removed prior to commencement of general work activities.
- The hazards of any remaining lead will be analyzed and an exposure control and monitoring plan developed to prevent worker lead exposures in excess of the PEL (required) and the AL (where feasible). The exposure control plan must be approved by the SH&E Department prior to implementation.

- Prior to commencing demolition activities the appropriate notifications must be filed with the federal, state, and local regulatory agencies as when necessary. The **Project Manager** is required to determine the appropriate reporting requirements.
- If workers may be exposed in excess of the AL, they must complete baseline medical monitoring and lead awareness training.
- Disposal of lead containing materials must meet federal, provinicial, territorial, state, and local regulatory requirements. The project manager is required to address this in the project work plan.

4.4.3 Other Activities

If the presence of lead-containing material is identified or suspected at any work location, and there is the potential for this material to become disturbed during planned work activities, then the following requirements must be observed:

- A lead exposure hazard assessment will be completed for each task in which lead-containing material may be disturbed.
- If any exposure assessment indicates the potential for worker exposures to exceed the AL, then appropriate exposure mitigation procedures must be identified to keep exposures to less than the PEL (required) and the AL (where feasible). Mitigation procedures must be reviewed and approved by the **SH&E Manager** prior to implementation.
- If workers may be exposed in excess of the AL, they must complete baseline medical monitoring and lead awareness training.
- The **SH&E Department** will determine if any exposure-monitoring procedures must be implemented during work activities.

## 4.5 Worker Exposure Control Program

The following requirements pertain to all workers performing tasks where the associated lead exposure assessment indicates the potential for lead exposures to exceed the AL.

4.5.1 Medical Monitoring Requirements

- Prior to commencing work where lead exposure may exceed the AL, each employee will have completed a biological monitoring procedure for blood lead and ZPP (Zinc Protoporphyrin) concentrations. This testing may include baseline and exit collections. The specific requirements will be defined by AECOM's Corporate Medical Provider and SH&E Manager prior to project initiation. Workers must have a medical clearance from AECOM's Corporate Medical Provider prior to performing work involving potential lead exposures at or above the AL.

4.5.2 Medical Removal

- AECOM will temporarily remove an employee from work where there is excess exposure to lead as determined by a physician's written medical opinion that the employee should be removed from such exposure. The physician's determination may be based on biological monitoring results, the employee's inability to wear a respirator, evidence of illness, other signs or symptoms of lead-related dysfunction or disease or any other reason deemed medically sufficient by the physician.

4.5.3 Training

Each worker who may be exposed shall complete training consisting of the following elements:

- Lead exposure limits and other regulatory requirements.
- Job-specific lead hazards and exposure prevention measures.
- The health hazards associated with lead exposure.
- The quantity, location, manner of use, release, and storage of lead in the workplace and the specific nature of operations that could result in exposure to lead, especially exposures above the PEL.
- The project-specific engineering controls and work practices associated with the employee's job assignment.
- The measures employees can take to protect themselves from exposure to lead, including modification of such habits as smoking and personal hygiene, and specific procedures that AECOM has implemented to protect employees from exposure to lead such as appropriate work practices, emergency procedures, and the provision of personal protective equipment.
- The purpose, proper selection, fitting, proper use, and limitations of respirators and protective clothing.

- The purpose and a description of the medical surveillance program.
- The employee's rights of access to records, as per *S3NA-604-PR Medical Records*.

4.5.4 Respiratory Protection

Where respiratory protection is specified for use in controlling worker exposures to lead each employee must:

- Be medically qualified for use of the specified respiratory protection.
- Complete respirator training and fit testing.
- Be assigned an appropriate respirator for use during field operations.

4.5.5 Personal Protective Equipment

In any operation where workers may experience airborne lead concentrations above the AL, or where the possibility of skin or eye irritation exists, employees shall be provided with the following:

- Disposable coveralls or similar full-body work clothing
- Gloves, hoods, and boots or disposable shoe coverlets
- Face shields, goggles, or other appropriate protective equipment necessary for safe job performance
- Clean change rooms equipped with separate storage facilities that will prevent cross contamination from protective work clothing and equipment to street clothes
- All protective clothing shall be cleaned, laundered, properly disposed of, and repaired or replaced as necessary. AECOM will provide all necessary PPE that is incidental to the work at no cost to the employee.

4.5.6 Air Monitoring

- Operations involving the potential airborne exposure to lead shall be required to conduct initial and ongoing personal air sampling to represent employee exposure

## 4.6 Safe Work Practices

4.6.1 Regulated Areas

- Access to lead-contaminated work areas shall be regulated and limited to authorized persons. A daily roster of all persons entering such areas shall be kept. AECOM employees shall not enter or remain in regulated areas when any of the safety systems such as ventilation or containment is not functional.
- In each work area, where the AL is exceeded, the following warning sign shall be posted:

**WARNING**
**LEAD WORK AREA**
**POISON**
**NO SMOKING OR EATING**

4.6.2 General Work Practices

- Contaminated protective equipment such as respirators, airline hoses, etc., shall not be removed from the regulated area until it has been cleaned.
- Employees shall not be permitted to exit the regulated area until contaminated equipment and clothing have been removed in accordance with the preceding bullets and employees have showered and washed their hands and face with soap and water.
- Removal of lead from protective clothing or equipment by blowing, shaking, or any other means which could disperse lead into the air is prohibited.
- No food or beverages shall be present or consumed in the regulated area.
- No tobacco products shall be present or used and cosmetics shall not be applied in the regulated area.
- All employees shall be required to shower at the end of each work shift.
- During the operation, all employees shall be required to wash their hands and face prior to eating, drinking, smoking, or applying cosmetics.
- Whenever possible, wet methods shall be used when handling or processing lead compounds. Water spray, fogging, or water collection systems, etc., shall be used (e.g., lead contaminated soil shall be thoroughly wetted for excavation operations).

- Dry sweeping of lead or lead-contaminated materials is prohibited. When wet methods cannot be used, HEPA filter vacuum cleaners shall be required.
- Containers of contaminated protective clothing and equipment are to be labeled as follows:

  CAUTION: CLOTHING CONTAMINATED WITH LEAD. DO NOT REMOVE DUST BY BLOWING OR SHAKING. DISPOSE OF LEAD CONTAMINATED WASH WATER IN ACCORDANCE WITH APPLICABLE LOCAL, STATE OR FEDERAL REGULATIONS

## 5.0 Records

5.1 The employer shall establish and maintain an accurate record of all monitoring as per *S3NA-602-PR Exposure Monitoring*.

5.2 The employer shall maintain or assure that the physician maintains those medical records for at least 40 years, or for the duration of employment plus 20 years, whichever is longer.

## 6.0 References

6.1 **United States:** Title 29, Code of Federal Regulations, Sections 1910.1025 and 1926.62

6.2 CalOSHA Title 8 1532.1

6.3 Canadian Centre for Occupational Health and Safety

6.4 S3NA -208-PR Personal Protective Equipment Program

6.5 S3NA-418-PR Welding, Cutting and Other Hot Work

6.6 S3NA-519-PR Respiratory Protection Program

6.7 S3NA-605- PR Medical Surveillance Program

# S3NA-517-PR Radiation, Non-Ionizing

## 1.0 Purpose and Scope

1.1 Provides the requirements and guidelines to control occupational and public exposure to non-ionizing radiation including lasers and radiofrequency (RF), infrared (IR), and ultraviolet (UV) radiation.

1.2 This procedure applies to all AECOM North America based employees and operations.

## 2.0 Terms and Definitions

2.1 **Controlled Environment**: An area where the occupancy and activity of those within is subject to control and supervision for the purpose of protection from radiation hazards.

2.2 **Hazard Distance:** Distance from a radiofrequency emitter at which the power density equals the Uncontrolled Environment Maximum Permissible Exposure Limit power density level as established by the latest edition of the ANSI C95.1.

2.3 **Maximum Permissible Exposure (MPE) Limits**:The level of laser exposure which is considered as the limit between safe and potentially harmful.

2.4 **Non-ionizing Radiation**: Any type of electromagnetic radiation that does not carry enough energy to ionize atoms or molecules. Examples include radiofrequency radiation, microwave radiation, ultraviolet radiation, visible light, infrared radiation, lasers, static electric and magnetic fields, etc.

2.5 **Uncontrolled Environment**: Locations where there is the exposure of individuals who have no knowledge or control of their exposure.

## 3.0 Attachments

3.1 None

## 4.0 Procedure

### 4.1 Roles and Responsibilites

#### 4.1.1 Corporate Radiation Safety Officer

- The **SH&E Department** will maintain this procedure and include it the annual review of the Corporate Radiation Safety Program.

#### 4.1.2 Region SH&E Manager

- The **Region SH&E Manager** will provide technical guidance to projects that involve the use/survey of non-ionizing sources as well as identifying the proper controls to mitigate employee exposure to non-ionizing radiation sources, including UV radiation. In addition, **Region SH&E Managers** will:
    - Review and approve all Non-Ionizing Radiation Protection Plans (NIRPP).
    - Conduct non-ionizing radiation hazard assessments.
    - Provide applicable awareness training on non-ionizing radiation hazards to project teams.
    - Authorize the use of a Class 4 laser.

#### 4.1.3 Project Managers (field task managers, supervisors)

- **Project Managers** are responsible for the overall safety and planning for a project. **Project Managers** are also responsible to:
    - Verify that the presence of non-ionizing radiation sources at project work sites is identified in Task Hazard Analyses (THA) prior to commencing field activities.
    - Addressing and controlling potential non-ionizing radiation hazards through consultation with the SH&E Department and/or development of a NIRPP.
    - Verify incident and injury reporting procedures are followed when a suspected overexposure to non-ionizing radiation, an incident of sunburn, or other excessive non-ionizing radiation exposure occurs in the workplace.
    - Monitor **employee** compliance with the requirements of this policy.

4.1.4 **Site Safety Officers and Site Supervisors**

- Will identify both known and suspected non-ionizing radiation sources on the THA and report any change in site conditions related to non-ionizing radiation sources to the **Project Manager**.
- Provide non-ionizing radiation awareness training to employees as directed by the **Region SH&E Manager.**
- Enforce compliance with the requirements of this policy.

4.1.5 **Employees**

- Will not disturb or handle any non-ionizing sources or work in any identified non-ionizing radiation hazard area (i.e., Controlled Environment) without appropriate training and safety procedures.
- Will work in accordance with all established manufacturer, client, and NIRPP requirements.
- Will immediately notify the project manager of the presence or suspected presence of previously unidentified non-ionizing radiation sources in the workplace, and cease all work activities involving potential exposure to non-ionizing radiation until further direction is received.
- Will use UV personal protection when working outdoors.

## 4.2 Hazard Assessment

4.2.1 AECOM will identify and assess the hazards associated with work where the potential exists for personnel to be exposed to laser radiation or other non-ionizing radiation sources including ultraviolet (UV) radiation. This assessment will be documented in the THA or other relevant hazard assessment documentation.

4.2.2 AECOM will develop and implement an appropriate NIRPP to control identified hazards where the potential to exceed the applicable Maximum Permissible Exposure (MPE) limits exist.

## 4.3 Laser Protection Requirements

4.3.1 Only qualified and trained employees will be assigned to install, adjust, and operate laser equipment for surveys, alignment/grade-checks, tunnel work, etc.

4.3.2 Where direct or reflected laser light greater than 0.005 watts (5 milliwatts) for ≥ ¼ second exists, employees will be provided with laser safety goggles that will protect them for the specific wavelength of the laser and be of an optical density (OD) adequate for the energy involved. The laser safety goggles will be selected in accordance with the requirements of ANSI Z136.1-2007 (or the most current edition).

4.3.3 Operation of an ANSI Class 3B or 4 laser requires medical surveillance.

4.3.4 Use of an ANSI Class 4 laser requires the approval of the **Region SH&E Manager**.

4.3.5 All protective goggles will bear a label identifying the following data:

- The laser wavelength for which use is intended.
- The optical density of that wavelength.
- The visible light transmission.

4.3.6 Class 1 Lasers

- Safe for the naked eye and through optical instruments (prescription lenses, telescopes, beam reducers, etc.)
- Very low power lasers or enclosed lasers.
- MPE is never exceeded, even for very long exposure (hours), or with the use of optical instruments.
- Nominal Hazard Zone: none.

4.3.7 Class 1M Lasers

- Safe for the naked eye only, but potentially hazardous when optical instruments are used.
- Medium power lasers either collimated with a large beam or highly divergent.
- MPE can be exceeded when using optical instruments.
- Nominal Hazard Zone: none for the naked eye.

4.3.8 Class 2 Lasers

- Safe for unintended exposure, (less than 0.25 seconds) but hazardous when looking at for more than 0.25 seconds.
- Visible (wavelength of 400–700 nanometers) low power lasers.
- MPE is not exceeded provided the viewings are accidental only. MPE calculation assumes the blink reflex will stop the light after 0.25 second.
- Nominal Hazard Zone: none for accidental exposure.

4.3.9 Class 2M Lasers

- Safe for the naked eye when the exposure is unintended, (less than 0.25 seconds) but hazardous when looking at for more than 0.25 seconds or when optical instruments are used.
- Visible (wavelength of 400–700 nanometers) medium power lasers either collimated with a large beam or highly divergent.
- MPE is not exceeded provided the viewings are accidental only and only with naked eyes. MPE calculation assumes the blink reflex will stop the light after 0.25 seconds. Using optical instruments might bring the exposure above the MPE as well.
- Nominal Hazard Zone: none for accidental exposure to the naked eye.

4.3.10 Class 3R Lasers

- Unsafe, except when handled carefully by experienced users. Accidental short exposure is considered as a small hazard.
- Low power lasers.
- MPE can be exceeded up to 5 times.
- Nominal Hazard Zone: hazard area for the eye, none for the skin.

4.3.11 Class 3B Lasers

- Unsafe without exception, laser safety goggles must be worn within the nominal hazard zone. Focused lasers of this class are a potential fire hazard.
- Medium power lasers.
- MPE is exceeded more than 5 times. Skin MPE is not generally exceeded, except at focus.
- Nominal Hazard Zone: hazard area for the eye, none for the skin.

4.3.12 Class 4 Lasers

- Dangerous, Personal Protective Equipment (PPE) for eyes and skin must be worn within the nominal hazard zone. Class 4 lasers are fire hazards as well. Diffuse reflections may be hazardous.
- High power lasers.
- Ocular and skin MPE are exceeded. Diffuse reflections exceed the MPE.
- Nominal Hazard Zone: hazard area for the eye and for the skin.

4.3.13 Class 2M Lasers and Greater

- Areas where a Class 2M or higher, non-enclosed path laser beam is in use will be posted with standard laser-warning placards
- Beam shutters or caps will be used, or the laser turned off, when laser transmission is not actually required. When the laser is left unattended for a period of time (e.g., >5 minutes), such as during the lunch hour, overnight, or at change of shifts, the laser will be turned off.
- Only mechanical or electronic means will be used as a detector for guiding the internal alignment of the laser. Aligning the laser with the naked eye is prohibited.
- The laser beam will not be directed at personnel. Laser units will be set above or below the heads of personnel.
- Laser equipment will bear a label to indicate maximum power output, ANSI class, and beam spread.
- Personnel exposure will be controlled to stay within the MPE limits specified in ANSI Z136.1-2007 (or the most current edition).
- Looking into the primary beam is prohibited and care will be taken to avoid looking at specular reflections of the beam, including those from lens surface work.

4.4 **Radiofrequency Radiation Protection**

4.4.1 Reduction in radiofrequency (RF) exposures can be accomplished through the implementation of appropriate, administrative, work practice and engineering controls. These various controls are the elements of an RF Protection Program. Should routine occupational RF exposures be part of a project, AECOM project and safety personnel should develop such a Program or NIRPP.

4.4.2 However, generally where RF emitters are identified, AECOM personnel will:

- Remain outside of any demarcated area where an RF hazard exists.
- Remain within the General Public exposure region.
- If the preceding requirements cannot be met or determined, the project team will obtain a hazard assessment from the emitter's operator for controlling entity and provide it to the **Region SH&E Manager** for evaluation and determination of the relevant hazard mitigation measures.

4.4.3 If the above information is not available, an RF emitter survey will be required to assess the potential exposure hazards. Such a survey will be performed by a competent person who can effective assess RF exposures.

4.4.4 Unless using an RF meter under the direction of a competent person, AECOM personnel will not enter any area which is located within the RF hazard distance identified by the RF survey. AECOM personal may enter a controlled area if the emitter has been de-energized and locked-out using standard Lockout/Tagout procedures to prevent exposure.

4.4.5 Where a meter is in use, personnel performing survey activities will ensure that they do not exceed 110% of the MPE power density level at any time. Exposure to power density levels above the MPE will not exceed two minutes during any six-minute period. In addition, personnel will not be exposed to microwave power densities in excess of 10 milliwatts per square centimeter from any RF emitting equipment.

4.5 **Infrared Radiation Protection**

4.5.1 Performance of welding and oxygen/acetylene cutting operations (torch cutting, brazing, welding) involves the use of an exposed high-temperature flame. This flame produces infrared (IR) radiation at the welding location which can cause thermal burns to the welder or other persons located nearby.

4.5.2 Skin Protection

- Long sleeve, flame-resistant shirts and/or forearm length Nomex gloves will be worn.
- Leather welder's apron will be worn.
- Long pants will be worn during any hot work task.
- Welding screens will be utilized where feasible to protect the general public or other unprotected personnel.

4.5.3 Eye Protection

- A welder's helmet or goggles with the appropriate lens shade will be worn.

4.6 **Ultraviolet Radiation Protection**

4.6.1 Broad-spectrum UV radiation is classified as a known human carcinogen. UV radiation can cause harmful effects from both chronic and acute exposures including reddening of the skin (regardless of skin tone), accelerated skin aging, and damage to the eyes (e.g., cataracts, retinal burns, or welder's flash), and sunburn. AECOM **employees** may be exposed to UV radiation from natural sunlight or manmade sources such as germicidal lamps (e.g., UV groundwater treatment systems) and welding.

4.6.2 While not required, the completion of an exposure or UV risk assessment will assess the risk posed by UV at the site. Such an assessment can be part of a Task Hazard Analysis (THA). Special consideration should be given to work activities at higher elevations as the intensity of UV exposures are significantly higher than at lower elevations. Typically, UV exposure can increase 4-5% for every 1000 feet ascended. Also, some medications (e.g., Tetracycline) can increase sensitivity to UV exposure.

4.6.3 Control measures will be implemented at a worksite according to the conditions and work performed.

4.6.4 Engineering Controls

- **Employees** will be encouraged to maximize use of the shade provided by trees, buildings, and other structures.

- Where there is limited access to natural shade, fixed or portable shade structures will be provided where practical.
- It is acknowledged that the provision of shade does not provide total protection from UV; therefore, it is recommended that outdoor workers adopt personal protection strategies such as protective clothing, sunscreen, and the wearing of hats in addition to using shade.

4.6.5 Administrative Controls

Consideration will be given to the reorganization of outdoor work programs to reduce UV exposure including, but not limited to:

- Use of the UV Index to assess UV hazards.
- Rescheduling work hours to enable workers to start earlier during May-September.

The UV Index, shown in Table 1, can help employees be aware of the expected level of UV radiation exposure on any given day.

**Table 1. UV Index**

| Exposure Category | Index Number | Sun Protection Messages |
|---|---|---|
| Low | < 2 | Wear sunglasses on bright days. In winter, reflections off of snow can nearly double UV strength. If you burn easily, cover up and use sunscreen. |
| Moderate | 3-5 | Take precautions, such as covering up and using sunscreen. |
| High | 6-7 | Protection against sunburn is needed. |
| Very High | 8-10 | Take extra precautions. Unprotected skin will be damaged and can burn quickly. |
| Extreme | 11+ | Take all precautions. Unprotected skin can burn in minutes. |

4.6.6 Personal Protective Equipment

**Employees** who work outdoors must provide and utilize personal outer clothing (i.e. shirt and trousers) that meets the established general clothing requirements per *S3NA-208-PR Personal Protective Equipment Program*. For those circumstances where the outer clothing requirements exceed the general clothing requirements, AECOM will provide the necessary clothing. The selection of appropriate protective clothing will take into account both the need to block UV and the need to reduce the effects of heat.

- Protective Clothing
  - All outer clothing will have at least elbow-length sleeves and long trouser pants (where practical, the fabric will have a close weave);
  - Where possible, clothing will be lightweight, loose fitting and have a collar;
  - Clothing and head wear with a sun protection factor (SFP) is encouraged but not required;
- Secondary hazards such as fire resistance will be considered.
- Head, Face, and Neck Protection
  - Hats provide shade and the larger the brim the greater the amount of shade that is provided;
  - Full brim hard hats are recommended (for additional protection, neck flaps are recommended);
  - In circumstances where the wearing of a broad-brimmed hard hat causes difficulties due to its size, sunscreen and other protective measures will be used.
- Eye Protection
  - Wrap-around, close-fitting, large safety glasses will reduce the amount of UV and glare that may pass around the edges of the glasses (the color or darkness of the lenses does not indicate the level of UV protection; therefore, verification with the manufacturer should be performed);
  - Safety glass will have a minimum UV reduction rating of 98% (must still be ANSI Z87 compliant);
  - For hot work activities that may produce ultraviolet radiation, eye protection will utilize the proper welding shade

- Sunscreen
  - Sunscreen does not offer complete protection against the sun and should always be used in conjunction with other protective measures;
  - A broad spectrum and water-resistant sunscreen with a SPF of 30+, or a rating of no less than three stars, will be provided;
  - Expiration dates on the sunscreen will be regularly checked to ensure it has not expired per the manufacturer's instructions;
  - Sunscreen should be placed in an easily accessible location and employees instructed on the correct application and use;
  - Sunscreen should be generously applied to all areas of exposed skin at least 20 minutes before going outside and reapplied every two hours, or as needed by the work conditions.

### 4.7 Non-ionizing Radiation Training Program

4.7.1 **Employees** will receive training where the need for non-ionizing radiation control measures has been identified in the Health and Safety Plan, Non-Ionizing Radiation Protection Plan, or the UV risk assessment. Awareness training on the applicable non-ionizing radiation source will be provided to **employees** prior to the start of work in the area where the hazard exists as well as when **employees** are required to enter non-ionizing radiation Controlled Environments. Training curriculums will be provided by the SH&E Department.

## 5.0 Records

5.1 Training records should be made part of an employee's personal training file as well as the project file.

5.2 RF surveys will become part of the applicable project files.

## 6.0 References

6.1 S3NA-208-PR Personal Protective Equipment Program

6.2 S3NA-418-PR Welding, Cutting and Other Hot Work

6.3 S3NA-516-PR Radiation Safety Program

6.4 ANSI C95.1, Standard for Safety Levels with Respect to Human Exposure to Radio frequency Electromagnetic Fields, 3 kHz to 300 GHz.

6.5 ANSI Z136.1-2007, American National Standard for Safe Use of Lasers

6.6 ANSI Z87, Occupational and Educational Personal Eye and Face Protection Devices

# S3NA-518-PR Radiation Gauge Source Program

## 1.0 Purpose and Scope

1.1 Portable gauges are used in various AECOM business lines involved in agriculture, construction, and civil engineering to measure things like the moisture or compaction in soil, and the density of asphalt in paving mix.

1.2 While gauge source license requirements vary based upon Regulatory Agencies, radioactive material sources, project location (i.e. Federal property, Agreement State, etc.), and length of project, this procedure provided AECOM with a standard approach to managing Gauge Soruce Programs.

1.3 This procedure provides a set of guidelines for all AECOM Authorized Operators of portable gauging devices that contain radioactive sealed sources (i.e., byproduct and/or accelerator produced material).

1.4 The procedure establishes requirements for AECOM gauge source license holders to provide information on their program, inventory, license, etc. to AECOM's Corporate Radiation Safety Officer (Corporate RSO).

1.5 This procedure applies to all AECOM North America based employees and operations.

## 2.0 Terms and Definitions

2.1 **Accelerator Produced Material**: Material that has been bombarded with energetic particles (accelerated) to create energies that are suitable for certain technological and medical applications

2.2 **Agreement State**: A State that has entered into an agreement with the Nuclear Regulatory Commission (NRC) which gives the State the authority to license radioactive materials used, possessed, and stored within its State borders and jurisdiction.

2.3 **ALARA**: As Low As Reasonably Achievable. Acronym for methods used to minimize exposure to radioactive materials through time, distance and shielding.

2.4 **Authorized Operators:** Employee who has successfully completed a gauge manufacturer's training course and has been trained in the specific provisions of this standard operating procedure (SOP) and the requirements of AECOM's respective Radioactive Materials License.

2.5 **Byproduct Material**: Any radioactive material yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear materials.

2.6 **Corporate Radiation Safety Officer (RSO)**: AECOM employee responsible for AECOM's North American Corporate Radiation Safety Program (S3NA-516-PR).

2.7 **Leak Test**: A physical process in which a sample is collected on the outside of the gauge's sealed source(s) shielding to determine the presence of radioactive leakage.

2.8 **Licese Radiation Safety Officer (RSO)**: AECOM employee named as RSO on an AECOM radioactive materials license. This employee is responsible for developing, maintaining, auditing, implementing, and amending an appropriate Radiation protection Plan in accoradance with AECOM's Corporate Radiation Safety Program and license conditions.

2.9 **Portable Gauges**: Various instruments manually used in the measurement of material properties. Typical portable gauges owned, leased, and operated by AECOM include (but not limited to): nuclear density and/or moisture gauges, XRF Spectrum Analyzers, and Electron Capture Detectors.

2.10 **Project Manager**: Employee responsible for the management of the project activities, including but not limited to health and safety as well as the technical and financial performance of the project.

2.11 **Radioactive Material (RAM) License:** License issued by a regulating agency for the possession, use and/or storage of portable gauging and measurement equipment that contains radioactive sealed sources.

2.12 **Radioactive Sealed Source**: Any radioactive material that is encased in a capsule designed to prevent leakage or escape of the radioactive material that is created from either byproduct and/or accelerator-produced material.

2.13 **Reciprocity**: The act of one regulatory agency honoring the license of another regulatory agency.

2.14 **Regulatory Agency**: A government body with designated authority for radioactive material within designated boundaries. Regulatory Agencies for portable gauging and measuring equipment include the NRC, the US Department of Energy, Agreement States, and military bases.

2.15 **Thermo luminescent Dosimeter (TLD)**: A type of dosimeter for measuring the external exposure to gamma, X-ray, and β radiation. Energy absorbed from the radiation is stored and emitted at the time of analysis as light. The amount of light emitted is proportional to the energy absorbed and hence to the dose received by the individual wearing the TLD.

2.16 **Transport Index (TI)**: The maximum radiation level in millirem/hour at a distance of one meter from all external surfaces of the prepared portable gauge package for shipping and/or transport. It is a dimensionless number placed on the label of a package to designate the degree of control to be exercised during shipment or transportation.

## 3.0 Attachments

3.1 None

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Corporate RSO** is responsible for:

- Maintaining and ensuring compliance with AECOM's Corporate Radiation Safety Program (*S3NA-516-PR Radiation Safety Program).*
- Maintainging and ensuring compliance with AECOM's Radiation Gauge Source Program by providing a single point fo contact and repository for information on all AECOM gauge source licenses and programs.
- Reviewing this procedure on an annual basis and revising it as necessary based on the results of the annual review.
- Approving all RAM license RSOs, including RSOs named on specific and general gauge source licenses.

4.1.2 **License RSO**

Each **License RSO** is responsible for ensuring that the conditions of AECOM's RAM License and the requirements of this SOP are successfully met. Specifically, the **License RSO** is responsible for:

- Providing copies of all licenses and compliance documents (audits, inventories, leack tests, training records, amendments, procedures, dose reports, etc.) to the **Corporate RSO**.
- Preparing and maintain the License Radiation Protection Plan (RPP).
- Completing compliance reports (annual or other) as required by regulatory authorities.
- Stopping unsafe licensed activities.
- Amending RAM Licenses to reflect current regulatory requirements, industry standards and procedures, and AECOM health and safety requirements.
- Obtainign necessary reciprocity licensing for work in areas regulated by other Regulatory Agencies.
- Ensuring that all users of portable gauges containing sealed sources have been authorized to operate such equipment.
- Ensuring initial and refresher training is provided for **Authorized Operators**.
- Ensuring that all records are properly filed and maintained.
- Conducting annual program audits.
- Reviewing the license Radiation Protection Plan on an annual basis and revising it as necessary based on the results of the annual review.
- Notifying Regulating Agency and **AECOM Corporate RSO** if a gauge is lost, stolen, stuck or damaged.

- Notifying either the US Department of Transportation (USDOT) or the CNSC if a transportation accident involving a gauge occurs.

4.1.3 **Authorized Operator**

- Conducting their work in accordance with the procedures established by this procedure, the License RPP, and the conditions and operating procedures of specific RAM License.
- Implementing and following all site specific health and safety requirements.
- Coordinate all shipping/transportation of portable gauges to and from project site.

4.1.4 **Project Manager (field task manager, supervisor)**

- Contact the **License RSO** prior to portable gauge usage at a project site to insure all licensing requirements are complete prior to receipt of the portable gauge at the facility, authorized operators have been selected, and if requirements for dosimetry and radiation surveys are needed/met.
- Ensure gauge users are **Authorized Operators** and have current certifications and training.
- Contact the **License RSO** prior to the anticipated end of the portable gauge use to insure proper regulatory tracking and notification.
- Contact the **License RSO** regularly with portable gauge usage for proper and timely billing of equipment to project.

## 4.2 Radiation Protection Plan

All RAM Licenses shall have an assocated RPP that is prepared and approved in accordance with the AECOM Corporate Radiation Safety Program. The RPP shall describe in detail the subjects described in Sections 4.2.1 through 4.2.9.

4.2.1 ALARA Policy Statement

It is AECOM's policy to plan and conduct its radiological activities safely and in such a fashion as to protect the health and safety of its employees, subcontractors, members of the public, and the environment. To achieve this, AECOM shall ensure that efforts are taken to reduce radiological exposures and releases to the environment as low as is reasonably achievable, taking into account social, technical, economic, practical and public policy considerations. AECOM is committed to implementing a radiological control program that reflects this policy.

4.2.2 Personnel Monitoring

The RPP will define the method for tracking dose to **Authorized Operators.** Tyically, and often required by a license, all **Authorized Operators** will wear a personnel monitorind devise, such as a thermolumenscent dosimeter (TLD) badge, to measure radiation exposure when using or transporting gauges. The badges shall be excanaged at interncvals not to exceed 3 months. The **License RSO** who authorizes a person to operate an gauge containing a radioactive source shall provide the **Authorized Operator** with a dosimeter that:

- Has been issued by a licensed dosimetry service [in the US, National Voluntary Laboratory Acredidation Program (NVLAP) acredidation is required];
- Has not been used by another person since its last reading;
- Is of a type suitable for recording any dose of radiation that the person is likely to receive as a result of the operation of the exposure device; and
- Is designed so that it can be worn on the trunk of the body.

Upon receipt of the results of the analysis by the dosimetry service, the **Licnese RSO** shall review the results for conformance to license and exposure requirements. A copy of the dosimetry service's report will be maintained in the RAM License file and a copy shall be forward to the **Corporate RSO**. At any time, at the request of the employee, the **License RSO** will provide copies of any and/or all personnel radiation dosimetry records for that employee.

Alternate methods for tracking dose must be defined in the RPP and approved by the **Corporate RSO**.

4.2.3 Radiation Detection Instruments

AECOM will maintain radiation survey meters for use in the event on an incident involving a gauge. The survey meters will be calibrated annually and checked for functionality before use (e.g., with the gauge source or a check source). The **License RSO** will provide **Authorized Operators** with a radiation survey meter that:

- Is capable of measuring a dose rate of gamma radiation from the sealed source of between 2 mrem/hr (20 μSv/hr) and 10 rem/hr (100 mSv/hr), and
- Indicates that the power level of its batteries is sufficient for its operation.

4.2.4 Sealed Source Leak Testing

- Leak testing (i.e., a check for removable radioactive contamination) will be performed to determine whether there is any radioactive leakage from the source(s) in the gauge. Leak tests shall be collected on all AECOM-owned and leased portable gauges.
- Leak tests will be collected by the **License RSO** or an **Authorized Operator** using an approved kit, such as Troxler Leak Test Kit 3880, in accordance with the kit supplier's instructions. Leak tests will be analysed by an organiation authorized by the applicable regulatory agency (NRC, CNSC, or Agreement State).
- Leak tests shall be collected at frequencies in accordance with license requirements.
- Leak test results will be maintained for a period of three (3) years or in accordance with license requirements.

4.2.5 Material Receipt and Accountability

- All **AECOM License RSOs** will complete an inventory of all sealed sources and portable gauges corresponding with the specific RAM Licenses at a minimum once every six months.
- Radioactive materials must be tracked from "cradle to grave." **AECOM License RSOs** shall maintain records of receipt, transfer, and disposal of gauges for a period of three (3) years. Source inventories must also be performed at intervals not to exceed six months. Inventory records will include the following information:
  - Radionuclide and amount of material in each sealed source.
  - Manufacturer, model number and serial number of each device containing radioactive material.
  - Date inventory was performed.
- Inventory records will be maintained by the **License RSO** with other program documents for three (3) years.

4.2.6 Public Dose

- AECOM **License RSOs** and **Authorized Operators** must ensure that following:
  - Gauges are used, transported, and stored in such a way that no member of the public receives a dose of more that 100 mrem ( 1 mSv) in one year;
  - The dose in unrestricted areas does not exceed 2 mrem (20 Sv) in any one hour; and
  - Gauges that are not in storage are controlled and secured from authorized use or removal.
- Members of the public include persons who live, work, or may be near locations where gauges are used or stored This may including AECOM employees or subcontractos whose assigned duties do not include use of gauges, but work in the vicinity where gauges are used or stored.
- In general, gauges should be stored as far away as possible from areas occupied by members of the public. **AECOM License RSOs** must ensure that radiation levels in areas adjacent to gauge storage locations will not exceed the dose limits provided above.
- **License RSOs** should demonstrate in the RPP how compliance the public dose limits will be determined (e.g., provide public dose calucation worksheet).

4.2.7 Maintenance

- AECOM is not licensed to perform any maintenance or cleaning on any portable gauge containing a sealed source unless the source is safely shielded within the gauge. Any maintenance or cleaning will always be performed with the radioactive source in the safe shielded position in accordance with the manufacturer's directions or recommendations.
- **License RSOs** will implement and maintain procedures for routine maintenance (cleaning and lubrication) of licensed gauges according to the manufacturer's recommendations and instructions. The **License RSO** will send gauges to the manufacturer to perfrom non-routine maintenance or repair operations that require removal of the source or source rod from the gauge.

4.2.8 Transportation

- **License RSOs** shall incorporate appropriate transportation procedures into the license RPP and operating procedures. These procedures must ensure that gauges are transported in compliance with US DOT or CNSC regulations.

4.2.9 Audit Program

- AECOM will verify, on an annual basis, that our activities are being conducted in accordance with the conditions of our RAM Materials License. The **RAM License RSO**, another **RAM License RSO**, or an independent third party may conduct the audit. The audit will include a review of records to ensure that AECOM has properly documented our activities and that this documentation can adequately demonstrate regulatory compliance. Verify with license requirements if annual audit must be completed by an independent party. Copies of completed audits to maintained in the license files.

## 4.3 Operational Procedures

To limit radiation dose to **Authorized Operators** and the public, each **License RSO** must ensure that an operating procedure(s) is implemented and maintained. A copy of the operating procedure(s) should be distributed to gauge users before initial use of equipment and maintained at the job site. Operating procedures should include the following requirements:

4.3.1 Dosimeters

- Always wear assigned personnel dosimetrydevice (e.g., TLD) when using or transporting the gauge.
- Never wear another person's dosimeter.
- Never store a dosimeter near the gauge or other radiation source.

4.3.2 Storage

- Before removing the gauge from its place of storage, ensure that in gauges with movable source rods, the rod is locked in the shielded position, and the transport case is locked.
- Sign out the gauge in a logbook, stating the date(s) of use, name(s) of **Authorized Operator(s)** who will be responsible for the gauge, and the temporary job site(s) where the gauge will be used.
- Whe the gauge is not in use at a temporary job site, place the gauge in a second storage location (e.g., locked in a trunck of a car or locked in a storage shed).
- After making changes affecting the gauge storage area (e.g., changing the location of the gauges within the area, removing shielding, adding gauges, changing the occupancy of adjacent areas, moving the storage are to a new location), reevaluate compliance with public dose limits and ensure proper security of gauges.
- All required signage including Notice of Employee postings, Caution Radiation postings and specific RAM License postings shall be properly located and maintained. Remove all postings when the gauge is removed from the facility.

4.3.3 Transportation

- Prior to transporting the gauge, ensure that each gauge source is in the fully shielded position. Ensure that the soruce rod is locked in the shielded position and that the gauge is placed into the case and lock the case.
- Block and brace the gauge to prevent movement during transportation and lock the gauge in or to the vehicle. Follow all regulatory requirements regarding transportation.
- Lock the case in or to the vehicle.

4.3.4 Use and Mainteance

- Use the gauge according to the manufacturer's instructions and recommendations.
- Keep gauges away from heavy equipment that could inadvertently run over the unit and potentially expose the source.
- Do not touch the end of the source rod with your fingers, hamds, or any part of your body or place any part of the body in the radiation field of the unshielded source.
- If gauges are used for measurements with the unshielded source extended more than 3 feet (1 meter) below the ground surface, use piping, tubing or other casing material to line the hole from the lowest depth o 12 inches (0.3 meters) above the surface. If the piping, tubing, or other casing material cannot extend 12 inches (0.3 meters) above the surface, cap the hole liner or take other

steps to ensure that the hole is free of debris (and it is unlikely that debris will enter the cased hole), os that the unshielded soruce can move freely (e.g., use a dummy probe to verify that the hole is free of obstructions).

- Unless absolutely necessary, do not look under the gauge when the source rod is being lowered into the ground. If you must look under the gauge to align the source rod with the hole, keep all body parts as far from the unshielded source as possible to minimize radiation exposure.
- After completing each measurement in which the source is unshielded, immediataely return the source to the shiedled position.
- Return the gauge to its proper storage location at the end of the work shift.
- Log the gauge into the daily use log when it is returned to storage. Perform routine cleaning and maintenance according to the manufacturer's instructions and recommendations.

4.3.5 Security

- Always maintain constant surveillance and immediate control of the gauge when it is not in storage or secured in the transport vehicle.
- Never leave an unsecured gauge unattended.
- Always keep unautherized persones away from the area when the gauge is being used.

## 4.4 Emergency Procedures

Lost or stolen gauges and gauges damaged by heavy equipment used at the job site are the most common emergencies that present a potential radiation safety risk. Other emergencies include the failure of the source in the neutron probe to return to the shielded position as a result of being damaged or stuck below the ground surface.

To limit radiation dose to **Authorized Operators** and the public, each **License RSO** must ensure that an energency procedure(s) is implemented and maintained. A copy of the emergency procedure(s) should be distributed to gauge users before initial use of equipment and maintained at the job site. Energency procedures should include the following requirements:

4.4.1 Lost or Stolen Gauge

- The **Authorized Operator** must notify the **License RSO** as soon as it is determined that a gauge is missing.
- The **License RSO** will immediately notify the rental firm, if applicable, and contact appropriate Regulating Agency to notify them of the missing or stolen gauge.
- The **License RSO** will notify the **AECOM Corporate RSO** and follow all AECOM incident reporting procedures.
- The **Authorized Operator** and the **License RSO** will discuss the reasons for the theft/loss and make the necessary changes in the gauge storage area and/or gauge transportation procedures.

4.4.2 Damaged Gauge

- Refer to the RAM License specific operating procedures for guidance on gauge damage procedures for specific portable gauges.
- Immeddiately secure the area and keep people at least 15 feet (5 meters) from the gauge until the situation is assessed and radiation levels are known. However, perform first air for injuried individuals and remove them from the area only when medically safety to do so.
- If any heavy equipment if involved, detain the equipment and operator until it is determined there is no contmiantion present.
- Gauge users and other potentially contaminated individuals should not leave the scene until emergency assistance arrives.
- Visually inspect the gauge to determine the position of the source rod (exposed or shielded), and the position of the source shutter (open or closed), and the extent of damage, if any, to the source housing and/or shield.
- In all cases, immediately contact the **License RSO** and the **Licnese RSO** will contact the Regulatory Agency and make reports within the required reporting timeframe.
- The **License RSO** will notify the **AECOM Corporate RSO** and follow all AECOM incident reporting procedures.
- The **License RSO** must arrance for a radiation survey to be conducted as soon as possible.

- Before shipping a damaged gauge, contact the **AECOM Corporate RSO** and the gauge receipient for special requirements.

4.4.3 Stuck Source

- Use the gauge manufacturer's recommended procedures for retrieving a stuck source. When it becomes apparent that efforts to recover the source will be unsuccessful, the **License RSO** will contact the Regulatory Agency.
- The **License RSO** will notify the **AECOM Corporate RSO** and follow all AECOM incident reporting procedures.

## 4.5 Employee Training and Qualification

Only those AECOM employees, or subconsultants, who have been authorized by a **License RSO** to operate portable gauges, will be permitted to operate gauges at jobsites on behalf of AECOM. The **License RSO** must keep records of all employee training.

The **License RSO** shall have either documented gauge safety training as outlined below or documented RSO training.

4.5.1 Initial Training

- Employees who wish to operate a portable gauging device must successfully complete the following instruction before operating the device:
  - A gauge manufacturer's training course (that meets the criteria in the section entitled "Training for Individuals Working In or Frequenting Restricted Areas" in Draft NUREG-1556, Vol 1, dated September 1996) for the specific gauge to be operated.
  - Instruction by the **AECOM License RSO** on the contents of this standard operating procedure
  - Completion of HAZMAT DOT shipping training for portable gauges (US operators)
- If employees have received initial training in an alternative course or previously through another employer, the **RSO** may still require the employee to participate in the gauge manufacturer's training course.

4.5.2 Annual Refresher Training

- The **License RSO** will conduct, on an annual basis, a refresher training course for all authorized operators of portable gauges containing sealed sources. The refresher course will include the following topics:
  - Changes in CNSC, NRC, or state regulations.
  - Changes in AECOM's license or license conditions.
  - Review of the contents of this standard operating and emergency procedure including a "dry run" of AECOM's emergency procedures.
  - Review of deficiencies identified during annual audit of the license's radiation safety program (as it relates to the use of portable gauges).
  - Review requirements for the transport of sealed sources in portable gauges.

4.5.3 Radiation Awareness Training

- AECOM personnel in offices or other locations where gauge sources are storded shall receive Radiation Awareness (RA) training in accordance with the AECOM Corporate Raditaion Safety Program (*S3NA-516-PR*) and applicable license and RPP requrements. RA training will cover, at a minimum, the hazrds associated with the stored radiation soruces, recognition of radiation warning signs, location of stored sources, and emergency procedures.

## 4.6 Gauge Disposal and Transfer

- All portable gauges assigned for disposal or transfer must be transferred to regulatory licensed entity approved for the possession, storage, and disposal for the given source types. Gauges containing licensed radioactive material and shall not be disposed in the trash. Contact the **License RSO** to properly dispose of a portable gauge that contains a radioactive source. Upate all inventory records foolowing gauge disposal or transfer.

## 5.0 Records

5.1 AECOM understands that our records are evidence of our efforts to maintain compliance with the conditions of the respective RAM Licenses and applicable regulations. As such, the License RSO will be responsible for maintaining the following records. Records shall be maintained in a manner that is conducive to being audited by the licensing authority or the AECOM Corporate RSO. Copies of records should be provided to the Corproate RSO.

5.1.1 Employee's initial and refresher training records will be maintained for a period of no less than 3 years after the individual terminates employment with AECOM.

5.1.2 Equipment inventory records will be maintained for at least 3 years from the date of the inventory.

5.1.3 Annual audit reports will be maintained for 3 years.

5.1.4 Leak test reports will be maintained for 3 years.

5.1.5 Calibration records for each radiation survey meter used at job sites, if necessary, will be maintained for 3 years.

5.1.6 Personnel monitoring results.

5.1.7 Radiation screening records, if generated, will be maintained for 3 years.

## 6.0 References

6.1 AECOM Corprotate Radiation Safety Program (S3NA-516-PR)US Code of Federal Ragulations Title 10, Part 20 (10 CFR 20), Standards for Protection Against Radiation Canadian Radiation protection Regulations (SOR-2000-203).

6.2 Canadian Nuclear Substances and Radiation Devices Regulations (SOR-2000-203).Working Safety With Nuclear Gauges, Canadian Nuclear Safety Commission, http://www.nuclearsafety.gc.ca/eng/readingroom/publications/gauges/index.cfm

# S3NA-519-PR Respiratory Protection Program

## 1.0 Purpose and Scope

1.1 This procedure establishes methods that AECOM will use to prevent employee exposure to hazardous concentrations of airborne contaminants or to supply breathing-quality air to employees working in oxygen-deficient atmospheres.

1.2 This procedure applies to all AECOM North America-based employees and operations.

## 2.0 Terms and Definitions

2.1 **Air-purifying respirator:** A respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

2.2 **Approved:** Equipment tested and listed by the Bureau of Mines, jointly by the Mining Enforcement and Safety Administration (MESA), and the National Institute for Occupational Safety and Health (NIOSH), or jointly by the Mine Safety and Health Administration (MSHA) and NIOSH.

2.3 **Assigned protection factor (APF):** The ratio of the ambient concentration of an airborne substance (outside the respirator) to the concentration of the substance inside the respirator. NIOSH defines this as 10 for an approved half-face respirator and 50 for an approved full-face respirator.

2.4 **Atmosphere-supplying respirator:** A respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

2.5 **Breakthrough:** The first perception of an odor, taste or irritation experienced while wearing an air-purifying respirator. Breakthrough is generally an indication that the cartridges are saturated and are no longer filtering out the contaminant. Breakthrough can also be an indication of an improperly functioning respirator.

2.6 **Confined space:** An enclosure, such as a storage tank, process vessel, boiler, silo, tank car, pipeline, tube, duct, sewer, underground utility vault, tunnel, or pit, that has limited means of egress and poor natural ventilation and that may contain hazardous contaminants or be oxygen deficient.

2.7 **Canister or cartridge:** A container that has a filter, sorbent, or catalyst, or a combination of these items and that removes specific contaminants from the air passed through the container.

2.8 **Demand respirator:** An atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

2.9 **Emergency situation:** Any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant.

2.10 **Employee exposure:** Exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.

2.11 **End-of-service-life indicator (ESLI):** A system that warns the respirator user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective.

2.12 **Escape-only respirator:** A respirator intended to be used only for emergency exit.

2.13 **Filter or air purifying element:** A component used in respirators to remove solid or liquid aerosols from the inspired air.

2.14 **Filtering facepiece (dust mask):** A negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

2.15 **Fit factor:** A quantitative estimate of the fit of a particular respirator to a specific individual, typically estimating the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

2.16 **Fit test:** The use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual. (See also Qualitative fit test QLFT and Quantitative fit test QNFT.)

2.17 **Helmet:** A rigid respiratory inlet covering that also provides head protection against impact and penetration.

2.18 **HASP:** Health and Safety Plan

2.19 **Hazardous atmosphere:** Any atmosphere, either immediately or not immediately dangerous to life or health, that is oxygen-deficient or that contains a toxic or disease-producing contaminant exceeding the legally established permissible exposure limit (PEL) or, where applicable, the Threshold Limit Value (TLV) established by the American Conference of Governmental Industrial Hygienists (ACGIH).

2.20 **High efficiency particulate air (HEPA) filter:** A filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters.

2.21 **Hood:** A respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

2.22 **Immediately dangerous to life or health (IDLH):** An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

2.23 **Loose-fitting facepiece:** A respiratory inlet covering that is designed to form a partial seal with the face.

2.24 **Maximum use concentration (MUC):** The protection factor (PF) of an approved respirator assembly times the permissible exposure limit (PEL). MUC = PF x PEL

2.25 **Negative pressure respirator (tight fitting):** A respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

2.26 **Oxygen deficient atmosphere:** An atmosphere with oxygen content below 19.5% by volume.

2.27 **Powered air-purifying respirator (PAPR):** A respirator that contains a blower that passes ambient air through an air-purifying component. Air-purifying respirators may be half-face (covering the nose and mouth) or full-face (covering the eyes, nose, and mouth).

2.28 **Physician or other licensed health care professional (PLHCP):** An individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide or be delegated the responsibility to provide some or all of the health care services required by paragraph (e) of this section.

2.29 **Positive pressure respirator:** A respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

2.30 **Powered air-purifying respirator (PAPR):** An air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

2.31 **Program administrator:** The individual that has the responsibility to verify full compliance with this SOP and determines the need for medical evaluations or any other additional medical attention in regards to the use of a respirator.

2.32 **Pressure demand respirator:** A positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

2.33 **Qualitative fit test (QLFT):** A pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

2.34 **Quantitative fit test (QNFT):** An assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

2.35 **Respiratory inlet covering:** That portion of a respirator that forms the protective barrier between the user's respiratory tract and an air-purifying device or breathing air source, or both. It may be a facepiece, helmet, hood, suit, or a mouthpiece respirator with nose clamp.

2.36 **Self-contained breathing apparatus (SCBA):** An atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

2.37 **Service life:** The period of time that a respirator, filter or sorbent, or other respiratory equipment provides adequate protection to the wearer.

2.38 **Supplied-air respirator (SAR) or airline respirator:** An atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

2.39 **Tight-fitting facepiece:** A respiratory inlet covering that forms a complete seal with the face.

2.40 **User seal check:** An action conducted by the respirator user to determine if the respirator is properly sealed to the face.

## 3.0 Attachments

3.1 S3NA-519-FM1 Respiratory Equipment Fit Test

3.2 S3NA-519-FM2 Respiratory Equipment Maintenance Log

3.3 S3NA-519-FM3 Respiratory Equipment Inspection

3.4 S3NA-519-WI1 Fit Testing Protocol

3.5 S3NA-519-WI2 User Seal Check Procedures

3.6 S3NA-519-WI3 Respirator Cleaning Procedures

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Program Administrator.** The AECOM Americas **SH&E Director** is the Respiratory Protection Program Administrator. The **Program Administrator** shall:

- Verify full compliance with this SOP.
- Determine the need for medical evaluations or any other additional medical attention related to the use of a respirator.
- Perform the program evaluations described in this SOP.

4.1.2 **District/office manager** and **project manager (including Operations Field Manager, supervisors, etc)** shall**:**

- Verify compliance with the respiratory protection program set forth in this procedure.
- Verify that only those employees who are medically qualified, properly trained, and fit tested are assigned to respirator work.
- Verify that respirators are provided, repaired, or replaced as may be required due to wear and deterioration.

4.1.3 **Region SH&E Manager** shall**:**

- Monitor compliance with the various aspects of this program.
- Provide technical assistance regarding respirator selection and use, evaluate the effectiveness of this program, and support respirator training and fit testing.
- Audit company compliance with this procedure.

4.1.4 **Employees** shall**:**

- Will use the provided respiratory protection in accordance with instructions and training received.
- Will guard against damage to the respirator.
- Will report immediately any malfunction of the respirator to the supervisor or other responsible person.

4.2 **Medical Surveillance**

> No employee shall be assigned to a task that requires the use of a respirator unless it has been determined that he/she is physically able to perform the work while using the required respirator.

4.2.1 Prior to wearing a respirator, **employees** will complete an initial baseline medical surveillance examination performed by a PLHCP in accordance with the requirements of the Medical Surveillance Program (*S3NA-605- PR Medical Surveillance Program).*

4.2.2 **Employees** who continue to use respiratory protection will receive an annual medical surveillance examination.

4.2.3 Additional medical examinations will be provided to employees who wear respirators if/when:

- An **employee** reports medical signs or symptoms that are related to ability to use a respirator;
- A PLHCP, supervisor, or the respirator program administrator determines that an employee needs to be reevaluated;
- Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation; or
- A change occurs in workplace conditions (e.g., physical work effort, protective clothing, temperature, etc.) that may result in a substantial increase in the physiological burden placed on an employee.

4.2.4 All medical surveillance examinations shall occur during normal working hours; shall be convenient, understandable, and confidential; and the employee will be given chance to discuss results with examining physician.

## 4.3 Training

4.3.1 Project staff that may be exposed to the hazard will be oriented to the hazard and the controls prior to beginning work.

4.3.2 Atmospheric testing will be carried out by someone trained in the use, calibration, and interpretation of the test equipment.

4.3.3 **Employees** who may be required to use a breathing apparatus shall be properly trained in the operation, maintenance, cleaning and storage of the apparatus.

4.3.4 All staff will receive an orientation to the hazards on the job site as well as initial Field Safety training which outlines appropriate PPE requirements.

4.3.5 **Employees** who wear respiratory protection must receive training before they are assigned to a task that requires the use of respiratory protection.

4.3.6 Retraining shall be administered annually, and when the following situations occur:

- Changes in the workplace or the type of respirator render previous training obsolete;
- Inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill; or
- Any other situation arises in which retraining appears necessary to verify safe respirator use.

4.3.7 Frequency of Training

- All employees who may have the need to wear respiratory protection are required to participate in AECOM's internal SH&E training program.
- In addition, AECOM's SH&E Department will conduct respirator training classes, as necessary, for those who may need to wear respiratory protection but did not participate in AECOM's HAZWOPER training classes.

4.3.8 Basic Respirator Training Program

Respirator training classes will include, at a minimum, the following:

- Instruction in the nature of the respiratory hazards, whether acute, chronic, or both, and a description of potential health effects if the respirators are not used.

- Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator.
- The limitations and capabilities of the respirator.
- Proper fitting, including demonstrations and practice in wearing, adjusting, determining the fit of, and performing a user seal check (in accordance with *S3NA-519-WI1 Fit Testing Protocol)* each time respirator is donned.
- How to inspect, put on, use and remove the respirator.
- How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions.
- The procedures for maintenance and storage of the respirator.
- How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators.
- The general requirements of the OSHA and OH&S Respiratory Protection Standard.

### 4.4 Respirator Selection

4.4.1 AECOM will maintain air purifying respirators and cartridges from at least two providers (i.e. MSA and North).

4.4.2 Prior to fit testing, the employee shall be allowed to pick the most comfortable respirator from the brands offered.

4.4.3 The type of respirator most commonly used by AECOM staff is a cartridge type air purifying respirator (APR). Many different types of APRs exist, and field staff should always fit test an APR prior to use.

### 4.5 Fit Testing Procedures

4.5.1 A respirator that doesn't fit properly will not provide adequate protection.

4.5.2 Four types of tests can be used:

- Positive Pressure Sealing Check: Close off the exhalation valve and exhale gently. The fit is satisfactory if a slight positive pressure can be built up inside the face piece for a full 10 seconds without detecting any outward leakage of air between the sealing surface of the face piece and the wearer's face.
- Negative Pressure Sealing Check: Close off the inlet opening of the cartridges by covering them with the palm of the hands. Inhale gently and hold breath for at least 10 seconds. The face piece should collapse slightly with no detection of inward leakage of air into the face piece.
- Isoamyl Acetate Test (banana oil test): A tube or bottle of banana oil is held in front of and around the mask. The fit is adequate if the wearer does not detect the odour of bananas. During the test, the wearer should be demonstrating movements that approximate a normal working situation, including deep breathing, side-to-side and up-and-down head movements, and talking.
- Irritant Smoke Test (Stannic Chloride Test): The procedure is similar to that of the banana oil test except that an irritant smoke is used. The wearer of the mask will cough (involuntary reaction) if he/she detects the irritant smoke in the mask.

4.5.3 Fit Testing Frequency

Additional fit tests will be performed:

- Whenever there is an indication that changes in the **employee's** physical condition might have an effect on respirator fit. (Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.)
- Whenever there is an indication that changes in the **employee's** physical condition might have an effect on respirator fit. (Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.)
- If the **employee** notifies his/her supervisor or Regional SH&E Manager that the fit of his/her respirator is unacceptable.

4.5.4 Fit Testing Records

A written record of each fit test performed must be maintained in the **employee's** health and safety records. *S3NA-519-FM1 Respiratory Equipment Fit Test* will be used to document each fit test.

### 4.6 Interference with Gas-Tight Seal

Respiratory protection can only be worn when it can be determined that there is no obstruction of contact between the wearer's skin and the sealing surfaces of the mask whatsoever. Such obstruction can include facial hair, head hair, and the temple bars of eye glasses.

4.6.1 Respirator wearers cannot be afforded protection from hazardous airborne contaminants when conditions prevent a complete gas-tight face seal.

4.6.2 Although eyeglass temple bars will interfere with the formation of a gas-tight face seal in the case of full-face respirators, this problem is correctable by use of internally mounted spectacle kits. Management and supervisors shall verify that **employees** under their supervision who regularly wear eyeglasses, and who will require the use of a full-face respirator, are provided with appropriate spectacle kits at company expense.

The use of contact lenses in hazardous atmospheres or in operations involving intense heat, molten metals or the potential for chemical splash shall be prohibited.

4.6.3 Because facial hair (even beard stubble) will interfere with a gas-tight seal, employees shall be required to be clean- shaven whenever the use of respiratory protection is specified.

4.6.4 Respiratory Protection will only be assigned to those **employees** without physical obstructions to a gas-tight face seal to jobs that may require the use of respiratory protection. Candidates for employment shall be made aware that their versatility may be limited if they cannot wear a respirator and that this can affect their job assignments.

### 4.7 Specification of Proper Level of Respiratory Protection

4.7.1 The **Region SH&E Manager** or his/her designated and qualified representative is responsible for specifying the proper selection and use of all respiratory protective devices, including half-face and full-face air purifying respirators, airline respirators, and self-contained breathing apparatus. This information is generally specified as part of the written site-specific Health and Safety Plan (HASP).

4.7.2 **Employees** engaged in activities not covered by a HASP must consult with the **Region SH&E Manager** or his/her designated representative to determine the proper equipment prior to use. Whenever appropriate, exposure levels will be measured to verify that the actual use conditions are within the limitations of the approvals specified by NIOSH/MSHA for the selected respirator.

4.7.3 Conditions Required for Air-Purifying Respirator (APR) Use

Air-purifying respirators (APR) shall only be specified for use when it can be determined that the following conditions exist:

- The oxygen concentration is greater than 19.5%.
- The contaminant is known and its concentration can be quantified.
- The airborne contaminant concentration is below its IDLH.
- A canister or cartridge is available which is approved for the contaminant.
- The contaminant concentration is below the concentration for which the canister is approved.
- The contaminant concentration is below the Maximum Use Concentration (MUC) of the respirator.

In all cases where OSHA has specified that a particular respirator be used (asbestos, formaldehyde, benzene, arsenic, lead, etc.), that respirator, or one providing equal or better protection, shall be specified.

4.7.4 APR Filter and Chemical Cartridges

An adequate supply of the following cartridges shall be maintained in stock at each office location where respiratory protective equipment:

- High efficiency particulate air (HEPA) filter cartridges;
- Organic vapor cartridges; and
- Combination HEPA/acid gas/organic vapor cartridges

4.7.5 Change Out Schedule

Filter cartridges shall be changed out whenever an increase in breathing resistance is detected by the user.

When available, chemical cartridges that are equipped with end-of-service life indicators (ESLI) shall be utilized. In those cases, cartridges should be changed when indicated by the ESLI.

In the absence of cartridges equipped with an ESLI, employees shall change chemical cartridges on the following schedule:

- Immediately if breakthrough is perceived;
- In accordance with the change out schedule developed by the Regional SH&E Manager in the site-specific Health and Safety Plan (HASP); and
- After each day's use.

The change out schedule will be based upon the anticipated contaminant concentration, environmental conditions, employee work rate, and the specific data provided by manufacturer

When powered air-purifying respirators **(**PAPRs) are worn, the same rules apply with the exception that filter cartridges should be changed when airflow through the filter elements decreases to an unacceptable level, as indicated by the manufacturer's test device.

## 4.8 Air-Supplying Respirator Use

4.8.1 Conditions Requiring Use of Air-Supplying Respirators

Air-supplying respirators will be specified for use when it has been determined that any of the following conditions exist:

- The oxygen concentration is less than 19.5%;
- The contaminant is unknown or its concentration cannot be quantified;
- The airborne contaminant concentration is above its IDLH;
- An air-purifying respirator canister or cartridge that removes the contaminant is not available;
- The contaminant concentration is above the concentration for which an air-purifying canister or cartridge is approved; or
- The contaminant concentration is above the Maximum Use Concentration (MUC) of a full-face air-purifying respirator.

No employee may engage in an operation requiring the use of an air-supplied respirator unless a representative of the SH&E Department has reviewed the operation and approved its use.

The determination of the type of air-supplying respirator (i.e., SCBA, air-line, demand, pressure demand, etc.) which is appropriate for the job, outside standby persons, communication, proper training and equipment, notification procedures, and necessary action all require planning. Mandatory equipment including SCBA or SAR with auxiliary air supply & emergency appropriate retrieval equipment or equivalent rescue means will be made by the **Region SH&E Manager** or his/her designated representative at the time of review. The need for any additional precautions (i.e., equipment specific training, on-site H&S support, etc.) will also be determined by the **Region SH&E Manager**.

## 4.9 Minimum Procedures for IDLH atmospheres

4.9.1 One **employee** or, when needed, more than one employee shall be located outside the IDLH atmosphere. This employee shall be responsible for communicating with the **employees** in the IDLH atmosphere, alerting rescue services if needed, and restricting entrance to the IDLH area by untrained and unapproved persons.

4.9.2 Visual, voice, or signal line communication shall be maintained between the **employee**(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere.

4.9.3 The **employee**(s) located outside the IDLH atmosphere shall be trained and equipped to provide effective emergency rescue or to initiate onsite rescue services.

4.9.4 If on-site rescue services are to be used, the **Site Safety Officer** shall confirm that the service is available to respond prior to any employees entering the IDLH area.

4.9.5 **Employee**(s) located outside the IDLH area and/or on-site rescue services shall be equipped with:

- Pressure demand or other positive pressure SCBAs, or a pressure demand or other positive pressure supplied-air respirator with auxiliary SCBA; and either
- Appropriate retrieval equipment for removing the employee(s) who enter(s) these hazardous atmospheres where retrieval equipment would contribute to the rescue of the employee(s) and would not increase the overall risk resulting from entry; or
- Equivalent means for rescue where retrieval equipment would create a hazard to the workers in the IDLH area.

## 4.10 Breathing Air Quality

> Compressed air used for respiration shall be of high purity and shall meet, as a minimum, the requirements of the specification for Grade D breathing air as described in Compressed Gas Association Specification G-7.1 (ANSI Z86.1).

Oxygen shall NOT be used as a source of breathing air at any time in open-circuit SCBAs or air-line respirators.

4.10.1 Compressor Supplied Breathing Air

All compressors used for filling SCBA air cylinders or for supplying air-line respirators shall be equipped with the following safety and standby devices:

- The compressor intake shall be located to verify that only respirable (uncontaminated) air is admitted. This requires attention to the location of the compressor intake with respect to compressor engine exhaust, chemical storage or use areas, and suitable intake screening or filtration.
- Alarms to indicate compressor failure (such as low-pressure air horns, etc.) shall be installed in the system.
- A receiver of sufficient capacity to enable the respirator wearer to exit from a contaminated atmosphere shall be provided.

If an oil-lubricated compressor is used to supply breathing air, it shall be equipped with both of the following devices:

- A continuous reading carbon monoxide monitoring system set to alarm should the carbon monoxide concentration exceed 10 ppm; and,
- A high temperature alarm which will activate when the discharge air exceeds 110% of the normal operating temperature in degrees Fahrenheit.

An in-line purifying filter assembly to remove oil, condensed water, particulates, odors, and organic vapors shall be used in conjunction with the air compressor.

Routine inspection and maintenance of air compressor shall be performed.

4.10.2 Compressed Air Cylinders

Breathing air cylinders shall be legibly identified with the word AIR by means of stenciling, stamping, or labeling as near to the valve end as practical.

Cylinders shall be stored and handled to prevent damage to the cylinder or valve.

> Cylinders shall be stored upright with the protective valve cover in place and, in such a way (e.g. supported with substantial rope or chain in the upper one third of the cylinder, or in racks designed for this purpose) as to prevent the cylinder from falling.

Cylinders shall not be dropped, dragged, rolled, or allowed to strike each other or to be struck violently. Cylinders shall never be exposed to temperatures exceeding $125^0$ F. Cylinders with visible external damage, evidence of corrosion damage, or exposure to fire shall not be accepted or used.

Only cylinders within current hydrostatic test periods shall be used. Steel cylinders must be hydrostatically tested every five years and fiberglass wrapped aluminum cylinders must be tested every three years.

4.10.3 Compressed Air Cylinder Systems for Air-Line Respirators

Compressed air cylinder systems used to supply air-line respirators shall be equipped with low pressure warning bells (e.g., Scott Pak-Alarm) or similar warning devices to indicate air pressure in the manifold below 500 psi. When such systems are used, one employee shall be assigned as safety standby within audible range of the low pressure alarm.

Air-line hose couplings shall be incompatible with outlets for other gas systems to prevent inadvertently supplying air-line respirators with nonrespirable gases or oxygen.

The air pressure at the hose connection to air-line respiratory equipment shall be within the range specified in the approval of the equipment by the manufacturer.

4.10.4 Compressed Air Cylinder Systems for Recharging SCBAs

When a cascade system is used to recharge SCBA air cylinders, it shall be equipped with a high-pressure supply hose and coupling rated at a capacity of at least 3000 psi.

4.10.5 Escape/Egress Units

Escape/egress unit respirators are intended for use in areas where escape with a short-term (5 minutes) air supply is necessary.

They may be used as adjuncts to airline pressure demand respirators as a backup air supply or as independent emergency devices in areas where respiratory protection is not normally required.

Appropriate training shall be conducted and documented prior to assigning employees to tasks or locations subject to the use of these respirators.

> Escape/egress units (5 minutes) shall never be used to enter a hazardous atmosphere or as primary standby respirators for confined space entry.

4.10.6 Respirator Inspection, Cleaning, Maintenance, and Storage

When respirator use is required, only properly cleaned and maintained NIOSH/MSHA approved respirators shall be used.

4.10.7 Inspection

- Respirators should be inspected before and after use. Those for emergency use should be inspected once per month.
- All connections, including gaskets, o-rings should be checked for damage and tightness.
- The face piece should be inspected for cracks and rubber or elastomer parts should be checked for deterioration and pliability.
- All respirators shall be inspected routinely by the user before, during, and after each use. Defects shall be reported to supervision. No defective respirator shall be issued or worn.

- Routinely used respiratory equipment shall be inspected by an individual qualified by experience or training to do the work.

4.10.8 Cleaning and Maintenance

- Respirator facepiece assemblies shall be cleaned and sanitized minimally after each day of use in accordance with the requirements specified in *S3NA-519-WI3 Respirator Cleaning Procedures*.
- Respiratory equipment shall not be passed from one person to another until it has been cleaned and sanitized.
- Respiratory equipment shall be maintained according to manufacturer's instructions.
- Where respirators are assigned to individual employees, management shall verify compliance with cleaning and maintenance requirements by periodic inspection and field audits of respiratory equipment.
- Respirators must be cleaned after each use and then placed into a clean bag for storage.
- Prior to cleaning, the filters, cartridges, or canisters must be removed and discarded.
- The respirator should then be inspected for any damaged parts (repair should only be done by trained personnel with the proper tools) and cleaned with a hot water/mild detergent solution.
- In field situations, a premoistened towelette (e.g., baby wipes) can be used. The mask should then be rinsed with clean warm water and dried.
- Alcohol should never be used to clean masks as it can damage the face pieces and rubber parts.

4.10.9 Storage

- Store clean respirators so that they are protected from dust, excessive moisture, damaging chemicals, temperature extremes and direct sunlight. They should be placed in a sealed plastic bag and stored in the original box.

> When not in use, respirator facepieces shall be placed in clean Ziploc-style bags and stored to protect against dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals.

## 4.11 Hygiene

Employees must leave the work area to wash, change cartridges, or if they detect breakthrough or resistance.

## 4.12 Program Evaluation

4.12.1 The **Region SH&E Manager** will conduct evaluations of the workplace as necessary to verify that the provisions of the current written program are being effectively implemented and that it continues to be effective.

4.12.2 The **Region SH&E Manager** will regularly (i.e., during annual training) consult employees required to use respirators to assess their views on program effectiveness and to identify any problems. Any problems that are identified during this assessment shall be corrected. Factors to be assessed include but are not limited to:

- Respirator fit (including the ability to use the respirator without interfering with effective workplace performance);
- Appropriate respirator selection for the hazards to which the employee is exposed;
- Proper respirator use under the workplace conditions the employee encounters; and
- Proper respirator maintenance.

4.13 **Costs**

4.13.1 The costs for training, medical examinations, fit testing, respirators, and cleaning materials should be considered as operational costs for the respective AECOM business lines.

## 5.0 Records

### 5.1 Medical Records

Medical records under this section will be maintained at a minimum in accordance with 29 CFR 1910.1020 – Access to Employee Exposure and Medical Records (*S3NA-604 Medical Records*).

### 5.2 Fit Test Records

Fit test records will include the name of the employee tested; the type of fit test performed; the specific style, make, model, and size of the respirator tested; the date of the test; and the pass/fail results for QLFTs or QNFT test documentation (i.e., strip charts).

### 5.3 Training Records

- Respiratory protection training records will be maintained by the employee with copies provided to their SH&E Coordinators or Administrators.
- On-site records of training and fit testing will be maintained as necessary.
- For situations where training is required by and provided by clients, copies of SH&E Records shall be maintained by AECOM.

## 6.0 References

6.1 The following standards apply to respiratory equipment:

| Association | Standard |
|---|---|
| **Canadian Standards Association (CSA)** | Z180.1-00, Compressed Breathing Air and Systems<br>Z94.4-02, Selection, Use and Care of Respirators |
| **Department of Labor - Occupational Safety and Health Administration** | 29 Code of Federal Regulation 1910. 134<br>29 Code of Federal Regulation 1926.103 |

# S3NA-519-FM1 Respiratory Equipment Fit Test

| **Date of Testing:** | | **Respirator Type(s):** | |
|---|---|---|---|
| **Employee Name:** | | **Location:** | |
| **Method & Testing Agent:** | | | |
| **Test Exercise** | **Pass / Fail** | **Test Exercise** | **Pass / Fail** |
| Sensitivity Check | | Normal Breathing | |
| Deep Breathing | | Turning Head (side to side) | |
| Moving Head (up/down) | | Rainbow Passage* | |
| Bending Over | | Normal Breathing | |

**Successful Respirator Fit Determined:** ☐ **Yes** ☐ **No**

I certify that I have been tested with the respirator(s) listed above. I have also had the opportunity to ask questions and those questions have been answered to my satisfaction. I also understand that the above fit test is voided if respirator limitations are not followed or the respirator is not worn or if conditions (e.g., facial hair) prevent a good face seal.

| Employee Signature: | Date: |
|---|---|
| Signature of Tester: | Date: |

***Rainbow Passage.** "When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch with its path high above and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow."*

| | | | | | | |
|---|---|---|---|---|---|---|
| Date:<br>Tester: | MSA Comfo II HM<br>S ☐ M ☐ L ☐ | MSA Ultra Twin FM<br>S ☐ M ☐ L ☐ | North 7700 HM<br>S ☐ M ☐ L ☐ | North 7600 FM<br>S ☐ M/L ☐ | HM<br>S ☐ M ☐ L ☐ | FM<br>S ☐ M ☐ L ☐ |
| Qualitative Test Agent(s):<br>IAA ☐ Smoke ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ |
| Quantitative Test Device | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor |
| Date:<br>Tester: | MSA Comfo II HM<br>S ☐ M ☐ L ☐ | MSA Ultra Twin FM<br>S ☐ M ☐ L☐ | North 7700 HM<br>S ☐ M ☐ L ☐ | North 7600 FM<br>S ☐ M/L ☐ | HM<br>S ☐ M ☐ L ☐ | FM<br>S ☐ M ☐ L ☐ |
| Qualitative Test Agent(s):<br>IAA ☐ Smoke ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ |
| Quantitative Test Device | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor |
| Date:<br>Tester: | MSA Comfo II HM<br>S ☐ M ☐ L ☐ | MSA Ultra Twin FM<br>S ☐ M ☐ L ☐ | North 7700 HM<br>S ☐ M ☐ L ☐ | North 7600 FM<br>S ☐ M/L ☐ | HM<br>S ☐ M ☐ L ☐ | FM<br>S ☐ M ☐ L ☐ |
| Qualitative Test Agent(s):<br>IAA ☐ Smoke ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ |
| Quantitative Test Device | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor |

Instructions

1. Complete the employee information at the top of the record (one record per employee).
2. Enter the date of the test and the name of the person conducting the fit test.
3. Circle the brand and model of respirator tested (e.g., MSA Comfo II, North 7700, etc.) or enter another brand and model in one of the last two columns.
4. Circle the size of the respirator tested.
5. For qualitative fit tests, circle the test agent used - IAA = Isoamyl Acetate, Smoke = Irritant Smoke (Stannic Chloride) and the outcome of the test (i.e., Pass or Fail).
6. For quantitative fit tests, enter the name of the instrument used and the overall fit factor measured by the test.
7. Keep a copy in the employee's training files and enter subsequent (e.g., annual) tests until the record is filled.

# S3NA-519-FM2 Respiratory Equipment Maintenance Log

| Unit No. | Respirator Type | Cleaned | Sterilized | Date | Performed by |
|---|---|---|---|---|---|
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# S3NA-519-FM3 Respiratory Equipment Inspection

| | | | | |
|---|---|---|---|---|
| **Date:** | | **Inspected by:** | | |
| **Air Purifier Unit #:** | | | | |

| | N/A | Pass | Fail |
|---|---|---|---|
| **Examine Face Piece for**: | | | |
| Excessive dirt | ☐ | ☐ | ☐ |
| Cracks, tears, holes, or distortion from improper storage | ☐ | ☐ | ☐ |
| Inflexibility (stretch and massage to restore flexibility) | ☐ | ☐ | ☐ |
| Cracked or badly scratched lenses in full face pieces | ☐ | ☐ | ☐ |
| Incorrectly mounted full-face piece lens or broken or missing mounting clips | ☐ | ☐ | ☐ |
| Lens sealed properly in receptacle, retaining clamp secured | ☐ | ☐ | ☐ |
| Cracked or broken air-purifying element holder(s), badly worn threads or missing gasket(s) (if appropriate) | ☐ | ☐ | ☐ |
| **Examine the Head Straps or Head Harness for:** | | | |
| Breaks | ☐ | ☐ | ☐ |
| Loss of elasticity | ☐ | ☐ | ☐ |
| Broken or malfunctioning buckles and attachments | ☐ | ☐ | ☐ |
| Excessively worn serrations on the head harness that might permit slippage (full face pieces only) | ☐ | ☐ | ☐ |
| Tears in headband at cradle attachment | ☐ | ☐ | ☐ |
| **Examine the Inhalation and Exhalation Valves for:** | | | |
| Foreign material, such as detergent residue, dust particles, or human hair under the valve seat | ☐ | ☐ | ☐ |
| Cracks, tears, or distortion in the valve material | ☐ | ☐ | ☐ |
| Improper insertion of the valve body in the face piece | ☐ | ☐ | ☐ |
| Cracks, breaks, or chips in the valve body, particularly in the sealing surface | ☐ | ☐ | ☐ |
| Missing or defective valve cover | ☐ | ☐ | ☐ |
| **Examine the Air Purifying Elements for:** | | | |
| Incorrect cartridge, canister, or filter for the hazard | ☐ | ☐ | ☐ |
| Incorrect installation, loose connection, missing or worn gaskets, or cross-threading in the holder | ☐ | ☐ | ☐ |
| Expired shelf life date on cartridge or canister | ☐ | ☐ | ☐ |

| | | |
|---|---|---|
| Defects Noted: | | |
| Unit Deemed Suitable for Use | ☐ Yes | ☐ No |

# S3NA-519-WI1 Fit Testing Protocol

## 1.0 Selection

1.1 The test subject shall be allowed to pick the most acceptable respirator from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

1.2 Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension, and how to determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject’s formal training on respirator use, because it is only a review.

1.3 The test subject shall be informed that he/she is being asked to select the respirator that provides the most acceptable fit. Each respirator represents a different size and shape and if fitted and used properly will provide adequate protection.

## 2.0 Comfort

2.1 The test subject shall be instructed to hold each chosen face piece up to the face and to eliminate those that obviously do not give an acceptable fit.

2.2 The more acceptable face pieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort.

2.3 If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

2.4 Assessment of comfort shall include a review of the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

- Position of the mask on the nose
- Room for eye protection
- Room to talk
- Position of mask on face and cheeks

## 3.0 Fit Test Criteria

3.1 The following criteria shall be used to help determine the adequacy of the respirator fit:

- Chin properly placed;
- Adequate strap tension, not overly tightened;
- Fit across nose bridge;
- Respirator of proper size to span distance from nose to chin;
- Tendency of respirator to slip;
- Self-observation in mirror to evaluate fit and respirator position.

3.2 The test subject shall conduct a user seal check, either the negative and positive pressure seal checks described in *S3NA-519-WI2 User Seal Check Procedures* or those recommended by the respirator manufacturer that provide equivalent protection to the procedures in *S3NA-519-WI2 User Seal Check Procedures.*

3.3 Before conducting the negative and positive pressure checks, the subject shall be told to seat the mask on the face by moving the head from side to side and up and down slowly while taking in a few slow deep breaths. Another face piece shall be selected and retested if the test subject fails the user seal check tests.

3.4 The test shall not be conducted if there is any hair growth between the skin and the face piece sealing surface, such as stubble beard growth, beard, mustache, or sideburns that cross the respirator sealing surface. Any type of apparel that interferes with a satisfactory fit shall be altered or removed.

3.5 If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician or other licensed health care professional, as appropriate, to determine whether the test subject can wear a respirator while performing her or his duties.

3.6 If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.

## 4.0 Exercise Regimen

4.1 Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.

4.2 The fit test shall be performed while the test subject is wearing any applicable safety equipment that may be worn during actual respirator use and that could interfere with respirator fit.

## 5.0 General Test Exercises

5.1 The following test exercises are to be performed for all fit testing methods prescribed in this appendix, except for the CNP method. A separate fit testing exercise regimen is contained in the CNP protocol. The test subject shall perform exercises, in the test environment, in the following manner:

5.1.1 **Normal breathing**. In a normal standing position, without talking, the subject shall breathe normally.

5.1.2 **Deep breathing.** In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as not to hyperventilate.

5.1.3 **Turning head side to side.** Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.

5.1.4 **Moving head up and down.** Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

5.1.5 **Talking.** The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song.

5.1.6 **Rainbow Passage.** "When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch with its path high above and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow."

5.1.7 **Grimace.** The test subject shall grimace by smiling or frowning. (This applies only to QNFT testing; it is not performed for QLFT.)

5.1.8 **Bending over.** The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT or QLFT units that do not permit bending over at the waist.

5.1.9 **Normal breathing**. In a normal standing position, without talking, the subject shall breathe normally (this is the same as the first test).

5.2 Each test exercise shall be performed for one minute except for the grimace exercise, which shall be performed for 15 seconds.

5.3 The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried.

5.4 The respirator shall not be adjusted once the fit test exercises begin. Any adjustment voids the test and the fit test must be repeated.

# 6.0 Qualitative Fit Test (QLFT) Protocols

## 6.1 General

6.1.1 AECOM will ensure that persons administering QLFT are able to calibrate equipment and perform tests properly, recognize invalid tests, and ensure that test equipment is in proper working order.

6.1.2 AECOM will ensure that that QLFT equipment is kept clean and well maintained so as to operate within the parameters for which it was designed.

## 6.2 Irritant Smoke (Stannic Chloride) Protocol

6.2.1 This qualitative fit test uses a person's response to the irritating chemicals released in the "smoke" produced by a stannic chloride ventilation smoke tube to detect leakage into the respirator.

6.2.2 **General Requirements and Precautions:**

- The respirator to be tested shall be equipped with high efficiency particulate air (HEPA) or P100 series filter(s).
- Only stannic chloride smoke tubes shall be used for this protocol.
- No form of test enclosure or hood for the test subject shall be used.
- The smoke can be irritating to the eyes, lungs, and nasal passages. The test conductor shall take precautions to minimize the test subject's exposure to irritant smoke. Sensitivity varies, and certain individuals may respond to a greater degree to irritant smoke. Care shall be taken when performing the sensitivity screening checks that determine whether the test subject can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the test subject.
- The fit test shall be performed in an area with adequate ventilation to prevent exposure of the person conducting the fit test or the build-up of irritant smoke in the general atmosphere.

6.2.3 **Sensitivity Screening Check**

The person to be tested must demonstrate his or her ability to detect a weak concentration of the irritant smoke.

- The test operator shall break both ends of a ventilation smoke tube containing stannic chloride and attach one end of the smoke tube to a low flow air pump set to deliver 200 milliliters per minute or to an aspirator squeeze bulb. The test operator shall cover the other end of the smoke tube with a short piece of tubing to prevent potential injury from the jagged end of the smoke tube.
- The test operator shall advise the test subject that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the subject to keep his/her eyes closed while the test is performed.
- The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties and to determine if he/she can detect the irritating properties of the smoke. The test operator shall carefully direct a small amount of the irritant smoke in the test subject's direction to determine that he/she can detect it.

6.2.4 **Irritant Smoke Fit Test Procedure**

- The person being fit tested shall don the respirator without assistance, and perform the required user seal check(s).
- The test subject shall be instructed to keep his/her eyes closed.
- The test operator shall direct the stream of irritant smoke from the smoke tube toward the face seal area of the test subject, using the low flow pump or the squeeze bulb. The test operator shall begin at least 12 inches from the face piece and move the smoke stream around the whole perimeter of the mask. The operator shall gradually make two more passes around the perimeter of the mask, moving to within six inches of the respirator.

- If the person being tested has not had an involuntary response and/or has not detected the irritant smoke, proceed with the test exercises.
- The General Test Excercises (Section 5.0) shall be performed by the test subject while the respirator seal is being continually challenged by the smoke, directed around the perimeter of the respirator at a distance of six inches.
- If the person being fit tested reports detecting the irritant smoke at any time, the test is failed. The person being retested must repeat the entire sensitivity check and fit test procedure.
- Each test subject passing the irritant smoke test without evidence of a response (involuntary cough, irritation) shall be given a second sensitivity screening check, with the smoke from the same smoke tube used during the fit test, once the respirator has been removed, to determine whether he/she still reacts to the smoke. Failure to evoke a response shall void the fit test.
- If a response is produced during this second sensitivity check, then the fit test is passed.

## 7.0 Quantitative Fit Test (QNFT) Protocols

### 7.1 General

- AECOM will confirm that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly, and ensure that test equipment is in proper working order.
- AECOM will ensure that QNFT equipment is kept clean and is maintained and calibrated according to the manufacturer's instructions so as to operate at the parameters for which it was designed.

### 7.2 Ambient Aerosol Condensation Nuclei Counter (CNC) Quantitative Fit Testing Protocol

7.2.1 The ambient aerosol condensation nuclei counter (CNC) quantitative fit testing (Portacount TM) protocol quantitatively fit tests respirators with the use of a probe. The probed respirator is only used for quantitative fit tests. A probed respirator has a special sampling device installed on the respirator to allow the probe to sample the air from inside the mask. A probed respirator is required for each make, style, model, and size that the employer uses and can be obtained from the respirator manufacturer or distributor. The CNC instrument manufacturer, TSI Inc., also provides probe attachments (TSI sampling adapters) that permit fit testing in an employee's own respirator. A minimum fit factor pass level of at least 100 is necessary for a half-mask respirator, and a minimum fit factor pass level of at least 500 is required for a full face piece negative pressure respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

7.2.2 **Portacount Fit Test Requirements**

- Check the respirator to make sure the sampling probe and line are properly attached to the face piece and that the respirator is fitted with a particulate filter capable of preventing significant penetration by the ambient particles used for the fit test (e.g., NIOSH 42 CFR 84 series 100, series 99, or series 95 particulate filter) according to the manufacturer's instructions.
- Instruct the person to be tested to don the respirator for five minutes before the fit test starts. This purges the ambient particles trapped inside the respirator and permits the wearer to make certain the respirator is comfortable. This individual shall already have been trained on how to wear the respirator properly.
- Check the following conditions for the adequacy of the respirator fit: chin properly placed; adequate strap tension, not overly tightened; fit across nose bridge; respirator of proper size to span distance from nose to chin; tendency of the respirator to slip; self-observation in a mirror to evaluate fit and respirator position.
- Have the person wearing the respirator do a user seal check. If leakage is detected, determine the cause. If leakage is from a poorly fitting face piece, try another size of the same model respirator, or another model of respirator.
- Follow the manufacturer's instructions for operating the Portacount and proceed with the test.
- The test subject shall be instructed to perform the exercises in General Test Excercises (Section 5.0).

- After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried.

7.2.3 **Portacount Test Instrument**

- The Portacount will automatically stop and calculate the overall fit factor for the entire set of exercises. The overall fit factor is what counts. The Pass or Fail message will indicate whether or not the test was successful. If the test was a Pass, the fit test is over.
- Since the pass or fail criterion of the Portacount is user programmable, the test operator shall confirm that the pass or fail criterion meet the requirements for minimum respirator performance.
- A record of the test needs to be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style, and size of respirator used; and date tested.

# S3NA-519-WI2 User Seal Check Procedures

## 1.0 Requirements

1.1 The individual who uses a tight-fitting respirator is to perform a user seal check to confirm that an adequate seal is achieved each time the respirator is put on.

1.2 Either the positive and negative pressure checks listed here or the respirator manufacturer's recommended user seal check method shall be used.

1.3 User seal checks are not substitutes for qualitative or quantitative fit tests.

## 2.0 Facepiece Positive and/or Negative Pressure Checks

### 2.1 Positive pressure check

2.1.1 Close off the exhalation valve and exhale gently into the facepiece.

2.1.2 The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal.

2.1.3 For most respirators, this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.

### 2.2 Negative pressure check

2.2.1 Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s), inhale gently so that the facepiece collapses slightly, and hold your breath for 10 seconds.

2.2.2 The design of the inlet opening of some cartridges cannot be effectively covered with the palm of the hand.

2.2.3 The test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove.

2.2.4 If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

## 3.0 Manufacturer's Recommended User Seal Check Procedures

3.1 The respirator manufacturer's recommended procedures for performing a user seal check may be used instead of the positive and/or negative pressure check procedures, provided that the employer demonstrates that the manufacturer's procedures are equally effective.

# S3NA-519-WI3 Respirator Cleaning Procedures

## 1.0 Requirements

1.1 These procedures are general in nature. The cleaning recommendations provided by the manufacturer may be used for the respirators used by their employees, provided such procedures are as effective as those listed here.

1.2 Equivalent effectiveness simply means that the procedures used must accomplish the objectives set forth (i.e., confirm that the respirator is properly cleaned and disinfected in a manner that prevents damage to the respirator and does not cause harm to the user).

## 2.0 Procedures for Cleaning Respirators

2.1 Remove filters, cartridges, or canisters. Disassemble facepieces by removing speaking diaphragms, demand and pressure-demand valve assemblies, hoses, or any components recommended by the manufacturer. Discard or repair any defective parts.

2.2 Wash components in warm (43$^{o}$C [110$^{o}$F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.

2.3 Rinse components thoroughly in clean, warm (43$^{o}$C [110$^{o}$F] maximum), preferably running water. Drain.

2.4 When the cleaner used does not contain a disinfecting agent, respirator components should be immersed for two minutes in one of the following:

- Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 43$^{o}$C (110$^{o}$F); or,
- Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine (6-8 grams ammonium and/or potassium iodide/100 cc of 45% alcohol) to one liter of water at 43oC (110oF); or,
- Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.

2.5 Rinse components thoroughly in clean, warm (43$^{o}$C [110$^{o}$F] maximum), preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.

2.6 Components should be hand dried with a clean, lint-free cloth or air-dried.

2.7 Reassemble facepiece, replacing filters, cartridges, and canisters where necessary.

2.8 Test the respirator to ensure that all components work properly.

2.9 After the fit test, wipe down the respirator with a sanitary swab.

# S3NA-520-PR Spill Response, Incidental

## 1.0 Purpose and Scope

1.1 This procedure defines the role of AECOM employees in the event of a chemical spill in AECOM offices, laboratories, or storage areas and during field investigations, including the appropriate containment procedures that AECOM employees will follow.

1.2 This procedure applies to all AECOM North America-based employees and operations.

## 2.0 Terms and Definitions

2.1 **Emergency Response**: A response effort by employees from outside the immediate release area or by other designated responders (i.e., mutual aid groups, local fire departments, etc.) to an occurrence that results, or is likely to result, in an uncontrolled release of a hazardous substance or whenever a release requires that a federal or state agency be notified, such as:

2.1.1 A release at or above a reportable quantity (RQ) of a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substance (40 CFR 302.8) is required to be reported to the National Response Center (NRC).

2.1.2 A hazardous chemical release at or above an RQ under the Emergency Planning and Community Right-to-Know Act (EPCRA) (Title III under the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 350-372) is required to be reported to state and local officials.

2.1.3 A release in violation of a facilities Spill Prevention, Control, and Countermeasure (SPCC) Plan (40 CFR 112).

2.2 **Incidental Releases**: A response to a spill or release of a hazardous substance (in quantities below its RQ) where the substance can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area using equipment and materials available to them at the time or the spill or release. Any spill or release that cannot be managed with the personnel, materials, and equipment at the site shall be considered an Emergency Response.

2.2.1 Responses to releases of hazardous substances where there is no potential safety or health hazard (i.e., fire, explosion, or chemical exposure) are not considered to be emergency responses. Handling of incidental releases shall be in accordance with applicable standard operating procedures.

## 3.0 Attachments

3.1 None

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Supervisor/Project Manager** shall become the individual in charge at the incident until relieved by more qualified personnel. All AECOM emergency responders and their communications shall be coordinated and controlled through this individual. The individual in charge shall implement the Incident Command System (ICS) and shall be responsible for the following tasks:

- Designate a safety officer who is knowledgeable about the operations being implemented at the emergency response site and who will have specific responsibility to identify and evaluate hazards and to provide direction on the safety of operations for the emergency at hand. If the safety officer judges activities to be an Immediately Dangerous to Life or Health (IDLH) and/or to involve an imminent danger condition, the safety officer shall have the authority to alter, suspend, or terminate those activities. The safety official shall immediately inform the individual in charge of the ICS of any actions needed to be taken to correct these hazards at the emergency scene.

- Identify all hazardous substances or conditions present and address as appropriate site analysis, use of engineering controls, maximum exposure limits, hazardous substance, and handling procedures.
- Implement appropriate emergency operations.
- Limit the number of emergency response personnel at the emergency site.
- Implement the buddy system in groups of two or more.
- Provide standby, backup personnel with equipment ready to provide assistance or rescue. Qualified basic life support personnel, as a minimum, shall also be standing by with medical equipment and transportation as necessary.
- Verify that personal protective equipment (PPE) meets, at a minimum; the criteria contained in 29 CFR 1910.156(e) when worn while performing firefighting operations beyond the incipient stage for any incident.
- Determine if employees, who are engaged in emergency response and exposed to hazardous substances presenting an inhalation hazard or potential inhalation hazard, wear positive pressure self-contained breathing apparatus, until such time that the individual in charge of the ICS determines through the use of air monitoring that a decreased level of respiratory protection is appropriate.
- When deemed necessary for meeting the tasks at hand, an approved, self-contained, compressed air breathing apparatus may be used with approved cylinders from other approved, self-contained, compressed air breathing apparatuses provided that such cylinders are of the same capacity and pressure rating. All compressed air cylinders used with self-contained breathing apparatuses shall meet U.S. Department of Transportation and National Institute for Occupational Safety and Health criteria.
- Ensure that the PPE worn is appropriate for the hazards to be encountered.
- Implement appropriate decontamination procedures after emergency operations have terminated.
- Responsibility for the emergency response shall be transferred upon arrival of a more qualified AECOM Incident Commander or a Public Service Incident Commander.

4.1.2 **Region Safety, Health and Environmental Manager** is responsible for the following:

- Provide technical assistance to the Incident Commander regarding the correct way to respond to the spill.
- Decide whether AECOM or an outside emergency response company will clean up the spill.
- Prepare project-specific Spill Response Plans when required.
- Report spills, as necessary, to state/provincial environmental agencies.
- Review the incident report and facilitate the post-response discussion.
- Review and revise this SOP as necessary based on recommendations from post-response discussions.

4.1.3 **AECOM Employees** are responsible for the following:

- Follow precautions and safe handling practices to avoid spills.
- Alert Supervisor/Project Manager to any deteriorating hazardous materials containers within the office or project area.
- Report all spills and leaks to the Supervisor/Project Manager immediately.
- Secure the spill area as quickly as possible and prevent the migration of exterior spilled materials or substances to drains or other openings.

4.1.4 **First Responder Awareness Level** are those employees who are likely to witness or discover a hazardous substance release and who have been trained to initiate an emergency response by notifying the proper authorities of the release. They take no further action beyond notifying the authorities of the release.

4.1.5 First responders at the awareness level shall have sufficient training or experience to demonstrate competency in the following areas:

- An understanding of what hazardous substances are and the risks associated with them in an incident.
- An understanding of the potential outcomes associated with an emergency created when hazardous substances are present.
- The ability to recognize the presence of hazardous substances in an emergency.
- The ability to identify the hazardous substances, if possible.
- An understanding of the role of the first responder awareness individual in the employer's emergency response plan, including site security and control and the U.S. Department of Transportation's Emergency Response Guidebook.
- The ability to realize the need for additional resources and to make appropriate notifications to the communication center.

4.1.6 **First Responder Operations Level** are individuals who respond to releases or potential releases of hazardous substances as part of the initial response to the site for the purpose of protecting nearby persons, property, or the environment from the effects of the release. They are trained to respond in a defensive fashion without actually trying to stop the release. Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures.

First responders at the operational level shall receive at least eight hours of training or have had sufficient experience to objectively demonstrate competency in the following areas in addition to those listed for the awareness level:

- Knowledge of the basic hazard and risk assessment techniques.
- Know how to select and use proper PPE provided to the first responder operational level.
- An understanding of basic hazardous materials terms.
- Know how to perform basic control, containment, and/or confinement operations within the capabilities of the resources and PPE available with their unit.
- Know how to implement basic decontamination procedures.
- An understanding of the relevant standard operating procedures and termination procedures.

4.1.7 **Hazardous Materials Technicians** are employees who respond to releases or potential releases for the purpose of stopping the release. They assume a more aggressive role than a first responder at the operations level in that they will approach the point of release in order to plug, patch, or otherwise stop the release of a hazardous substance.

Hazardous materials technicians shall receive at least 24 hours of training equal to the first responder operations level and in addition have competency in the following areas:

- Know how to implement the employer's emergency response plan.
- Know the classification, identification, and verification of known and unknown materials by using field survey instruments and equipment.
- Be able to function within an assigned role in the Incident Command System.
- Know how to select and use proper specialized chemical PPE provided to the hazardous materials technician.
- Understand hazard and risk assessment techniques.
- Be able to perform advance control, containment, and/or confinement operations within the capabilities of the resources and PPE available with the unit.
- Understand and implement decontamination procedures.
- Understand termination procedures.
- Understand basic chemical and toxicological terminology and behavior.

4.1.8 **Hazardous Materials Specialists** are individuals who respond with and provide support to hazardous materials technicians. Their duties parallel those of the hazardous materials technician; however, those duties require a more directed or specific knowledge of the various substances they may be called upon to contain. The hazardous materials specialist would also act as the site liaison with federal, state, local, and other government authorities.

4.1.9 Hazardous materials specialists shall receive at least 24 hours of training equal to the technician level and in addition have competency in the following areas:

- Know how to implement the local emergency response plan.
- Understand classification, identification, and verification of known and unknown materials by using advanced survey instruments and equipment.
- Know the state emergency response plan.
- Be able to select and use proper specialized chemical PPE provided to the hazardous materials specialist.
- Understand in-depth hazard and risk techniques.
- Be able to perform specialized control, containment, and/or confinement operations within the capabilities of the resources and PPE available.
- Be able to determine and implement decontamination procedures.
- Have the ability to develop a site safety and control plan.
- Understand chemical, radiological, and toxicological terminology and behavior.

4.1.10 **On Scene Incident Commander,** who will assume control of the incident scene beyond the first responder awareness level, shall receive at least 24 hours of training equal to the first responder operations level and in addition have competency in the following areas:

- Know and be able to implement the employer's incident command system.
- Know how to implement the employer's emergency response plan.
- Know and understand the hazards and risks associated with employees working in chemical protective clothing.
- Know how to implement the local emergency response plan.
- Know the state emergency response plan and of the Federal Regional Response Team.
- Know and understand the importance of decontamination procedures.

4.1.11 **Skilled Support Personnel** who are skilled in the operation of certain equipment (such as mechanized earth moving or digging equipment or crane and hoisting equipment), who are needed temporarily to perform immediate emergency support work that cannot reasonably be performed in a timely fashion by AECOM's employees, and who will be or may be exposed to the hazards at an emergency response scene are not required to meet the training required. However, these Skilled Support Personnel shall be provided an initial briefing at the site prior to their participation in the emergency response. At a minimum, the initial briefing shall include instruction in the wearing of appropriate PPE, what chemical hazards are involved, and what duties are to be performed. All other appropriate safety and health precautions provided to AECOM's own employees shall also be provided to any Skilled Support Personnel.

4.1.12 **Specialist Employees** are AECOM employees who, in the course of their regular job duties, work with and are trained in the hazards of specific hazardous substances and who will be called upon to provide technical advice or assistance at a hazardous substance release incident to the individual in charge shall receive training or demonstrate competency in the area of their specialization annually.

## 4.2 Emergency Response Plan

4.2.1 An emergency response plan shall be developed and implemented to handle anticipated emergencies prior to performing emergency response operations. The plan shall be in writing and available for inspection and copying by employees, their representatives, and OSHA personnel. The plan shall be reviewed and approved by the Regional SH&E Manager prior to issue.

4.2.2 If contract does not require AECOM to provide emergency response services, then AECOM'S SH&E Procedures *S3NA-101-PR Emergency Response Planning, Offices* and *S3NA-203-PR Emergency*

*Response Planning, Field* shall apply and employees shall evacuate from the danger area whenever an emergency occurs.

4.2.3 Upon completion of the emergency response, all followup remediation work shall be done in accordance with AECOM SH&E Procedure *S3NA-509-PR Hazardous Waste Operations and Emergency Response.*

4.2.4 At a minimum, the emergency response plan shall address the following:

- Pre-emergency planning and coordination with outside parties
- Personnel roles, lines of authority, training, and communication
- Emergency recognition and prevention
- Safe distances and places of refuge
- Site security and control
- Evacuation routes and procedures
- Decontamination
- Emergency medical treatment and first aid
- Emergency alerting and response procedures
- Critique of response and follow-up
- PPE and emergency equipment

4.2.5 (Note: Local and state emergency response plans may need to be review and incorporated into the plan.)

### 4.3 Training

4.3.1 Training for responders shall be provided by AECOM's Regional SH&E Manager or by individuals who have the training and/or academic credentials and instructional experience necessary to demonstrate competent instructional skills and a good command of the subject matter of the courses they are to teach. Employees who receive responder training shall also receive annual refresher training if their responding responsibilities continue.

4.3.2 Employees receiving initial and refresher responder training shall be issued a certificate indicating training competency. Copies of all training records shall be maintained by the Site Safety Officer.

### 4.4 Medical Surveillance

4.4.1 All employees participating in an emergency response shall participate in AECOM'S *S3NA-605-PR Medical Surveillance Program*.

### 4.5 Chemical Protective Clothing

4.5.1 Chemical protective clothing shall be worn in accordance with AECOM'S *S3NA-208-PR Personal Protective Equipment Program*.

### 4.6 Spill Response Equipment

4.6.1 All AECOM offices that store chemicals at their facility shall have the appropriate spill response equipment. Such equipment may include the following:

- Overpack containers of varying capacities
- Absorbent material such as vermiculite or commercially prepared, absorbent containing pillows, rolls, sheets, or booms
- Acid and base neutralizing agents
- Chemically resistant gloves for solvents, alcohols, and acids
- Polycoated Tyvek coveralls
- Safety goggles
- Respiratory protection

4.6.2 Spill response equipment shall be placed adjacent to areas where chemicals are routinely handled, stored, and/or where shipments are received. Similar types of spill response equipment shall also be available in any AECOM vehicle or rented vehicle in which chemicals are being transported. Access to the spill response equipment shall be designed to avoid likely spill locations.

## 4.7 Spill Response Equipment for Field Programs

4.7.1 The amount of chemicals being used during a field program will dictate the types and quantity of spill response equipment that is brought to the site. If several squirt bottles of decontamination solutions are all that is being brought to a site, a few spill pillows and a one-gallon bucket may be sufficient to respond to a spill of these materials. If gallons of chemicals are being delivered to the site in drums or bulk tanks, a greater variety of spill response equipment will be needed. As indicated previously, during these types of field programs, a separate spill plan will be incorporated into the project health and safety plan (HASP) and will provide a greater level of detail regarding the specific spill response effort for that field program.

## 4.8 Immediate Response

4.8.1 Evacuate all personnel that will not be involved in the clean up from the immediate area of the spill or release.

4.8.2 Take all reasonable measures to confine, repair, and remedy the effects of the spill; cleanup must be done by knowledgeable personnel and is in accordance with the product label and MSDS.

4.8.3 Use the appropriate equipment and PPE so that you do not expose yourself to any chemicals or hazardous substances.

4.8.4 Clean up teams shall be organized outside the spill area and re-enter for cleanup activities.

4.8.5 If it is not practicable to maintain the airborne concentration of a flammable gas or vapour below the applicable exposure limit, for example, in a temporary situation or an emergency,

- Only the minimum number of workers necessary for the work may be exposed,
- Every worker exposed must be adequately trained and equipped to safely perform the required duties,
- The concentration of the flammable gas or vapor must not exceed 20% of the lower explosive limit (LEL), and
- In a life-threatening emergency only, exposure of emergency response workers is permitted above 20% of the LEL, provided that only those qualified and properly trained and equipped workers necessary to correct the unsafe condition are exposed to the hazard and every possible effort is made to control the hazard while this is being done.

## 4.9 First Aid

4.9.1 In the event of an incident, refer to the MSDS labels to ensure proper first aid is administered for the hazardous material and call the nearest Poison Centre or 911.

4.9.2 The American National Standards Institute (ANSI) Standard for Emergency Eyewash and Shower Equipment (ANSI Z358.1-1998) recommends that the affected body part must be flushed immediately and thoroughly for at least 15 minutes using a large supply of clean fluid under low pressure. However, other references recommend a minimum 20-minute flushing period if the nature of the contaminant is not known. The flushing or rinsing time can be modified if the identity and properties of the chemical are known. For example, at least

- 5 minutes flushing time for mild irritants.
- 20 minutes for moderate to severe irritants.
- 20 minutes for nonpenetrating corrosives.
- 60 minutes for penetrating corrosives.
- If irritation persists, repeat the flushing procedure.

4.9.3 It is important to note that ingestion of any chemical is not likely to occur in the workplace. If ingestion does occur, evidence indicates that inducing vomiting is not necessary in most situations where there has been an occupational chemical ingestion. Induction of vomiting should only be recommended if the chemical has very high, short-term (acute) toxicity, and medical follow-up is not readily available. In these cases, first aiders should receive special training on how to safely and effectively induce vomiting in the appropriate circumstances.

4.9.4 In the unlikely event that there is an on-site release of a hazardous substance (e.g., H2S):

- Get out of the area (in an upwind direction).
- Sound an alarm.
- Assess situation.
- Put on a breathing apparatus.
- Rescue victim(s).
- Revive victim(s).
- Get medical aid.

### 4.10 Reporting

4.10.1 Should there be a spill or leak involving a hazardous product, employees shall immediately notify the Supervisor and SH&E Incident Reporting Line.

4.10.2 "Dangerous occurrences" must be reported immediately to the police, employer, vehicle owner/leaser and the dangerous goods owner. Such events would include spills, bulk container damage, fire, explosion, and transportation accidents involving dangerous goods.

4.10.3 Confirm and seek direction on external reporting requirements.

- A major release of a hazardous substance must be reported to the appropriate provincial or territorial governing body for Occupational Health and Safety.
- All spills and releases must be reported to the governing regulatory body. Each jurisdiction has regulations governing the minimum quantities for reporting based on the type of product spilled or released.

4.10.4 If you have knowledge of spill, release, or unlawful discharge, notify authorities immediately. Reporting does not imply guilt or assign blame. You will need to report the following details.

- Location and time of spill.
- Description of circumstances leading to spill.
- Type and quantity of material or substance spilled.
- Details of any action taken at the site of the spill.
- Description of location of spill and immediately surrounding the area.
- Any additional information in respect of the spill that the Minister, environmental protection officer or person designated by regulations requires.

## 5.0 Records

5.1 None

## 6.0 References

6.1 40 CFR 302.8

6.2 40 CFR 350-372

6.3 40 CFR 112

6.4 S3NA-101-PR Emergency Response Planning, Office

6.5 S3NA-203-PR Emergency Response Planning, Field

6.6 S3NA-208-PR Personal Protective Equipment Program

6.7 S3NA-509-PR Hazardous Waste Operations and Emergency Response

6.8 S3NA-605-PR Medical Surveillance Program

| Jurisdiction | Name | Phone |
|---|---|---|
| **Alberta** | Environmental Service Response Centre | 1-800-222-6514 |
| **British Columbia** | Provincial Emergency Program | 1-800-663-3456 |
| **Manitoba** | Conservation Emergency Response Program | 1-204-944-4888 |

| | | |
|---|---|---|
| **New Brunswick** | Canadian Coast Guard | 1-800-565-1633 |
| **Newfoundland & Labrador** | Canadian Coast Guard | 1-800-563-9089 |
| **NWT & Nunavut** | Spill Report Line | 1-867-920-8130 |
| **Nova Scotia** | Canadian Coast Guard | 1-800-565-1633 |
| **Ontario** | Spill Action Centre | 1-800-268-6060 |
| **Prince Edward Island** | Canadian Coast Guard | 1-800-565-1633 |
| **Quebec** | Environmental Emergency Response | 1-866-694-5454 |
| **Saskatchewan** | Spill Report Centre | 1-800-667-7525 |
| **Yukon Territory** | Spill Report Centre | 1-867-667-7244 |

# S3NA-521-PR Decontamination

## 1.0 Purpose and Scope

1.1 To define appropriate procedures to decontaminate both equipment and personnel when exposure to hazardous chemicals or physical agents has occurred.

1.2 This procedure applies to all AECOM North America based operations and employees.

## 2.0 Terms and Definitions

2.1 **Contamination Reduction Zone (CRZ):** the transition area between the contaminated area and the clean area where decontamination activities occur.

2.2 **Decontamination:** the process of removing or neutralizing contaminants that have accumulated on personnel or equipment.

2.3 **Exclusion Zone (EZ):** the area where primary activities occur, such as sampling, remediation operations, installation of wells, cleanup work, etc.

2.4 **Support Zone (SZ):** an uncontaminated zone where administrative and other support functions, such as first aid, equipment supply, emergency information, etc., are located.

## 3.0 Attachments

3.1 None

## 4.0 Procedure

### 4.1 Roles & Responsibilities

4.1.1 **Project Managers** will be responsible for the following:

- Authorizing the procurement of the necessary decontamination supplies
- Verifying that the applicable decontamination steps are clearly defined in the approved work plan
- Verifying staff are appropriately trained to execute the defined decontamination procedures
- Verifying that adequate staffing is available to safely conduct the applicable decontamination steps

4.1.2 **Supervisor** will be responsible for the following:

- Establishing the designated site work zones (i.e., EZ, CRZ, SP, etc.)
- Conduct site-specific training on the applicable decontamination steps/procedures, as required
- Procuring the necessary decontamination supplies and establishing the decon line
- Enforcing the applicable decontamination steps as defined in the approved work plan

4.1.3 **Employees** will be responsible for the following:

- Following the defined decontamination steps as stated in the approved work plan

4.1.4 **Region SH&E Manager**

- Advise project managers and site supervisors as to the necessary decontamination procedures based on the known or reasonably anticipated chemical hazards and physical agents associated with the planned scope of work
- Support the project team to verify that adequate supplied-air respiratory protection measures are in-place, as applicable

### 4.2 General Requirements

4.2.1 When possible, all necessary steps shall be taken to reduce or minimize contact with chemicals and impacted materials while performing field activities (e.g., avoid sitting or leaning on, walking through, dragging equipment over, tracking, or splashing potential or known impacted materials).

4.2.2 All personal decontamination activities shall be performed with an attendant (buddy) to provide assistance to personnel that are performing decontamination activities. Depending on specific site hazards, attendants may be required to wear a level of protection that is equal to the required level in the exclusion zone.

4.2.3 All persons and equipment entering the EZ shall be considered contaminated, and thus, must be properly decontaminated prior to entering the SZ.

4.2.4 Decontamination procedures may vary based on site conditions and nature of the contaminant. If chemicals or decontamination solutions are used, care should be taken to minimize reactions between the solutions and contaminated materials. In addition, personnel must assess the potential exposures created by the decontamination chemical(s) or solutions. The MSDS must be reviewed, implemented, and filed by personnel contacting the chemicals/solutions.

4.2.5 All contaminated personal protective equipment (PPE) and decontamination materials shall be stored and disposed of in accordance with site-specific requirements identified in the approved work plan.

4.2.6 For all Level B and A ensembles, adequate supplied air must be available to allow the employee to safely complete all necessary decontamination steps.

4.2.7 Where decontamination procedures involving radioactive materials are required, the removable limits for both personnel and equipment will be specified by a Certified Health Physicist in the project’s approved Radiation Protection Plan or approved safety planning document.

## 4.3 Materials Needed to Decontaminate Personnel and/or Equipment

4.3.1 The equipment required to perform decontamination may vary based on site-specific conditions and nature of the contaminant(s). The following equipment is commonly used for decontamination purposes:

- Soft-bristle scrub brushes or long-handled brushes to remove contaminants;
- Hoses, buckets of water or garden sprayers for rinsing;
- Large plastic/galvanized wash tubs or children's wading pools for washing and rinsing solutions;
- Large plastic garbage cans or similar containers lined with plastic bags for the storage of contaminated clothing and equipment;
- Metal or plastic cans or drums for the temporary storage of contaminated liquids;
- Paper or cloth towels for drying protective clothing and equipment; and
- Poly or plastic sheeting to lay down and form the base for the CRZ, as well as to contain contaminants and decontamination fluids.

### 4.4 Personal Decontamination Steps: Level D Ensemble

4.4.1 Remove residual or caked on soil from boots using a dry method (i.e., soft-bristle scrub brush to knock off the soil)

4.4.2 Wash exposed skin with soap and water, as applicable.

### 4.5 Personal Decontamination Steps: Modified Level D Ensemble

4.5.1 In the Exclusion Zone

- Equipment drop on plastic sheet
- Remove the majority of gross contamination
- Wash boot covers and outer gloves
- Rinse boot covers and outer gloves
- Remove tape
- Remove boot covers and outer gloves

4.5.2 In the Contaminant Reduction Zone (keep the most contaminated equipment near the EZ)

- Wash protective suits and safety boots
- Rinse protective suits and safety boots
- Safety boot removal
- Remove protective suit
- Wash inner gloves
- Rinse inner gloves
- Remove inner gloves.
- Remove inner clothing (if necessary)

4.5.3 In the Support Zone

- Finish with personal decon/hygiene wash procedures
- Redress (if necessary).

## 4.6 Personal Decontamination Steps: Level C Ensemble

4.6.1 In the Exclusion Zone

- Equipment drop on plastic sheet
- Remove the majority of gross contamination
- Wash boot covers and outer gloves
- Rinse boot covers and outer gloves
- Remove tape
- Remove boot covers and outer gloves

4.6.2 In the Contaminant Reduction Zone (keep the most contaminated equipment near the EZ)

- Wash protective suits and safety boots
- Rinse protective suits and safety boots
- Change out (if required): Filter/mask change and redress (boot covers and outer gloves)
- Safety boot removal
- Remove protective suit
- Wash inner gloves
- Rinse inner gloves
- Remove respirator/mask
- Remove inner gloves
- Remove inner clothing (if necessary)

4.6.3 In the Support Zone

- Finish with personal decon/hygiene wash procedures
- Redress (if necessary)

## 4.7 Personal Decontamination Steps: Level B Ensemble

4.7.1 In the Exclusion Zone

- Equipment drop on plastic sheet
- Remove the majority of gross contamination
- Wash boot covers and outer gloves
- Rinse boot covers and outer gloves
- Remove tape
- Remove boot covers and outer gloves

4.7.2 In the Contaminant Reduction Zone (keep the most contaminated equipment near the EZ)

- Wash SCBA/airline equipment, protective suits and safety boots

- Rinse SCBA/airline equipment, protective suits and safety boots
- Change out (if required): Tank change and redress (boot covers and outer gloves)
- Safety boot removal
- SCBA backpack or airline equipment removal
- Remove protective suit and/or splash suit
- Wash inner gloves
- Rinse inner gloves
- Remove face piece/mask
- Remove inner gloves
- Remove inner clothing (if necessary)

4.7.3 In the Support Zone

- Finish with personal decon/hygiene wash procedures
- Redress (if necessary)

## 4.8 Personal Decontamination Steps: Level A Ensemble

4.8.1 In the Exclusion Zone

- Equipment drop on plastic sheet
- Remove the majority of gross contamination
- Wash boot covers and outer gloves (if applicable to ensemble)
- Rinse boot covers and outer gloves (if applicable to ensemble)
- Remove tape (if applicable to ensemble)
- Remove boot covers and outer gloves (if applicable to ensemble)

4.8.2 In the Contaminant Reduction Zone (keep the most contaminated equipment near the EZ)

- Wash protective suite and safety boots
- Rinse protective suits and safety boots
- Change out (if required): Tank change and redress (boot covers and outer gloves)
- Safety boot removal
- Remove fully encapsulating suit and hard hat
- Remove SCBA backpack
- Wash inner gloves
- Rinse inner gloves
- Remove face piece/mask
- Remove inner gloves
- Remove inner clothing (if necessary)

4.8.3 In the Support Zone

- Finish with personal decon/hygiene wash procedures
- Redress (if necessary)

## 4.9 Decontamination Steps during a Medical Emergency

4.9.1 If decontamination can be done:

- Wash, rinse and/or cut off protective clothing and equipment

4.9.2 If decontamination cannot be done:

- Wrap the victim in blankets, plastic sheeting, or rubber to reduce contamination of other personnel
- Alert emergency and offsite medical personnel to potential contamination
- Instruct them about specific decontamination procedures if necessary

## 4.10 Equipment Decontamination Steps

4.10.1 All equipment leaving the EZ shall be considered contaminated and must be properly decontaminated to minimize the potential for exposure and off-site migration of impacted materials. Such equipment may include, but is not limited to: sampling tools, heavy equipment, vehicles, PPE (hoses, cylinders, etc.), and various handheld tools.

4.10.2 All employees performing equipment decontamination shall wear the appropriate PPE to protect against exposure to contaminated materials. The level of PPE may be equivalent to the level of protection required in the EZ. Other PPE may include splash protection, such as face-shields and splash suits, and knee protectors. Following equipment decontamination, employees may be required to follow the proper personal decontamination procedures above.

4.10.3 For larger equipment, a high-pressure washer may need to be used. Some contaminants require the use of a detergent or chemical solution and scrub brushes to ensure proper decontamination.

4.10.4 For smaller equipment, use the following steps for decontamination:

1. Remove majority of visible gross contamination in EZ.
2. Wash equipment in decontamination solution with a scrub brush and/or power wash heavy equipment.
3. Rinse equipment.
4. Visually inspect for remaining contamination.
5. Follow appropriate personal decontamination steps outlined above.

4.10.5 All decontaminated equipment shall be visually inspected for contamination prior to leaving the CRZ. Signs of visible contamination may include an oily sheen, residue or contaminated soils left on the equipment. All equipment with visible signs of contamination shall be discarded or re-decontaminated until clean. Depending on the nature of the contaminant, equipment may have to be analyzed using a wipe method or other means.

## 5.0 Records

5.1 None

## 6.0 References

6.1 Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, National Institute of Occupational Safety and Health (NIOSH) 85-115, 1985.

# S3NA-603-PR Incident Investigation and Review

## 1.0 Purpose and Scope

1.1 To provide a consistent approach for the internal investigation of SH&E incidents.

1.2 When AECOM is required by contract to investigate and report findings related to SH&E incidents, the procedure to be followed must be detailed in the project plan and approved by the Region SH&E Manager and AECOM Project Manager. Note - The basic requirements of this procedure must be satisfied, in addition to any client and/or contractual requirements, when the incident involves an AECOM employee or other personnel under the direct control of AECOM.

1.3 To ensure that a thorough Root Cause Analyses is performed on the incident and that outcomes of those analyses are acted upon in a timely fashion.

1.3 Ensure that appropriate Lessons Learned are gathered from SH&E incidents and that information is shared regarding lessons learned throughout the organization.

1.4 This procedure applies to all SH&E incidents that involve an AECOM Americas based employee and/or SH&E incidents that involve operations/entities under the direct control of AECOM.

## 2.0 Terms and Definitions

2.1 **Lead Investigator:** Manager responsible for the incident investigation, as established in section 4.2.

2.2 **Low/ High Potential:** 'First Aid', 'Medically Treated Injuries', 'Modified Work' or 'Lost Time Injury' can often have the potential to be a 'Fatality' or 'Significant Injury' with disability if the circumstances would have been slightly different. For example, a 'Lost Time' incident due to a back soft tissue injury would only be counted as a 'Lost Time' with 'Low Potential' for a 'Serious Injury', whereas a 'First Aid Incident' involving a remotely operated machine striking a worker and imparting a small cut would be counted as a 'First Aid Incident' with 'High Potential' for a 'Fatality' or 'Significant Injury'.

Any injury having the potential to be a 'Fatality' or 'Significant Injury' if the circumstances had been slightly different, must be counted as 'High Potential'; all others must be counted as 'Low Potential'.

In terms of the Company's Risk Assessment language when the exposure, probability and consequence of the hazard(s) creating the incident calculate to a High or Extreme Risk level, the incident must be counted as a High Potential; all others must be counted as Low Potential.

2.3 **PIA:** "Enviance" is the third party database used to house incident information. A "PIA" is a performance improvement action entry to track follow up of incidents.

2.4 **SRI:** SH&E Report of Incident.

*2.5* **SH&E Incidents**: A potentially work-related event which is possibly harmful or damaging, may result in personal injury, environmental impact, or loss or may impact the reputation of AECOM or its clients or may result in an investigation by a regulatory agency or insurer. *S3NA-004 – Incident Reporting.*

## 3.0 Attachments

3.1 S3NA-603-WI1 Incident Investigation Process Checklist and Guideline

3.2 S3NA-603-FM1 Incident Investigation Report

## 4.0 Procedure

- Determine the need for an investigation – Section 4.1.
- Identify appropriate investigation team – Section 4.2.
- Collect appropriate background information and facts surrounding the incident – Attachment S3NA-603-WI1 Incident Investigation Process Checklist.

- When necessary, schedule and conduct Incident Review Call – Section 4.2.5 through 4.2.6.
- Complete investigation report – Section 4.3.
- When necessary, develop and complete Performance Improvement Actions based on investigation findings and develop and distribute appropriate lessons learned for release throughout the organization.

4.1 Determining need for investigation - When determining whether an Incident should be investigated, please refer to the table below:

Note: Set out in the table below are the minimum requirements to be carried out for particular types of incidents. Investigations can be initiated by a Region or by Americas SH&E Director to a stricter standard where required.

| **Severity Level** | | **Safety & Health** | **Environment** | **Regulatory Notice** | **Commercial/ Brand Exposure** | **Near Miss** |
|---|---|---|---|---|---|---|
| **Actual Outcome** | **Potential Outcome** | | | | | |
| 1 | LOW | First Aid Injury only | No environmental damage<br><br>Environmental hazard identified<br><br>Minor on site release of pollutant (non-reportable to gov't agency) that immediately remediated with no impact to the environment | Observation | Reputation loss from local staff<br><br>No disruption to contract | Could have resulted in any Actual or Potential Severity Level 1. |
| 2 | | Medical Treatment and Other AECOM Recordable Injuries/Illnesses<br><br>Restricted Time Injury<br><br>Lost Time Injury < 30 days | Onsite release of pollutant (non-reportable to gov't agency) that is immediately contained and remediated AND does not migrate offsite to land or waterways. | Observation<br><br>Warning | Reputation loss from local staff<br><br>Disruption to contract | Could have resulted in any Actual or Potential Severity Level 2. |
| 3 | HIGH | AECOM Serious SH&E Incident<br><br>Regulatory reportable incident | Onsite or offsite release of pollutant that causes land or water contamination requiring more than day of event remediation.<br><br>Onsite or offsite release of pollutant that is reportable to a government agency | Fine<br><br>Violation<br><br>Corrective Action | Reputation loss to client<br><br>Local or national media attention | Could have resulted in any Actual or Potential Severity Level 3. |

4.1.1 **Severity Level 1 -** An incident investigation should be considered and should be:

- managed at site (office or project) by work group, and
- involve a representative from Americas SH&E team for consultation.

4.1.2 **Severity Level 2 -** An incident investigation is required and should be:

- managed at site (office or project) by work group, and
- involve appropriate district and regional operations and business line personnel for review and confirmation of findings and recommended corrective/preventative actions.
- involve region SH&E manager for consultation and assistance in conducting the investigation and developing recommended corrective/preventative actions.

4.1.3 **Severity Level 3 -** An incident investigation is a mandatory requirement and must be:

- managed by the region under the direction of Americas Legal; and
- Americas SH&E personnel must be involved in consultation and review.

4.1.4 **High Potential incidents -** Any incident deemed to be High Potential must be investigated regardless of the actual outcome. Region Counsel must also be informed.

4.2 **Investigation Team Selection**- An incident investigation can be triggered for any incident with the agreement from the relevant Region Executive, District General Manager, District Business Line Manager or Group Leader and the Region SH&E Manager. The following points below dictate the composition of the investigation teams' dependant on the severity of the incident.

4.2.1 **Severity Level 1 and Severity Level 2 Investigations (Actual or Potential)** - Investigations shall be coordinated by the **Project Manager** (field-related incidents) and/or responsible **supervisor/department manager** (office-related incidents). The region SH&E team shall provide technical assistance and support as requested. Investigations shall be conducted in accordance with Section 4.3. At the discretion of the responsible District General Manager, recommended team members include:

- **Project/Program Director;**
- **District Manager/Region Business Line Leader;**
- **Region SH&E Manager; and**
- **Subject matter experts**.

Note: Incident review calls for all Severity Level 1 Incidents area at the discretion of the responsible regional management and SH&E teams. Review calls for all Severity Level 2 Incidents are required.

4.2.2 **Severity Level 3 (Actual or Potential)** - Investigations shall be coordinated by the responsible **Regional Executive** under the direction of **Americas Legal** and involve the **Project Manager** (field-related incidents) and/or responsible **supervisor/department manager** (office-related incidents). The Region **SH&E Manager** and appropriate subject matter experts shall provide technical assistance and support as requested by the **Region Executive**.

4.2.2.1 Investigations must be performed under the direction of **Americas Legal** and in compliance with the communication protocol set out in Section 4.4. Procedures for the investigation are outlined in Section 4.3

4.2.2.2 An investigation review teleconference call shall be held for any Fatality or Serious SH&E Incidents. The purpose of the call will be to review the preliminary investigation report.

4.2.2.3 The investigation review conference call will be arranged by the **Regional Executive** through the office of **Americas Chief Executive**. Timing for the call is no later than 10 calendar days following classification of the incident as a Fatality or Serious Incident by the responsible **SH&E Manager** (unless otherwise directed by Chief Executive, Americas Legal or Americas SH&E Director).

4.2.2.4 Required participants for the call will include:

- **Americas Chief Executive, responsible Regional Executive, District General Manager and Regional Business Line Leader;**
- **Americas Legal;**
- **Responsible Supervisor or Project Manager of the injured/involved employee;**
- **Region SH&E Manager and**
- **Americas SH&E Director.**
- Other participants may include, at the discretion of the Chief Executive:
    - **Americas HR Director**
    - **Relevant subject matter experts; or**
    - **Members of AECOM Enterprise Management Team.**

4.2.2.5 Following the investigation review teleconference call, **the Chief Executive and Business Line / Regional Executive**, under the direction of **Americas Legal**, shall issue a final Investigation Report to the **AECOM Chief Corporate Officer and Corporate VP, SH&E**.

4.2.2.6 Corrective actions identified by the investigation process must be formally tracked to closure by the **Region SH&E Manager**.

4.3 **Investigation Team Procedures** – All Investigations

- The team will follow an appropriate investigation technique (as agreed to by the **lead investigator, Region SH&E Manager** and Americas Legal) to determine the following:
    - Sequence of events leading up to the incident and steps followed immediately following the incident that may have had an impact on the final outcome.
    - Identification of the People, Parts/Equipment, Position and Paper/Documentation and other factors involved in the incident.
    - Determination of direct cause(s) and root causes using techniques agreed to by the **lead investigator** and **SH&E Manager.** (Note: Example root cause investigation tools include “5 Why’s”, TapRoot, Fishbone Diagram, etc.).
- The Investigation Team will prepare a preliminary report, signed by the **lead investigator**, documenting all findings and recommended corrective actions within 10 calendar days following the incident unless otherwise agreed by the **lead investigator** and **Region SH&E Manager**. All Severity Level 3 communications and reports shall be prepared at the direction of Americas Legal and shall be marked “Attorney Client Privileged Communication”.
- The report format for all incidents classified as Severity Level 3 will follow the sample template provided in *S3NA-603-FM1 Incident Investigation Report*. All other reports will be at the discretion of the responsible **Region SH&E Manager**.
- Note: Incident Review Calls are designed to summarize the preliminary investigation findings and come to agreement on contributing factors, root causes and appropriate corrective actions. Direct participation by the employee(s) involved in the incident is not necessary and requires prior approval from the Senior Manager assigned to the incident review committee. Other members of the incident review committee will be at the discretion of the most Senior Manager involved in the committee and Americas Legal.

4.3.1 Communication of Investigation Results

- Any and all written investigation reports (including drafts) must first be reviewed by **Americas Legal**. All drafts shall include “Attorney-Client Work-Product Privilege” at the top of such reports.

- Where appropriate based on the type, severity and/or scope of the incident, a formal Alert should be prepared by the **lead investigator** and responsible **Region SH&E Manager**. The Alert will be communicated to the most appropriate audience (i.e., regional, national, business line only, etc.).
- Action items and corrective actions identified by the investigation teams will be tracked to completion by the responsible **Region SH&E Manager**. Additionally, the results will be utilized by the SH&E department to develop appropriate regional, national and business line level reports and to improve existing procedures.
- Where required by local legislation and/or regulation or contract requirements, final incident investigation reports shall be provided to the appropriate workplace safety committees.

### 4.4 Communication protocol within AECOM about a Severity Level 3 incident

It is important that communication within AECOM be carefully managed following a Severity Level 3 incident.

It is preferable for any initial communications (i.e., communication which occurs within the first hour of an incident occurring) from AECOM employees, or contractor or subcontractor personnel to be conducted by telephone, with Amercias Legal representatives on the line until such time as an AECOM staff member is appointed as central point of contact to avoid confusion and unnecessary documentation. If you witness a serious incident, you should contact your project manager or direct supervisor by telephone immediately. The direct supervisor is to then notify the **Region SH&E Manager** or if not available the Americas SH&E Director. SH&E will coordinate with Americas Legal.

In some cases, it will be appropriate for a Severity Level 3 incident response and investigation to be carried out under legal professional privilege. This will occur where AECOM contemplates actual or anticipated legal proceedings arising from an incident and is seeking legal advice on its position. Where an investigation is conducted under legal professional privilege, it is important to ensure that all communication is also copied to AECOM internal and/or external legal and is marked “Attorney-Client Work-Product Privilege ".

Before creating any written documentation relating to a Severity Level 3 incident, AECOM employees should contact the AECOM project Manager or Direct Supervisor to ascertain how communication should be handled in relation to that particular incident.

AECOM employees should be aware that all written communication (including emails) and documents created as a result of the incident can be obtained by government agencies, such as US-OSHA, US-EPA, US-DOT, etc. as well as the client and injured third parties and used to form part of an investigation into the incident. For this reason, AECOM employees should always record factual information *only* and avoid speculation as to the cause of an incident in any documentation. Verbal communication related to the incident should also be restricted to those persons who have a role related to the investigation and limited to the identification of facts, not speculation as to fault.

## 5.0 Records

5.1 All files from the incident investigation are to be maintained in the master file as defined in S3NA-601-PR-Recordkeeping.

## 6.0 References

6.1 S3NA-601-PR-Recordkeeping

6.2 S3NA-004-PR Incident Reporting

# S3NA-603-WI1 Incident Investigation Process Checklist and Guideline

- [ ] Determine Investigation Team (i.e., those to be involved in conducting the investigation).
- [ ] Gather documentation/information as soon as possible to avoid 'decay' of information.
- [ ] Interview appropriate personnel to confirm event FACTS and reveal causal factors.
- [ ] Prepare an Events & Conditions Timeline to ensure EXACT event details understood.
- [ ] Determine what 'defenses' failed to prevent the event from occurring.
- [ ] Determine what 'human', 'conditional' and 'task' factors contributed to the incident.
- [ ] Determine what PROCESS (Systems) can be improved to prevent recurrence.
- [ ] Team to devise CORRECTIVE ACTIONS.
- [ ] Initiate CORRECTIVE and PREVENTATIVE ACTIONS into the PIA database in Enviance.

***Collecting Information Guideline***

- Use the prompt boxes below to ensure information is collected from all available sources

| **People** | Review personnel records (work history, training, time sheets, medical etc.) as required. Try to identify all the people who might have information about the event and get statements from them as soon as possible. Interview people individually away from distractions. If possible interview them at the scene of the Event to confirm at the scene information. |
|---|---|
| **Ask Interviewees:**<br>• Fully describe work and conditions leading up to the Event.<br>• Fully describe the Event sequence – start to finish.<br>• Note anything unusual observed prior to Event (sights, sounds).<br>• What was your role in the Event sequence?<br>• What conditions influenced the Event (weather, time, equip, etc.)<br>• How did people influence the Event (actions, emergency response, etc?)<br>• What do you think caused the Event?<br>• How do you think the Event could have been prevented?<br>• List other possible witnesses.<br>• Any additional comments/observations | **Determine:**<br>• Were those involved in the Event experienced in the task?<br>• Had they been adequately trained?<br>• Are they physically capable of conducting the task?<br>• What was the status of their health?<br>• Was fatigue a factor?<br>• Were they under stress or time pressures (work or personal)? |

| **Environment** | Examine the scene of the Event for information and to help understand the nature of the task being conducted and the local environmental conditions. The physical environments, especially sudden changes to that environment, are factors that need to be identified. The situation at the time of the Event is important, not the "usual" conditions. |
|---|---|
| **Determine:**<br>• What were the weather conditions?<br>• Was housekeeping a problem?<br>• Was it too hot or too cold? | • Was noise a problem?<br>• Was there adequate light?<br>• Were toxic or hazardous gases, dusts, or fumes present? |

| **Equipment** | Examine equipment involved in the Event looking at the condition of equipment, anything that may have changed or be out of the ordinary (e.g., abnormal stress, modifications, substitutions, distortions, fractures, etc.). Identify any design flaws, mismatched components or confusing labelling or marking. Ensure that the equipment was appropriate for the task. |
|---|---|
| **Determine:**<br>• Was there an equipment failure?<br>• What caused it to fail?<br>• Was the machinery poorly designed?<br>• Were hazardous substances involved?<br>• Were they clearly identified? | • Was a less hazardous substance possible and available?<br>• Was the raw material substandard in some way?<br>• Should personal protective equipment (PPE) have been used?<br>• Was the PPE used? |

| **Procedures** | Review the task that was being conducted. Examine work procedures, scheduling of the work to see whether they contributed to the Event. Examine the availability, suitability, use and supervisory requirements of procedures. |
|---|---|
| **Determine:**<br>• Was a safe work procedure used?<br>• Were written procedures available?<br>• Was a JSA conducted as part of the planning prior to the task?<br>• Had conditions changed to make the normal procedure unsafe? | • Were the appropriate tools and materials available?<br>• Were they used?<br>• Was lockout used when necessary?<br>• Were safety devices working properly? |

| **Organization** | Management holds the legal responsibility for the safety of the workplace and the workforce. The role of supervisors and management must always be considered in an Event investigation. |
|---|---|
| **Determine:**<br>• Who had the responsibility for control over the site?<br>• Were safety rules communicated /understood by all employees?<br>• Were they being enforced?<br>• Was there adequate supervision?<br>• Were workers trained to do the work? When? Still valid?<br>• Had hazards been previously identified? | • Had procedures been developed to overcome them?<br>• Were unsafe conditions corrected?<br>• Was regular maintenance of equipment carried out?<br>• Were regular safety inspections carried out?<br>• Any changes to equipment, environment, people or procedures. |

### Investigation Categories Guideline

1) Check off conditions below that were related to this event.
2) Copy each condition into Part B of the Incident Investigation Report S3NA-603-FM1.

## ABSENT OR FAILED DEFENSES

Identify the Defense factors that allowed the outcome. Defenses are those factors that are designed to detect and protect the overall system from the results of human or technical failures, that is, they are the “last minute” protection measures designed to avoid or mitigate and outcome.

***Check question:*** ***Does the item describe the equipment, work process, control measure, detection system, procedure or attribute which normally prevents this Event or limits the consequences?***

| *Questions:* | | *Event Facts: (Tick One)* | *Questions:* | | *Event Facts: (Tick One)* |
|---|---|---|---|---|---|
| DF01 | *Protection systems?* | ☐ Absent/Failed ☐ Not Applicable | DF05 | *PPE?* | ☐ Absent/Failed ☐ Not Applicable |
| DF02 | *Warning systems?* | ☐ Absent/Failed ☐ Not Applicable | DF06 | *Safety Device Ops?* | ☐ Absent/Failed ☐ Not Applicable |
| DF03 | *Guards or barriers?* | ☐ Absent/Failed ☐ Not Applicable | DFD7 | *ADF Other?* | ☐ Absent/Failed ☐ Not Applicable |
| DF04 | *Escape systems?* | ☐ Absent/Failed ☐ Not Applicable | | | |

## INDIVIDUAL / TEAM ACTIONS

Identify the individual/team actions that contributed to or caused the Event. These are the errors or violations that led directly to the Event. They are typically associated with personnel having direct contact with the equipment, such as operators or maintenance personnel. They are always committed ‘actively’ (someone did or didn’t do something) and have a direct relation with the Event.

***Check question:*** ***Does the item tell you about a potential error or violation of a standard or procedure made in the presence of or contributing to a hazard?***

| *Questions:* | | *Event Facts: (Tick One)* | *Questions:* | | *Event Facts: (Tick One)* |
|---|---|---|---|---|---|
| IT01 | *Supervision?* | ☐ Error/Violation ☐ N/A | IT07 | *Horseplay?* | ☐ Error/Violation ☐ N/A |
| IT02 | *Operating Authority?* | ☐ Error/Violation ☐ N/A | IT08 | *Materials Handling?* | ☐ Error/Violation ☐ N/A |
| IT03 | *Operating speed?* | ☐ Error/Violation ☐ N/A | ITD9 | *Hazard Recog. Perception?* | ☐ Error/Violation ☐ N/A |
| IT04 | *Equipment use?* | ☐ Error/Violation ☐ N/A | IT10 | *Risk Mgmt.* | ☐ Error/Violation ☐ N/A |
| IT05 | *PPE Use?* | ☐ Error/Violation ☐ N/A | IT11 | *Other* | ☐ Error/Violation ☐ N/A |
| IT06 | *Procedural Compliance?* | ☐ Error/Violation ☐ N/A | | | |

## TASK/ENVIRONMENTAL CONDITIONS

Identify the Task/Environmental conditions that contributed to the Event. These are the conditions in existence immediately prior or at the time of the Event. These are the conditions that directly influence human and equipment performance in the workplace. These are the circumstances under which the errors and violations took place and can be embedded in task demands, the work environment, individual capabilities and human factors.

***Check question:*** ***Does this item describe something about the task demands, work environment, individual capabilities or human factors that promoted errors / violations or undermined the effectiveness of system's Defenses?***

| *Questions:* | | *Event Facts: (Tick One)* | *Questions:* | | *Event Facts: (Tick One)* |
|---|---|---|---|---|---|
| HF01 | *Complacency/Attitude Motiv'n* | ☐ Contributor ☐ N/A | TW01 | *Task Analysis/Take Two* | ☐ Contributor ☐ N/A |
| HF02 | *Drugs/Alcohol Influence* | ☐ Contributor ☐ N/A | TW02 | *Work Procedures* | ☐ Contributor ☐ N/A |
| HF03 | *Fatigue* | ☐ Contributor ☐ N/A | TW03 | *Permit to Work (Avail/Suit.)* | ☐ Contributor ☐ N/A |
| HF04 | *Time/Production Pressures* | ☐ Contributor ☐ N/A | TW04 | *Routine/Non-routine Task* | ☐ Contributor ☐ N/A |
| HF05 | *Peer Pressure* | ☐ Contributor ☐ N/A | TW05 | *Tools/Equipment/Materials* | ☐ Contributor ☐ N/A |
| HF06 | *Physical/Mental Capability* | ☐ Contributor ☐ N/A | TW06 | *Training* | ☐ Contributor ☐ N/A |
| HF07 | *Physical/Mental Stress* | ☐ Contributor ☐ N/A | TW07 | *Housekeeping* | ☐ Contributor ☐ N/A |
| HF08 | *Distraction/ Pre-occupation* | ☐ Contributor ☐ N/A | TW08 | *Weather Conditions* | ☐ Contributor ☐ N/A |
| HFD9 | *Competency/Experience./Skill* | ☐ Contributor ☐ N/A | TW09 | *Congestion, Access* | ☐ Contributor ☐ N/A |
| HF10 | *Inadequate communications* | ☐ Contributor ☐ N/A | TW10 | *Surface Gradient/Conditions* | ☐ Contributor ☐ N/A |
| HF11 | *Tolerance of Violations* | ☐ Contributor ☐ N/A | TW11 | *Lighting* | ☐ Contributor ☐ N/A |
| HF12 | *Change of Routine* | ☐ Contributor ☐ N/A | TW12 | *Temperature* | ☐ Contributor ☐ N/A |
| HF13 | *Other Human Factor* | ☐ Contributor ☐ N/A | TW13 | *Noise* | ☐ Contributor ☐ N/A |
| HF14 | *Task Planning/ Preparation* | ☐ Contributor ☐ N/A | TW14 | *Gas, Dust, Chemical or Fumes* | ☐ Contributor ☐ N/A |

## ORGANIZATIONAL/SYSTEM FACTORS

Identify the Organizational Factors that contributed to the Event. These are the underlying organizational factors which produce the task / environmental conditions that affect performance in the workplace. These may include fallible management decisions, processes and practices.

***Check question:*** ***Does this item identify a standard Organizational Factor present before the Event and which resulted in the task / environmental conditions or allowed those conditions to go un-addressed?***

| *Questions:* | | *Event Facts: (Tick One)* | *Questions:* | | *Event Facts: (Tick One)* |
|---|---|---|---|---|---|
| OS01 | *Hardware* | ☐ Contributing ☐ N/A | OS07 | *Maintenance Management* | ☐ Contributing ☐ N/A |
| OS02 | *Training* | ☐ Contributing ☐ N/A | OS08 | *Design* | ☐ Contributing ☐ N/A |
| OS03 | *Organizational Structure* | ☐ Contributing ☐ N/A | OS09 | *Risk Management* | ☐ Contributing ☐ N/A |
| OS04 | *Communication* | ☐ Contributing ☐ N/A | OS10 | *Management of Change* | ☐ Contributing ☐ N/A |
| OS05 | *Incompatible Goals* | ☐ Contributing ☐ N/A | OS11 | *Contractor Management* | ☐ Contributing ☐ N/A |
| OS06 | *Procedures* | ☐ Contributing ☐ N/A | OS12 | *Other Org./System Factor* | ☐ Contributing ☐ N/A |

## Americas Safety, Health & Environment

S3NA-603-FM1

# Incident Investigation Report

- Refer to Incident Investigation Procedure (S3NA-603-PR) and S3NA-603-WI1 Incident Investigation Process Checklist and Guideline for a guide to complete this form.
- Attach the original SRI as an attachment to this completed form

| (Insert Title of Incident - Region / Incident Type / Description) |
|---|

| Incident Number (Office use only) | |
|---|---|

| PART A: Incident Investigation (Severity Level 1,2 and 3 incidents to complete) | | | | | |
|---|---|---|---|---|---|
| Incident Severity Rating (Level 1-3) | | Actual | | Potential | |
| Incident Date | | Time of Incident | | Region | |
| Business Line | | Project (if applicable) | | | |
| Who was involved (employee, contractor, and 3rd party?) | | | | | |
| Client notified? Yes ☐ No ☐ (attach documentation of contract requirement) | Name | | | | |
| | Contact No. | | | | |

| Description of Incident *(Who, what, where, how)* | Timeline attached? | *(Attachment 1)* ☐ |
|---|---|---|
| | Original Incident form attached? | *(Attachment 2)* ☐ |
| | | |

| Details of Injuries/Damage/Impact (Nature and extent of injuries/damage) |
|---|
| |

| Immediate Action Taken |
|---|
| |

| Corrective Actions Recommended (If actions are accepted transfer into Part C) |
|---|
| |

| Was there a risk assessment tool in use at the time of the event? | | | | |
|---|---|---|---|---|
| THA ☐ | Safety Work Plan ☐ | HASP ☐ | | No ☐ |
| Has the risk assessment tool been updated to reflect this incident? | | | Yes ☐ | No ☐ |
| Is there an existing procedure to control this event? Yes ☐ No ☐ | | | List: | |
| Was this procedure in use at the time of the incident? Yes ☐ No ☐ | | | | |

| Photographs (Insert photographs or diagrams below or at end of report) |
|---|
| |

| **Part B:** | **Incident Investigation (<u>Must be completed for all Severity Level 3 Incidents</u>) – use Incident Investigation Procedure (S3NA-603-WI1) – Investigation Categories Guideline for guidance in classifying the categories below.** | | |
|---|---|---|---|
| **Absent/Failed Defenses** | **Individual or Team Factors** | **Task/Environmental Conditions** | **Organizational Factors** |
| | | | |

| **Part C:** | **Corrective Actions Implemented (Must be completed for all Corrective Actions)** | | |
|---|---|---|---|
| All Recommendations must include a timeframe for implementation and a person responsible. | | | |
| **Enviance PIA No.** | **Recommendations** | **Person Responsible** | **Completion Date** |
| | | | |
| | | | |
| | | | |
| | | | |

add rows as required.

| **Part D:** | **Key Learning's (What should the business learn and pass on from this event)** |
|---|---|
| | |

| **Person Completing this Form** (*Contact for further information*) | |
|---|---|
| **Name** | **Position** |
| **Date** | **Contact No.** |
| **Email** | **Status of investigation** Initial / Final |
| **List Investigation Team Members** | |

| **Reviewed by** (*Compulsory only for Level 3 Incidents*) | | | |
|---|---|---|---|
| | | | |
| **Name** | **GCE (AECOM Serious Incidents only)** | **Signature** | **Date** |
| | | | |
| **Name (Americas Legal)** | **Position** | **Signature** | **Date** |
| | | | |
| **Name** | **Position** | **Signature** | **Date** |

## ATTACHMENT 1 - Events and Conditions Timeline

ATTACHMENT 2 - Copy of SRI

# S3NA-605-PR Medical Surveillance Program

## 1.0 Purpose and Scope

1.1 The Medical Surveillance Program provides a streamlined process to determine if employees meet the physical requirements to perform assigned duties as defined by applicable OSHA and/or provincial/territorial regulations.

1.2 The program is also designed to provide a means to collect data relevant to exposure to chemical and physical agents for the protection of the workers and to confirm the effectiveness of health and safety programs.

1.3 This procedure applies to all AECOM Americas based operations and employees whose work assignments involve potential exposure to harmful chemical and/or physical agents.

## 2.0 Terms and Definitions

2.1 **Modified Duty:** Modified duty (or temporary transitional duty) work is defined as a temporary job task adjustment or alternate job assignment other than the employee's normal essential duties, in response to physical activity restrictions or limitations established by AECOM's Contracted Medical Director, a designated clinical physician, or the employee's medical doctor.

2.2 **Medical Director:** The Medical Director is a physician, board-certified in occupational medicine, employed by the Medical Services Contractor. The Medical Director manages the services provided by the Medical Services Contractor and provides to AECOM guidance on medical matters.

2.3 **Medical Services Contractor:** The Medical Services Contractor manages all occupational medical services, including medical surveillance programs, travel medicine, and injury intervention for first aid support for employees with occupational injuries or illnesses.

2.4 **PEL:** OSHA Permissible Exposure Limit.

2.5 **OEL:** Occupational Exposure Limit.

2.6 **Physical Activity Restriction:** To prevent aggravation of an existing condition, the Medical Doctor recommends a physical activity restriction to limit exposure to a chemical or class of chemicals (such as benzene), a physical agent (such as noise or radiation), or an activity (such as lifting more than 40 pounds).

2.7 **PPE:** Personal Protective Equipment.

2.8 **Safety Sensitive:** A task or position is designated as safety sensitive when the task or position is such that an action would endanger the lives of others. Examples, but not a complete list, of positions that have been designated “safety-critical” by regulations include:

- Drivers of commercial vehicles
- Workers on pipelines carrying fuels or toxic or corrosive substances
- Workers at nuclear power plants
- Employees that operate Nuclear Regulatory Commission (NRC)-regulated devices (nuclear density gauges)
- Operators of industrial mobile equipment, including: cranes of more than 6,000-pound capacity, forklifts, loaders, etc.
- Operators of drill/boring rigs
- Laboratory technicians

## 3.0 Attachments

3.1 S3NA-605-FM Scheduling Request Form

3.2 S3NA-605-FM2 Sample Waiver

## 4.0 Procedure

4.1 All AECOM employees whose work assignments involve potential exposure to harmful chemical and/or physical agents should participate in the medical surveillance program.

4.2 In addition, employees may be requested to participate in the medical surveillance program if they perform a task that requires an assessment for fitness for duty (e.g. lifting, climbing, etc.). The **Office/Project Manager** and **Region SH&E Manager** will identify activities/tasks that will require fit-for-duty assessments.

**4.3 The medical surveillance program consists of the following types of examinations:**

- Baseline (initial)
- Periodic (annual or biennial)
- Special exposure-specific
- Contractual requirement
- Exit/termination
- Fit-for-duty
- Client specific

**4.4 Types of Medical Examinations**

4.4.1 Baseline/Pre-Placement/Pre-Employment

- The baseline medical examination is used to identify physical capabilities and medical limitations that may have an impact on the candidate's ability to perform in the position for which he/she is being considered and to provide a baseline against which periodic or project-specific monitoring can be compared. The baseline medical examination is used to determine the suitability of an existing employee for a new assignment (pre-placement) or a candidate's suitability to be hired (pre-employment) for a particular position.

4.4.2 Periodic/Annual/Biennial

- The periodic medical examination is used to evaluate an employee's continued fitness for duty and to assess any impact occupational exposures may have on his/her health status. The periodic examination includes an update to the medical and work history, results of any occupational exposure assessments and a detailed medical examination tailored to the job description.
- The **Region SH&E Manager** determines the frequency of the periodic medical examinations based on regulatory requirements, the position held by the employee, and the level of exposure to physical, chemical, and biological agents.

4.4.3 Exposure/Activity/Project-Specific

- The exposure-specific examination consists of medical tests to assess the impact of occupational exposures associated with a particular activity or project. The Medical Director or **Region SH&E Manager** will require an exposure-specific examination when he/she has reason to believe occupational exposures are impacting or may be impacting the health of an employee.

4.4.4 Client Specific

- Clients may recommend exposure-specific examinations for persons working on their projects. A client recommendation for an exposure-specific examination will be forwarded to the **Region**

**SH&E Manager** who will evaluate the request, and if appropriate, forward the recommendation to the Medical Director, who will determine the frequency of the exposure-specific medical examinations for each employee designated to participate based on sound medical practice and regulatory requirements.

4.4.5 Exit from the Program

- An exit medical examination is offered when an employee leaves the medical surveillance program, either because of termination of employment with AECOM or because of reassignment to a position not designated to participate in the medical surveillance program
- Employees who choose to waive their right to an exit exam will complete a waiver (see 5.4.1)
- The exit examination assesses any impact occupational exposures may have had on the employee's health status.

## 5.0 Participating Employees

5.1.1 Required Participation

- Participation in the medical surveillance program is required for employees who are or may be:
  - Exposed to substances at or above the PEL/OEL.
  - Required to participate by regulatory provisions (e.g., asbestos, lead OSHA standards).
  - Fit-tested for or wearing a respirator in the field.
  - Exposed above PELs OELs in accidents or emergency situations.
  - Working on sites/projects with specific state, provincial/territorial or federal medical surveillance requirements.
  - Driving a commercial motor vehicle.
  - Performing safety sensitive tasks.
- Employees may be required to participate in a fit-for-duty examination under the following scenarios:
  - Perform extensive physical activities (e.g. bending, lifting, climbing, pulling/pushing, etc.).
  - Experience a non-work related injury or illness.
  - Return to work after extended absence.
- Those employees required to participate will be identified by the **Project Manager, District General Manager** and **Region SH&E Manager**.

5.1.2 Employee

- When designated to participate in the medical surveillance program, the employee completes and signs the following documents:
  - Medical and Work History Questionnaire.
  - Medical records release authorizing Medical Services Contractor to receive the work clearance certificate.

5.1.3 The **SH&E Administrator** is responsible for providing the Medical Services Contractor with the following services:

- Facilitate the management and exchange of documentation regarding the medical surveillance program between AECOM (typically employee's manager) and the Medical Services Contractor using the ***S3NA-605-FM Scheduling Request form***.

- Schedule the initial exam for newly hired or re-assigned employees. Special requests should be coordinated with the Region SH&E Manager, prior to contacting Medical Services Contractor to schedule.
- Assist employees with scheduling examinations as necessary.
- Coordinate medical surveillance program information exchange between Human Resources and the Medical Resource Contractor as necessary.
- Provide information from previous examinations that may not be readily available.

## 6.0 Scheduling Pre-Employment Medical Examination

6.1.1 **SH&E Administrator**

- The SH&E Administrator coordinating a medical examination will:
  - Assist Human Resource Representative, Human **Resource Representative** with pre employment physicals as requested. The Medical Resource Contractor or **SH&E Administrator** may provide the required forms to the candidate.
  - Work with the candidate to identify the clinic location that is convenient for the candidate's medical examination.
  - Coordinate the scheduling of the examination with the Medical Services Contractor and candidate.
  - Notify the candidate's manager and **Human Resources Representative** upon receipt of the work clearance certificate from the Medical Services Contractor.

6.1.2 Hiring Manager

- When necessary based on the position being filled, the Hiring Manager/**Human Resources Representative** informs the candidate that the offer of employment is contingent on the candidate being physically and medically qualified to perform the duties of the position for which he/she is being hired. The Hiring Manager/**Human Resources Representative** may not allow the candidate to begin employment until the conditions of the offer letter have been satisfied.

6.1.3 **Region SH&E Manager**

- The **Region SH&E Manager** provides such assistance as is requested by the Hiring Manager to ensure the job description for the position being filled adequately describes the physical, chemical, and biological stresses of the position, and the PPE used or which may be used, including respiratory protection. The **Region SH&E Manager** provides all necessary assistance to ensure that required and appropriate information is provided with the request and authorization for medical examination.
- The **Region SH&E Manager** provides assistance to the Hiring Manager to interpret physical activity restrictions if such restrictions are noted on the work clearance certificate.

## 7.0 Scheduling Periodic and Exposure Specific Medical Examinations

7.1.1 Medical Services Contractor

- After the initial baseline is complete, the Medical Services Contractor provides notification to the **SH&E Administrator** approximately 30 days before subsequent periodic or exposure-specific medical examination is due. The Medical Services Contractor will also notify the employee 30 days before the periodic or exposure-specific medical examination is due.
- The Medical Services Contractor provides notification of delinquent medical examinations to the **SH&E Administrator**, who ensures the notification of examination due is forwarded to the employee.
- Any employee that has not completed the required medical evaluation within 30 days of an expiration date will be issued a non-qualified statement. The employee is not permitted to

perform the associated task and/or work until the required medical evaluation is completed and a qualified statement is issued by the Medical Director.

7.1.2 Employee's Manager

- The employee's manager arranges work assignments so that the employee is available to take the medical examination before the work clearance certificate expires. In the event that an employee has not completed the medical examination before the work clearance certificate expires, the manager shall remove the employee from the work assignment until the medical evaluation is completed and a qualified statement is issued by the Medical Director.

7.1.3 **Region SH&E Manager**

- The **Region SH&E Manager** will confirm that all relevant exposure assessments have been appropriately annotated to show the applicability to the employee and forwarded to the Medical Services Contractor. The **Region SH&E Manager** also confirms that employees on the delinquent medical examination list have been removed from designated assignments.

## 8.0 Scheduling Exit Medical Examinations

8.1.1 **Human Resources Representative/SH&E Administrator**

- Upon notification of termination or impending termination, the employee's manager working with the **Human Resources Representative** notifies the **SH&E Administrator** to arrange for exit medical examination. If the employee declines the opportunity to take the exit examination the **SH&E Administrator** will send a waiver memorandum to the employee on behalf of the employee's manager. Once the employee signs the waiver the **SH&E Administrator** will place the original in the employee's Human Resources personnel file and copy the Medical Services Contractor.

8.1.2 Manager

- Upon notification of termination or reassignment, the manager contacts the **Human Resources Representative.**
- The manager releases the terminating or reassigned employee from duties as necessary to complete the exit medical examination.

8.1.3 **Region SH&E Manager**

- The **Region SH&E Manager** provides assistance to ensure that terminating and reassigned employees are offered the opportunity to take an exit medical examination.

## 9.0 Reports

9.1.1 Report of Examination

- The Medical Services Contractor provides the employee with a confidential report of findings of the examination and a work clearance certificate. AECOM requires the employee to preserve the work clearance certificate in a safe place and provide copies of it to project managers and clients.
- The Medical Services Contractor provides the **SH&E Administrator** with a copy of the work clearance certificate.  A copy of the annual exam results are routinely sent to the employee my regular mail.

9.1.2 Examinations Due Report

- The Medical Services Contractor produces a list by organization code of employees due to be examined 30 days before the expiration of their work clearance certificate. This list is provided to **SH&E Administrators**, who ensures each manager is notified of the employees in his/her charge who are due examinations so they may be scheduled appropriately.

- The Medical Services Contractor notifies each employee via email or phone to the office of record 30 to 60 days before the periodic or exposure-specific medical examination is due.

9.1.3 Delinquent Examinations Report

- The Medical Services Contractor distributes a report of delinquent medical examinations to the **SH&E Administrator**.
- When an employee's name appears on the delinquent examination report for two consecutive months, the **SH&E Administrator** must notify the **Region SH&E Manager**, who will bring this to the attention of the employee's direct supervisor for resolution. If the delinquency issue is not resolved, the employee's **District or Business Line Manager** will be notified for final resolution.

9.1.4 Physical Activity Restriction Report

- The **SH&E Administrator** maintains a list of employees who have physical activity restrictions. The **SH&E Administrator** provides each manager in his/her area of responsibility with a list of the employees with physical activity restrictions who are assigned to their project/location.
- The **Region SH&E Manager** shall audit locations and projects periodically to ensure employees with physical activity restrictions are not exceeding their limitations. Concerns of an employee exceeding his/her physical activity restriction is brought to the attention of the employee's manager/ supervisor for resolution.

9.1.5 Annual Reports

- The Medical Services Contractor provides annual reports of utilization, medical trends, and statistical analyses. These reports are prepared to improve the service, manage trends, and reduce the cost of the medical surveillance program.

9.1.6 Cost Accounting

- The Medical Services Contractor submits invoices directly to the **SH&E Administrator**. Each examination and service invoiced includes the organization code of the employee examined or receiving the service. Departments with employees who participate in the medical surveillance program are responsible for the cost of administering the program. In addition, if special monitoring (e.g., for lead exposure) is to be conducted for a project, the **Project Manager** must inform the **SH&E Administrator** of that project's charge code.

## 10.0 Roles and Responsibilities

10.1.1 **Employees** – **Mandatory Participation** are responsible for the following:

- All employees designated to participate in the medical surveillance program as a condition of employment or participate voluntarily. Will be notified in advance if they will be assigned to a location, project or client which requires a Medical Surveillance Program. Employees whose duties fall within the categories listed will be included in the medical surveillance program. Each employee is individually responsible for ensuring that he/she maintains a current medical clearance as required for the performance of assigned work duties.

10.1.2 **District, Office and Project Managers** are responsible for the following:

- Operations managers and employee supervisors must evaluate the duties of each employee and prospective employee reporting to him or her. If the employee's position meets the criteria for required participation in the medical surveillance program, the manager is responsible for ensuring that the employee is enrolled in the program.
- Candidates for positions that require medical surveillance in order to meet their job description may not be on site until they have satisfactorily completed the baseline or pre-employment medical examination.

10.1.3 **Safety, Health, & Environment Administrators** are responsible for the following administrative activities for the medical surveillance program relative to the employees they support**:**

- Serves as the primary point of contact between the employee, employee's manager, the Medical Services Contractor, and the SH&E Department.
- Provides information regarding medical surveillance documentation, forms, and scheduling of services.
- Maintains a medical surveillance database and other associated documents.
- Assists employees with scheduling of exams with the Medical Surveillance Contractor.
- Participates in initial SH&E Administrator training and subsequent reviews and updates that will provide guidance on exam protocols.

10.1.4 **Region SH&E Manager** is responsible for the following:

- Reviews employee assignments with managers to ensure that all employees who should be participating in the medical surveillance program have been enrolled.
- Provides all assistance necessary to ensure all required information is provided to the Medical Director.
- Report any change in requirements, protocols or concerns with the contracted Medical Provider to the **Manager, NA SH&E Administration**.

10.1.5 **AECOM SH&E Director** is responsible for the following:

- The **AECOM SH&E Director** is responsible for the issuance, revision, and maintenance of this procedure. To ensure the appropriate medical examination and testing protocol, the Director will provide the Medical Services Contractor with appropriate references (e.g., a copy of AECOM's Medical Surveillance Policy, OSHA/state regulations, etc.). After consultation with the Medical Director, the **AECOM SH&E Director** may also designate other employees to participate in certain parameters of the medical surveillance program.

## 11.0 Records

11.1.1 Medical Records

- Medical records must be preserved and protected in accordance with applicable legislative requirements for the duration of employment plus 30 years. Medical records contain information that is protected by the Privacy Act. To meet the obligations of preserving the medical records and protecting the information they contain, AECOM has arranged for the Medical Services Contractor to manage the medical records.

11.1.2 Access to Records

- An employee or designated representative may request to review his/her medical. Such a request must be in writing, signed and dated, and include the employee's Social Security/ Insurance Number. The **Region SH&E Manager** or the **SH&E Administrator** will forward the request to the Medical Services Contractor, who will provide the employee with a copy of the medical record.

The Medical Services Contractor provides employees with a copy of their results after each physical. If employee would like a copy of their historical records,

- The Medical Services Contractor will supply the copy within 15 days after the request has been submitted by the employee or designated representative.

11.1.3 Quality Control and Quality Assurance

- The Medical Services Contractor performs quality control checks on all medical records to ensure examining physicians appropriately record the findings of the examination and tests.
- The Medical Services Contractor has access to all medical records to perform quality assurance checks to ensure proper recording and preservation.

## 12.0 References

29 CFR 1910 Medical Surveillance Guidelines
OSHA Publication 3162 Screening and Surveillance

# S3NA-605-FM Scheduling Request Form

Submit to: WORKCARE
300 S. Harbor Blvd, Suite 600 Anaheim, CA 92805

Phone: 714-978-7488 / 800-455-6155 Fax: 714-456-2154

Email: ana.martinez@workcare.com

| | | | | |
|---|---|---|---|---|
| ***REQUEST INFORMATION:*** | | | **Date:** | |
| **1.** | **Requested By:** | | **Email:** | |
| | **Phone #:** | | **Region:** | |
| | **Office Location Address:** | | **Business Line:** | |
| | **Regional Safety Manger** | | | |
| | | | | |
| ***EMPLOYEE INFORMATION:*** | | | **Billing Charge No.:** | |
| **2.** | **Employee Name:** | | **Email (if applicable):** | |
| | **Social Security No.:** | | **Work Phone #:** | |
| | **Home Phone #:** | | **Cell Phone #:** | |
| | **City, State, Zip for the Exam:**<br><br>**Please list three dates of availability:** | | | |
| | | | | |
| **3.** | **New Hire/Transfer?** | ☐ **Yes** ☐ **No** | | |
| | **Rehire?** | ☐ **Yes** ☐ **No** | | |
| | **Existing Employee?** | ☐ **Yes** ☐ **No** | | |
| | | | | |
| **4.** | **Drug Screen Needed:** | ☐ **Yes** ☐ **No (If No, skip to #6)** | | |
| | **Reason for Drug Screen:** | ☐ **DOT Clearance**<br>☐ **Client/Contract Requirement**<br>☐ **FRA** | ☐ **Post Accident**<br>☐ **For Cause** | |
| | **Drug Screen Type:** | ☐ **Non-DOT Type** ☐ **Federal DOT Type (Required for DOT Clearance)** | | |
| | | | | |
| **5.** | **Employee working in remote locations in high stress conditions** (subject to temperature/weather extremes) and limited access to emergency services? | ☐ **Yes** ☐ **No** | | |
| | | | | |
| **6.** | **Exam Types:** | | | |
| | A. Commercial Motor Vehicles (>10,000 lbs but < 26,001 lbs) (CMV-01) | ☐ Baseline<br>☐ Renewal | | |
| | B. Commercial Motor Vehicles (over 26,000 lbs.) (DOT-01) | ☐ Baseline<br>☐ Renewal (plus enrollment in random drug pool) | | |
| | C. HAZWOPER<br>Exam Frequency: Annual or Biennial | ☐ Baseline<br>☐ Annual<br>☐ Biennial<br>☐ Exit | | |
| | D. Laboratory Technician | ☐ Baseline<br>☐ 3 Year Protocol<br>☐ Exit | | |

| | | |
|---|---|---|
| | E. Hearing Conservation (HC-01) | ☐ Baseline<br>☐ Annual |
| | F. Immunizations/vaccinations | ☐ Hepatitis A Vaccination (only) (2 shot series)<br>☐ Hepatitis B Vaccination (only) (3 shot series)<br>☐ Twinrix (combination Hep A & B) (3 shot series)<br>☐ Other |
| | G. Lead ZPP | ☐ Baseline<br>☐ Annual |
| | H. Asbestos | ☐ Baseline<br>☐ Annual |
| | I. Diver | ☐ Baseline<br>☐ Annual |
| | J. Travel - Overseas | ☐ Location and duration of visit |
| | K. Records Review | ☐ Change Frequency of Physicals<br>☐ Other (specify in item 8) |
| | | |
| **6.** | **Other (ex. Stand Alone Tests/Exams: Note: Requests outside of standard exam need to be approved by the RSHEM.** | |
| **7.** | **NOTE: If employee needs any special accommodations (ie phobia's, allergies, personal medical– please check here**<br><br>☐ **Employee needs special accommodation and has been referred to call Workcare to schedule** | |

About AECOM

AECOM (NYSE: ACM) is a global provider of professional technical and management support services to a broad range of markets, including transportation, facilities, environmental, energy, water and government. With approximately 45,000 employees around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation, and collaborative technical excellence in delivering solutions that enhance and sustain the world's built, natural, and social environments. A *Fortune 500* company, AECOM serves clients in more than 130 countries and has annual revenue in excess of $8.0 billion.

More information on AECOM and its services can be found at www.aecom.com.

558 North Main Street, Oshkosh, WI 54901
920.235.0270

# Appendix C – Laboratory Analytical Reports

CT LABORATORIES
delivering more than data from your environmental analyses

1230 Lange Court • Baraboo, WI 53913 • 608-356-2760

www.ctlaboratories.com

# ANALYTICAL SUMMARY REPORT

This report at a minimum contains the following information:

Analytical Report of Test Results
Description of QC Qualifiers
Chain of Custody (copy)
Quality Control Summary (if applicable)
Case Narrative (if applicable)
Correspondence with Client (if applicable)

*This report has been specifically prepared to satisfy project or program requirements. These results are in compliance with NELAC requirements for parameters where accreditation is required or available, unless otherwise noted in the case narrative.*



Unless specifically stated to the contrary, soil/sediment/sludge sample results reported on a Dry Weight Basis

# ANALYTICAL SAMPLE DATA

AECOM
MICHELLE FREIMUND
558 MAIN STREET
OSHKOSH, WI 54901

Project Name: GULL ROCK
Project Phase:
Project #: 60289135
Folder #: 111888
Purchase Order #:
Contract #: 2806

Arrival Temperature: 5.6
Report Date: 6/24/2015
Date Received: 6/15/2015
Reprint Date: 6/24/2015

CT LAB#: 595902 Sample Description: SW-1 Client Sample #: Sampled: 6/9/2015 1010

| Analyte | Result | Units | DL | DOD LOD | DOD LOQ | RL | DF | Qualifier | Prep Date/Time | Analysis Date/Time | Analyst | Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Inorganic Results** | | | | | | | | | | | | | |
| pH | ***7.79*** | S.U. | | | | | 1.00 | | | 6/16/15 10:00 | SER | EPA 9040C | ^ |
| Alkalinity | ***41*** | mg/L | 6.0 | 15 | 30 | 30 | 1.00 | | | 6/22/15 14:16 | MER | EPA 310.2 | ^ |
| **Metals Results** | | | | | | | | | | | | | |
| Total Lead | <2.0 | ug/L | 1.4 | 2.0 | 4.0 | 4.0 | 1.00 | U | 6/16/2015 12:00 | 6/17/15 15:54 | NAH | EPA 6010C | ^ |
| Total Hardness | ***43*** | mg/L | 0.067 | 0.21 | 0.41 | 0.41 | 1.00 | | 6/16/2015 12:00 | 6/17/15 15:54 | NAH | SM2340B/6010 | ^ |

CT LAB#: 595903 Sample Description: SW-2 Client Sample #: Sampled: 6/9/2015 1005

| Analyte | Result | Units | DL | DOD LOD | DOD LOQ | RL | DF | Qualifier | Prep Date/Time | Analysis Date/Time | Analyst | Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Inorganic Results** | | | | | | | | | | | | | |
| pH | ***7.79*** | S.U. | | | | | 1.00 | | | 6/16/15 10:00 | SER | EPA 9040C | ^ |
| Alkalinity | ***41*** | mg/L | 6.0 | 15 | 30 | 30 | 1.00 | M | | 6/22/15 14:17 | MER | EPA 310.2 | ^ |
| **Metals Results** | | | | | | | | | | | | | |

Unless specifically stated to the contrary, soil/sediment/sludge sample results reported on a Dry Weight Basis

CT LAB#: 595903 Sample Description: SW-2 Client Sample #: Sampled: 6/9/2015 1005

| Analyte | Result | Units | DL | DOD LOD | DOD LOQ | RL | DF | Qualifier | Prep Date/Time | Analysis Date/Time | Analyst | Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Lead | <2.0 | ug/L | 1.4 | 2.0 | 4.0 | 4.0 | 1.00 | U | 6/16/2015 12:00 | 6/17/15 15:59 | NAH | EPA 6010C | ^ |
| Total Hardness | ***42*** | mg/L | 0.067 | 0.21 | 0.41 | 0.41 | 1.00 | | 6/16/2015 12:00 | 6/17/15 15:59 | NAH | SM2340B/6010 | ^ |

CT LAB#: 595904 Sample Description: SW-3 Client Sample #: Sampled: 6/9/2015 0957

| Analyte | Result | Units | DL | DOD LOD | DOD LOQ | RL | DF | Qualifier | Prep Date/Time | Analysis Date/Time | Analyst | Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Inorganic Results** | | | | | | | | | | | | | |
| pH | ***7.81*** | S.U. | | | | | 1.00 | | | 6/16/15 10:00 | SER | EPA 9040C | ^ |
| Alkalinity | ***43*** | mg/L | 6.0 | 15 | 30 | 30 | 1.00 | | | 6/22/15 14:21 | MER | EPA 310.2 | ^ |
| **Metals Results** | | | | | | | | | | | | | |
| Total Lead | <2.0 | ug/L | 1.4 | 2.0 | 4.0 | 4.0 | 1.00 | U | 6/16/2015 12:00 | 6/17/15 16:27 | NAH | EPA 6010C | ^ |
| Total Hardness | ***43*** | mg/L | 0.067 | 0.21 | 0.41 | 0.41 | 1.00 | | 6/16/2015 12:00 | 6/17/15 16:27 | NAH | SM2340B/6010 | ^ |

CT LAB#: 595905 Sample Description: SW-4 Client Sample #: Sampled: 6/9/2015 0951

| Analyte | Result | Units | DL | DOD LOD | DOD LOQ | RL | DF | Qualifier | Prep Date/Time | Analysis Date/Time | Analyst | Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Inorganic Results** | | | | | | | | | | | | | |
| pH | ***7.78*** | S.U. | | | | | 1.00 | | | 6/16/15 10:00 | SER | EPA 9040C | ^ |
| Alkalinity | ***44*** | mg/L | 6.0 | 15 | 30 | 30 | 1.00 | | | 6/22/15 14:22 | MER | EPA 310.2 | ^ |
| **Metals Results** | | | | | | | | | | | | | |
| Total Lead | <2.0 | ug/L | 1.4 | 2.0 | 4.0 | 4.0 | 1.00 | U | 6/16/2015 12:00 | 6/17/15 16:31 | NAH | EPA 6010C | ^ |
| Total Hardness | ***42*** | mg/L | 0.067 | 0.21 | 0.41 | 0.41 | 1.00 | | 6/16/2015 12:00 | 6/17/15 16:31 | NAH | SM2340B/6010 | ^ |

Unless specifically stated to the contrary, soil/sediment/sludge sample results reported on a Dry Weight Basis

CT LAB#: 595906 Sample Description: DUP-SW Client Sample #: Sampled: 6/9/2015

| Analyte | Result | Units | DL | DOD LOD | DOD LOQ | RL | DF | Qualifier | Prep Date/Time | Analysis Date/Time | Analyst | Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Inorganic Results** | | | | | | | | | | | | | |
| pH | ***7.77*** | S.U. | | | | | 1.00 | | | 6/16/15 10:00 | SER | EPA 9040C | ^ |
| Alkalinity | ***40*** | mg/L | 6.0 | 15 | 30 | 30 | 1.00 | | | 6/22/15 14:25 | MER | EPA 310.2 | ^ |
| **Metals Results** | | | | | | | | | | | | | |
| Total Lead | <2.0 | ug/L | 1.4 | 2.0 | 4.0 | 4.0 | 1.00 | U | 6/16/2015 12:00 | 6/17/15 16:36 | NAH | EPA 6010C | ^ |
| Total Hardness | ***42*** | mg/L | 0.067 | 0.21 | 0.41 | 0.41 | 1.00 | | 6/16/2015 12:00 | 6/17/15 16:36 | NAH | SM2340B/6010 | ^ |

CT LAB#: 595907 Sample Description: SW-5 Client Sample #: Sampled: 6/9/2015 1030

| Analyte | Result | Units | DL | DOD LOD | DOD LOQ | RL | DF | Qualifier | Prep Date/Time | Analysis Date/Time | Analyst | Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Inorganic Results** | | | | | | | | | | | | | |
| pH | ***7.77*** | S.U. | | | | | 1.00 | | | 6/16/15 10:00 | SER | EPA 9040C | ^ |
| Alkalinity | ***42*** | mg/L | 6.0 | 15 | 30 | 30 | 1.00 | | | 6/22/15 14:27 | MER | EPA 310.2 | ^ |
| **Metals Results** | | | | | | | | | | | | | |
| Total Lead | <2.0 | ug/L | 1.4 | 2.0 | 4.0 | 4.0 | 1.00 | U | 6/16/2015 12:00 | 6/17/15 16:53 | NAH | EPA 6010C | ^ |
| Total Hardness | ***42*** | mg/L | 0.067 | 0.21 | 0.41 | 0.41 | 1.00 | | 6/16/2015 12:00 | 6/17/15 16:53 | NAH | SM2340B/6010 | ^ |

CT LAB#: 595908 Sample Description: G-25 Client Sample #: Sampled: 6/9/2015 0955

| Analyte | Result | Units | DL | DOD LOD | DOD LOQ | RL | DF | Qualifier | Prep Date/Time | Analysis Date/Time | Analyst | Method |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Inorganic Results** | | | | | | | | | | | | |
| Solids, Percent | ***95.1*** | % | 0.1 | 0.1 | 0.1 | 0.1 | 1.00 | | | 6/17/15 09:24 | ABS | EPA 8000C |

Unless specifically stated to the contrary, soil/sediment/sludge sample results reported on a Dry Weight Basis

CT LAB#: 595908 Sample Description: G-25 Client Sample #: Sampled: 6/9/2015 0955

| Analyte | Result | Units | DL | DOD LOD | DOD LOQ | RL | DF | Qualifier | Prep Date/Time | Analysis Date/Time | Analyst | Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Metals Results** | | | | | | | | | | | | | |
| Lead | ***3.3*** | mg/kg | 0.043 | 0.13 | 0.27 | 0.27 | 1.00 | M | 6/16/2015 10:00 | 6/17/15 01:12 | NAH | EPA 6010C | ^ |

CT LAB#: 595909 Sample Description: G-25 Client Sample #: Sampled: 6/9/2015 0955

| Analyte | Result | Units | DL | DOD LOD | DOD LOQ | RL | DF | Qualifier | Prep Date/Time | Analysis Date/Time | Analyst | Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Metals Results** | | | | | | | | | | | | | |
| TCLP Lead | ***0.0030*** | mg/L | 0.0014 | 0.0020 | 0.0040 | 0.0040 | 1.00 | J | 6/18/2015 07:00 | 6/19/15 18:22 | NAH | EPA 6010C | ^ |

CT LAB#: 595910 Sample Description: G-21 Client Sample #: Sampled: 6/9/2015 1005

| Analyte | Result | Units | DL | DOD LOD | DOD LOQ | RL | DF | Qualifier | Prep Date/Time | Analysis Date/Time | Analyst | Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Inorganic Results** | | | | | | | | | | | | | |
| Solids, Percent | ***91.0*** | % | 0.1 | 0.1 | 0.1 | 0.1 | 1.00 | | | 6/17/15 09:24 | ABS | EPA 8000C | |
| **Metals Results** | | | | | | | | | | | | | |
| Lead | ***194*** | mg/kg | 0.044 | 0.14 | 0.27 | 0.27 | 1.00 | | 6/16/2015 10:00 | 6/17/15 01:37 | NAH | EPA 6010C | ^ |

CT LAB#: 595911 Sample Description: G-21 Client Sample #: Sampled: 6/9/2015 1005

| Analyte | Result | Units | DL | DOD LOD | DOD LOQ | RL | DF | Qualifier | Prep Date/Time | Analysis Date/Time | Analyst | Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Metals Results** | | | | | | | | | | | | | |
| TCLP Lead | ***0.013*** | mg/L | 0.0014 | 0.0020 | 0.0040 | 0.0040 | 1.00 | | 6/18/2015 07:00 | 6/19/15 18:52 | NAH | EPA 6010C | ^ |

Unless specifically stated to the contrary, soil/sediment/sludge sample results reported on a Dry Weight Basis

CT LAB#: 595912 Sample Description: G-22 Client Sample #: Sampled: 6/9/2015 1015

| Analyte | Result | Units | DL | DOD LOD | DOD LOQ | RL | DF | Qualifier | Prep Date/Time | Analysis Date/Time | Analyst | Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Inorganic Results** | | | | | | | | | | | | | |
| Solids, Percent | ***87.3*** | % | 0.1 | 0.1 | 0.1 | 0.1 | 1.00 | | | 6/17/15 09:24 | ABS | EPA 8000C | |
| **Metals Results** | | | | | | | | | | | | | |
| Lead | ***18.4*** | mg/kg | 0.048 | 0.15 | 0.30 | 0.30 | 1.00 | | 6/16/2015 10:00 | 6/17/15 01:42 | NAH | EPA 6010C | ^ |

CT LAB#: 595913 Sample Description: G-22 Client Sample #: Sampled: 6/9/2015 1015

| Analyte | Result | Units | DL | DOD LOD | DOD LOQ | RL | DF | Qualifier | Prep Date/Time | Analysis Date/Time | Analyst | Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Metals Results** | | | | | | | | | | | | | |
| TCLP Lead | ***0.0023*** | mg/L | 0.0014 | 0.0020 | 0.0040 | 0.0040 | 1.00 | J | 6/18/2015 07:00 | 6/19/15 19:10 | NAH | EPA 6010C | ^ |

CT LAB#: 595914 Sample Description: G-26 Client Sample #: Sampled: 6/9/2015 0945

| Analyte | Result | Units | DL | DOD LOD | DOD LOQ | RL | DF | Qualifier | Prep Date/Time | Analysis Date/Time | Analyst | Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Inorganic Results** | | | | | | | | | | | | | |
| Solids, Percent | ***85.6*** | % | 0.1 | 0.1 | 0.1 | 0.1 | 1.00 | | | 6/17/15 09:24 | ABS | EPA 8000C | |
| **Metals Results** | | | | | | | | | | | | | |
| Lead | ***3.4*** | mg/kg | 0.047 | 0.15 | 0.29 | 0.29 | 1.00 | | 6/16/2015 10:00 | 6/17/15 01:46 | NAH | EPA 6010C | ^ |

CT LAB#: 595915 Sample Description: G-26 Client Sample #: Sampled: 6/9/2015 0945

| Analyte | Result | Units | DL | DOD LOD | DOD LOQ | RL | DF | Qualifier | Prep Date/Time | Analysis Date/Time | Analyst | Method |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

CT LAB#: 595915 Sample Description: G-26 Client Sample #: Sampled: 6/9/2015 0945

| Analyte | Result | Units | DL | DOD LOD | DOD LOQ | RL | DF | Qualifier | Prep Date/Time | Analysis Date/Time | Analyst | Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Metals Results** | | | | | | | | | | | | | |
| TCLP Lead | <0.0020 | mg/L | 0.0014 | 0.0020 | 0.0040 | 0.0040 | 1.00 | U | 6/18/2015 07:00 | 6/19/15 19:15 | NAH | EPA 6010C | ^ |

Unless specifically stated to the contrary, soil/sediment/sludge sample results reported on a Dry Weight Basis

Notes:

^ Indicates the laboratory is NELAP accredited for this analyte by the indicated matrix and method. DL (detection limit), LOD (limit of detection), loq (limit of quantitation) as defined by most recent DOD QSM version.

All samples were received intact and properly preserved unless otherwise noted. The results reported relate only to the samples tested. This report shall not be reproduced, except in full, without written approval of this laboratory. The Chain of Custody is attached.

**This report has been specifically prepared to satisfy project or program requirements.** These results are in compliance with NELAC requirements for the parameters where accreditation is required or available, unless noted in the case narrative.

Submitted by: Pat M. Letterer
Project Manager
608-356-2760

## QC Qualifiers

| Code | Description |
|---|---|
| B | Analyte detected in the associated Method Blank. |
| C | Toxicity present in BOD sample. |
| D | Diluted Out. |
| E | Safe, No Total Coliform detected. |
| F | Unsafe, Total Coliform detected, no E. Coli detected. |
| G | Unsafe, Total Coliform detected and E. Coli detected. |
| H | Holding time exceeded. |
| I | BOD incubator temperature was outside acceptance limits during test period. |
| J | Estimated value. |
| L | Significant peaks were detected outside the chromatographic window. |
| M | Matrix spike and/or Matrix Spike Duplicate recovery outside acceptance limits. |
| N | Insufficient BOD oxygen depletion. |
| O | Complete BOD oxygen depletion. |
| P | Concentration of analyte differs more than 40% between primary and confirmation analysis. |
| Q | Laboratory Control Sample outside acceptance limits. |
| R | See Narrative at end of report. |
| S | Surrogate standard recovery outside acceptance limits due to apparent matrix effects. |
| T | Sample received with improper preservation or temperature. |
| U | Analyte concentration was below detection limit. |
| V | Raised Quantitation or Reporting Limit due to limited sample amount or dilution for matrix background interference. |
| W | Sample amount received was below program minimum. |
| X | Analyte exceeded calibration range. |
| Y | Replicate/Duplicate precision outside acceptance limits. |
| Z | Specified calibration criteria was not met. |

### Current CT Laboratories Certifications

Florida NELAP ID# E871111
Kansas NELAP ID# E-10368
Kentucky ID# 0023
ISO/IEC 17025-2005 A2LA Cert # 3806.01
New Jersey NELAP ID# WI001
North Carolina ID# 674
Wisconsin (WDNR) Chemistry ID# 157066030
Wisconsin (DATCP) Bacteriology ID# 105-289
DoD-ELAP L-A-B Cert # L2392
GA EPD Stipulation ID E871111, Expires Annually
Louisiana ID # 115843
Virginia ID# 7608
Illinois NELAP ID # 002413
Wisconsin (WOSB) ID# WI-5499-WBE
Maryland ID# 344

Rev 8/2014

# CHAIN OF CUSTODY



Company: AECOM
Project Contact: Lance Lindberg
Telephone: 906-226-4980
Project Name: Gull Rock
Project #: 60289135
Location: Michigan
Sampled By: Tony Parkinson

Folder #: 111888
Company: AECOM
Project: GULL ROCK
Logged By: TKR PM: PM

0 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

am:
RCRA SDWA NPDES
Waste Other CERCLA

Report To: Michelle Freimund
EMAIL: Michelle. Freimund
Company: AECOM
Address: 558 Main St. Oshkosh, WI 54901

Invoice To:*
EMAIL:
Company: Same as above
Address:

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed:
*Rush analysis requires prior CT Laboratories' approval*
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

ANALYSES REQUESTED — Fill in Spaces with Bottles per Test

| Date | Time | Matrix | Grab/ Comp | Sample # | Sample ID Description | Filtered? Y/N | Total Lead | Alkalinity | Hardness, total | pH | Total Lead | TCLP Lead | Total # Containers | Designated MS/MSD | CT Lab ID # (Lab use only) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6-9-15 | 10:10am | SW | Grab | | SW-1 | N | X | X | X | X | | | | | 595902 |
| 6-9-15 | 10:05am | ↓ | ↓ | | SW-2 | ↓ | ↓ | ↓ | ↓ | ↓ | | | | | 595903 |
| ↓ | 9:51am | | | | SW-3 | | | | | | | | | | 595904 |
| | 9:51am | | | | SW-4 | | | | | | | | | | 595905 |
| ↓ | | ↓ | | | Dup-SW | ↓ | | | | | | | | | 595906 |
| 6-9-15 | 10:05am | SW | | | MSD | N | | | | | | | | | 595903 |
| ↓ | ↓ | ↓ | ↓ | | MS | ↓ | | | | | | | | | 595903 |
| 6-9-15 | 10:30am | SW | Grab | | SW-5 | N | ↓ | ↓ | ↓ | ↓ | | | | | 595907 |
| | 9:55am | S | | | G-25 | | | | | | X | X | | | 595908/909 |
| | 10:05am | | | | G-21 | | | | | | | | | | 595910/911 |
| | 10:15am | | | | G-22 | | | | | | | | | | 595912/913 |
| ↓ | 9:45am | ↓ | ↓ | | G-26 | ↓ | | | | | ↓ | ↓ | | | 595914/915 |

Relinquished By: [signature] Date/Time: 6-9-15/6:30pm
Received By: TKR Date/Time: 6/15/15 1000
Received by: [signature] Date/Time: 6-9-15/6:30pm
Received for Laboratory by: TKR Date/Time: 6/15/15 1525

Lab Use Only
Ice Present Yes No
Temp 5.6° IR Gun # 4
Cooler # 3711

## CT Laboratories Terms and Conditions

Where a purchaser (Client) places an order for laboratory, consulting or sampling services from CT Laboratories (CTL), CTL shall provide the ordered services pursuant to these Terms and Conditions, and the related Quotation, or as agreed in a negotiated contract. In the absence of a written agreement to the contrary, the Order constitutes an acceptance by the Client of CTL's offer to do business under these Terms and Conditions, and an agreement to be bound by these Terms and Conditions. No contrary or additional terms and conditions expressed in a Client's document shall be deemed to become a part of the contract created upon acceptance of these Terms and Conditions, unless accepted by CTL in advance of the start of the project and in writing.

**1. ORDERS AND RECEIPT OF SAMPLES (Sample Acceptance Policy)**

1.1 The Client may place the Order (i.e., specify a Scope of Work) either by submitting a purchase order to CTL in writing, by telephone (confirmed in writing) or by negotiated contract. Whichever option the Client selects for placing the Order, the Order shall not be valid unless it contains sufficient specification to enable CTL to carry out the Client's requirements. It is the policy of CT Laboratories that samples not meeting the acceptance criteria, outlined in the NELAC standards and Section 5.8.3.2 of the DOD QSM, will not be accepted by the laboratory or will be qualified on the final report. All samples submitted to the laboratory must: (1) be accompanied by proper, full and complete documentation, including sample identification, location, date and time of collection, the collector's name, type of preservation (if any), type of sample, any special comments concerning the sample and any additional pertinent fields on the chain-of-custody. In the absence of any of the required information, the laboratory will attempt to contact the client to obtain the information; if unable to obtain the necessary information, the final report will be qualified. (2) be labeled appropriately with a unique sample identification written with indelible ink on water resistant labels. If the laboratory cannot determine the identity of a sample, it will be rejected and the client will be contacted for further instructions or resampling. (3) be in an appropriate sample container. If the container is inappropriate, the client will be contacted for further instructions or resampling. If analysis is possible, the final report will be qualified. CT Laboratories can provide a sampling guide containing approved containers and preservations for analytical methods requested. (4) adhere to specified holding times. If samples are received with less than ½ the holding time remaining for the requested test, CT Laboratories will make its best effort to analyze the samples and notify the client. If holding times are exceeded, the final report will be qualified. (5) contain adequate sample volume to perform the necessary testing. If sufficient volume is not present, the sample will be rejected and the client will be contacted for further instructions or resampling. If samples show signs of damage, contamination or inadequate preservation, the client will be notified. If analysis can be performed, the final report will be qualified. If not, the samples will be rejected and the client notified for further instructions or resampling.

1.2 CT Laboratories must be supplied with complete written disclosure of the known or suspected presence of any hazardous substances, as defined by applicable federal or state law. Where any samples which were not accompanied by the required disclosure, cause interruptions in the lab's ability to process work due to contamination of instruments or work areas, the Client will be responsible for the costs of clean up and recovery.

1.3 Prior to Sample Acceptance, the entire risk of loss or damage to samples remains with the Client. In no event will CTL have any responsibility or liability for the action or inaction of any carrier shipping or delivering any sample to or from CTL's premises. Client is responsible to assure that any sample containing any hazardous substance which is to be delivered to CTL's premises will be packaged, labeled, transported and delivered properly and in accordance with applicable laws

**2. PAYMENT TERMS**

2.1 Services performed by CTL will be in accordance with prices quoted and later confirmed in writing or as stated in the Price Schedule. Invoices may be submitted to Client upon completion of any sample delivery group. Payment in advance is required for all Clients except those whose credit has been established with CTL. For Clients with approved credit, payment terms are net 30 days from the date of invoice by CTL. All overdue payments are subject to an additional interest and service charge of one and one-half percent (1.5%) (or the maximum rate permissible by law, whichever is lesser) per month or portion thereof from the due date until the date of payment. All fees are charged or billed directly to the Client. The billing of a third party will not be accepted without a statement, signed by the third party that acknowledges and accepts payment responsibility. CTL may suspend work and withhold delivery of data under this order at any time in the event Client fails to make timely payment of its invoices. Client shall be responsible for all costs and expenses of collection including reasonable attorney's fees. CTL reserves the right to refuse to proceed with work at any time based upon an unfavorable Client credit report.

**3. CHANGE ORDERS, TERMINATION**

3.1 Changes to the Scope of Work, price, or result delivery date may be initiated by CTL after Sample Acceptance due to any condition which conflicts with analytical, QA or other protocols warranted in these Terms and Conditions. CTL will not proceed with such changes until an agreement with the Client is reached on the amount of any cost, schedule change or technical change to the Scope of Work, and such agreement is documented in writing.

3.2 Changes to the Scope of Work, including but not limited to increasing or decreasing the work, changing test and analysis specification or acceleration in the performance of the work may be initiated by the Client after sample acceptance. Such a change will be documented in writing and may result in a change in cost and turnaround time commitment. CTL's acceptance of such changes is contingent upon technical feasibility and operational capacity.

3.3 Suspension or termination of all or any part of the work may be initiated by the Client. CTL will be compensated consistent with Section 2 of these Terms and Conditions. CTL will complete all work in progress and be paid in full for all work completed.

**4. WARRANTIES AND LIABILITY**

4.1 Where applicable, CTL will use analytical methodologies which are in substantial conformity with published test methods. CTL has implemented these methods in its Laboratory Quality Manuals and referenced Standard Operating Procedures and where the nature or composition of the sample requires it, CTL reserves the right to deviate from these methodologies as necessary or appropriate, based on the reasonable judgment of CTL, which deviations, if any, will be made on a basis consistent with recognized standards of the industry and/or CTL's Laboratory Quality Manuals. Client may request that CTL perform according to a mutually agreed Quality Assurance Project Plan (QAPP). In the event that samples arrive prior to agreement on a QAPP, CTL will proceed with analyses under its standard Quality Manuals then in effect, and CTL will not be responsible for any resampling or other charges if work must be repeated to comply with a subsequently finalized QAPP.

4.2 CTL shall start preparation and/or analysis within holding times provided that Sample Acceptance occurs within 48 hours of sampling or 1/2 of the holding time for the test, whichever is less. Where resolution of inconsistencies leading to Sample Acceptance does not occur within this period, CTL will use its best efforts to meet holding times and will proceed with the work provided that, in CTL's judgment, the chain-of-custody or definition of the Scope of Work provide sufficient guidance. Reanalysis of samples to comply with CTL's Quality Manuals will be deemed to have met holding times provided the initial analysis was performed within the applicable holding time. Where reanalysis demonstrates that sample matrix interference is the cause of failure to meet any Quality Manual requirements, the warranty will be deemed to have been met.

4.3 CTL warrants that it possesses and maintains all licenses and certifications which are required to perform services under these Terms and Conditions provided that such requirements are specified in writing to CTL prior to Sample Acceptance. CTL will notify the Client in writing of any decertification or revocation of any license, or notice of either, which affects work in progress.

4.4 The warranty obligations set forth in Sections 4.1, 4.2 and 4.3 are the sole and exclusive warranties given by CTL in connection with any services performed by CTL or any Results generated from such services, and CTL gives and makes NO OTHER REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. No representative of CTL is authorized to give or make any other representation or warranty or modify this warranty in any way.

4.5 Client's sole and exclusive remedy for the breach of warranty in connection with any services performed by CTL, will be limited to repeating any services performed, contingent on the Client's providing, at the request of CTL and at the Client's expense, additional sample(s) if necessary. Any reanalysis requested by the Client generating Results consistent with the original Results will be at the Client's expense. If resampling is necessary, CTL's liability for resampling costs will be limited to actual cost or one hundred or one hundred fifty dollars ($150) per sample, whichever is less.

4.6 CTL's liability for any and all causes of action arising hereunder, whether based in contract, tort, warranty, negligence or otherwise, shall be limited to the lesser amount of compensation for the services performed or $100,000. All claims, including those for negligence, shall be deemed waived unless suit thereon is filed within one year after CTL's completion of the services. Under no circumstances, whether arising in contract, tort (including negligence), or otherwise, shall CTL be responsible for loss of use, loss of profits, or for any special, indirect, incidental or consequential damages occasioned by the services performed or by application or use of the reports prepared.

4.7 In no event shall CTL have any responsibility or liability to the Client for any failure or delay in performance by CTL which results, directly or indirectly, in whole or in part, from any cause or circumstance beyond the reasonable control of CTL. Such causes and circumstances shall include, but not be limited to, acts of God, acts of Client, acts or orders of any governmental authority, strikes or other labor disputes, natural disasters, accidents, wars, civil disturbances, equipment breakdown, matrix interference or unknown highly contaminated samples that impact instrument operation, unavailability of supplies from usual suppliers, difficulties or delays in transportation, mail or delivery services, or any other cause beyond CTL's reasonable control.

**5. RESULTS, WORK PRODUCT**

5.1 Data or information provided to CTL or generated by services performed under this agreement shall only become the property of the Client upon receipt in full by CTL of payment for the whole Order. Ownership of any analytical method, QA/QC protocols, software programs or equipment developed by CTL for performance of work will be retained by CTL, and Client shall not disclose such information to any third party.

5.2 Data and sample materials provided by Client or at Client's request, and the result obtained by CTL shall be held in confidence (unless such information is generally available to the public or is in the public domain or Client has failed to pay CTL for all services rendered or is otherwise in breach of these Terms and Conditions), subject to any disclosure required by law or legal process.

5.3 Should the Results delivered by CTL be used by the Client or Client's client, even though subsequently determined not to meet the warranties described in these Terms and Conditions, then the compensation will be adjusted based upon mutual agreement. In no case shall the Client unreasonably withhold CTL's right to independently defend its data.

5.4 CTL reserves the right to subcontract services ordered by the Client to another laboratory or laboratories, if, in CTL's sole judgment, it is reasonably necessary, appropriate or advisable to do so, and with the Client's permission. CTL will in no way be liable for any subcontracted services and all applicable warranties, guarantees and insurance are those of the subcontracted laboratory.

5.5 CTL shall dispose of the Client's samples 30 days after the analytical report is issued, unless instructed to store them for an alternate period of time or to return such samples to the Client, in a manner consistent with U.S. Environmental Protection Agency regulations or other applicable Federal, state or local requirements. Any samples for projects that are canceled or not accepted, or for which return was requested, will be returned to the Client at their own expense. CTL reserves the right to return to the Client any sample or unused portion of a sample that is not within CTL's permitted capability or the capabilities of CTL's designated waste disposal vendor(s).

5.6 Unless a different time period is agreed to in any order under these Terms and Conditions, CTL agrees to retain all records for five (5) years.

5.7 In the event that CTL is required to respond to legal process related to services for Client, Client agrees to reimburse CTL for hourly charges for personnel involved in the response and attorney fees reasonably incurred in obtaining advice concerning the response, preparation to testify, and appearances related to the legal process, travel and all reasonable expenses associated with the litigation.

**6. INSURANCE**

6.1 CTL shall maintain in force during the performance of services under these Terms and Conditions, Workers' Compensation and Employer's Liability Insurance in accordance with the laws of the states having jurisdiction over CTL's employees who are engaged in the performance of the work. CTL shall also maintain during such period, Comprehensive General and Contractual Liability (limit of $2,000,000 per occurrence/ aggregate), Comprehensive Automobile Liability, owned and hired, ($1,000,000 combined single limit), and Professional/Pollution Liability Insurance (limit of $5,000,000 per occurrence/aggregate). Any Client required changes to these limits or conditions may result in a change in cost to the Client.

**7. AUDIT**

7.1 Upon prior notice to CTL, the Client may audit and inspect CTL's records and accounts covering reimbursable costs related to work done for the Client, for a period of one (1) year after completion of the work. The purpose of any such audit shall be only for verification of such costs, and CTL shall not be required to provide access to cost records where prices are expressed as fixed fees or published unit prices

Rev 8/2014

# CHAIN OF CUSTODY



Company:
Project Contact:
Telephone:
Project Name:
Project #:
Location:
Sampled By:

CT LABORATORIES

1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

*Lab Use Only*
*Place Header Sticker Here:*

Program:
QSM RCRA SDWA NPDES
Solid Waste Other ______

PO #

Report To:
EMAIL:
Company:
Address:

Invoice To:*
EMAIL:
Company:
Address:

**Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions*

**Client Special Instructions**

**Matrix:**
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

**ANALYSES REQUESTED**: VOCS

**Turnaround Time**
Normal RUSH*
Date Needed: ______
*Rush analysis requires prior CT Laboratories' approval*
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

| Collection Date | Collection Time | Matrix | Grab/ Comp | Sample # | Sample ID Description | Filtered? Y/N | VOCS | | | | | | | | | | | | | | Total # Containers | Designated MS/MSD | CT Lab ID # *Lab use only* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Trip Blank | | X | | | | | | | | | | | | | | | | |

Fill in Spaces with Bottles per Test

| Relinquished By: | Date/Time | Received By: | Date/Time |
|---|---|---|---|
| [signature] | 6/11/15 5:15 PM | TW | 6/15/15 1000 |
| **Received by:** [signature] | **Date/Time** 6/11/15 5:15 PM | **Received for Laboratory by:** TW | **Date/Time** 6/15/15 1525 |

*Lab Use Only*
Ice Present Yes No
Temp 5.6° IR Gun # 4
Cooler # 3711

# CT Laboratories Terms and Conditions

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**1. ORDERS AND RECEIPT OF SAMPLES (Sample Acceptance Policy)**

1.1 The Client may place the Order (i.e., specify a Scope of Work) either by submitting a purchase order to CTL in writing, by telephone (confirmed in writing) or by negotiated contract. Whichever option the Client selects for placing the Order, the Order shall not be valid unless it contains sufficient specification to enable CTL to carry out the Client's requirements. It is the policy of CT Laboratories that samples not meeting the acceptance criteria, outlined in the NELAC standards and Section 5.8.3.2 of the DOD QSM, will not be accepted by the laboratory or will be qualified on the final report. All samples submitted to the laboratory must: (1) be accompanied by proper, full and complete documentation, including sample identification, location, date and time of collection, the collector's name, type of preservation (if any), type of sample, any special comments concerning the sample and any additional pertinent fields on the chain-of-custody. In the absence of any of the required information, the laboratory will attempt to contact the client to obtain the information; if unable to obtain the necessary information, the final report will be qualified. (2) be labeled appropriately with a unique sample identification written with indelible ink on water resistant labels. If the laboratory cannot determine the identity of a sample, it will be rejected and the client will be contacted for further instructions or resampling. (3) be in an appropriate sample container. If the container is inappropriate, the client will be contacted for further instructions or resampling. If analysis is possible, the final report will be qualified. CT Laboratories can provide a sampling guide containing approved containers and preservations for analytical methods requested. (4) adhere to specified holding times. If samples are received with less than ½ the holding time remaining for the requested test, CT Laboratories will make its best effort to analyze the samples and notify the client. If holding times are exceeded, the final report will be qualified. (5) contain adequate sample volume to perform the necessary testing. If sufficient volume is not present, the sample will be rejected and the client will be contacted for further instructions or resampling. If samples show signs of damage, contamination or inadequate preservation, the client will be notified. If analysis can be performed, the final report will be qualified. If not, the samples will be rejected and the client notified for further instructions or resampling.

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**2. PAYMENT TERMS**

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**4. WARRANTIES AND LIABILITY**

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4.3 CTL warrants that it possesses and maintains all licenses and certifications which are required to perform services under these Terms and Conditions provided that such requirements are specified in writing to CTL prior to Sample Acceptance. CTL will notify the Client in writing of any decertification or revocation of any license, or notice of either, which affects work in progress.

4.4 The warranty obligations set forth in Sections 4.1, 4.2 and 4.3 are the sole and exclusive warranties given by CTL in connection with any services performed by CTL or any Results generated from such services, and CTL gives and makes NO OTHER REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. No representative of CTL is authorized to give or make any other representation or warranty or modify this warranty in any way.

4.5 Client's sole and exclusive remedy for the breach of warranty in connection with any services performed by CTL, will be limited to repeating any services performed, contingent on the Client's providing, at the request of CTL and at the Client's expense, additional sample(s) if necessary. Any reanalysis requested by the Client generating Results consistent with the original Results will be at the Client's expense. If resampling is necessary, CTL's liability for resampling costs will be limited to actual cost or one hundred or one hundred fifty dollars ($150) per sample, whichever is less.

4.6 CTL's liability for any and all causes of action arising hereunder, whether based in contract, tort, warranty, negligence or otherwise, shall be limited to the lesser amount of compensation for the services performed or $100,000. All claims, including those for negligence, shall be deemed waived unless suit thereon is filed within one year after CTL's completion of the services. Under no circumstances, whether arising in contract, tort (including negligence), or otherwise, shall CTL be responsible for loss of use, loss of profits, or for any special, indirect, incidental or consequential damages occasioned by the services performed or by application or use of the reports prepared.

4.7 In no event shall CTL have any responsibility or liability to the Client for any failure or delay in performance by CTL which results, directly or indirectly, in whole or in part, from any cause or circumstance beyond the reasonable control of CTL. Such causes and circumstances shall include, but not be limited to, acts of God, acts of Client, acts or orders of any governmental authority, strikes or other labor disputes, natural disasters, accidents, wars, civil disturbances, equipment breakdown, matrix interference or unknown highly contaminated samples that impact instrument operation, unavailability of supplies from usual suppliers, difficulties or delays in transportation, mail or delivery services, or any other cause beyond CTL's reasonable control.

**5. RESULTS, WORK PRODUCT**

5.1 Data or information provided to CTL or generated by services performed under this agreement shall only become the property of the Client upon receipt in full by CTL of payment for the whole Order. Ownership of any analytical method, QA/QC protocols, software programs or equipment developed by CTL for performance of work will be retained by CTL, and Client shall not disclose such information to any third party.

5.2 Data and sample materials provided by Client or at Client's request, and the result obtained by CTL shall be held in confidence (unless such information is generally available to the public or is in the public domain or Client has failed to pay CTL for all services rendered or is otherwise in breach of these Terms and Conditions), subject to any disclosure required by law or legal process.

5.3 Should the Results delivered by CTL be used by the Client or Client's client, even though subsequently determined not to meet the warranties described in these Terms and Conditions, then the compensation will be adjusted based upon mutual agreement. In no case shall the Client unreasonably withhold CTL's right to independently defend its data.

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6.1 CTL shall maintain in force during the performance of services under these Terms and Conditions, Workers' Compensation and Employer's Liability Insurance in accordance with the laws of the states having jurisdiction over CTL's employees who are engaged in the performance of the work. CTL shall also maintain during such period, Comprehensive General and Contractual Liability (limit of $2,000,000 per occurrence/ aggregate), Comprehensive Automobile Liability, owned and hired, ($1,000,000 combined single limit), and Professional/Pollution Liability Insurance (limit of $5,000,000 per occurrence/aggregate). Any Client required changes to these limits or conditions may result in a change in cost to the Client.

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# Cooler Receipt Form

Ice Present YES NO

Temperature 5.6°

IR Gun # 4

Initials JLR

Date 6/15/15 Time 1000

Cooler #: 3711

UPS Next Day Air®
UPS Worldwide Express℠
Shipping Document

| WEIGHT | LTR | PAK | WEIGHT | DIMENSIONAL WEIGHT If Applicable | LARGE PACKAGE |
|---|---|---|---|---|---|
| | ☐ | ☐ | 46 | | ☐ |

☐ EXPRESS (INT'L)
☐ DOCUMENTS ONLY
SATURDAY DELIVERY ☐

1230

SHIPMENT FROM

UPS ACCOUNT NO. RA1034

REFERENCE NUMBER
60289135-1.2

TELEPHONE

LANCE LINDBERG
AECOM
1230 WILSON ST
MARQUETTE, MI 49855

UPS Next Day Air® 1

DELIVERY TO

TELEPHONE

CT LABORATORIES
1230 LANGE CT
BARABOO, WI 53913

J455 345 0136
TRACKING NUMBER

DATE OF SHIPMENT
6/12/15

010191116 1/07 MW United Parcel Service, Louisville, KY

CUSTODY SEAL
DATE 6/11/15 @ 1710 EST
SIGNATURE [signature]

QEC Quality Environmental Containers
800-255-3950 • 304-255-3900

CUSTODY SEAL
DATE 6/11/15 @ 1710 EST
SIGNATURE [signature]

QEC Quality Environmental Contai ers
800-255-3950 • 304-255-39 0

# QC SUMMARY REPORT

**AECOM** **Project Name: GULL ROCK**

**SDG #: 0** **Folder #: 111888** **Project Number: 60289135**

***Duplicate***

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115862 | Analysis Date: | 6/17/2015 | Prep Batch #: | | Matrix: | SOIL |
| CTLab #: | 597684 | Analysis Time: | 09:24 | Prep Date/Time: | | Method: | SW8000C |
| Parent Sample #: | 595914 | Analyst: | ABS | Prep Analyst: | | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Solids, Percent | 82.3 | % | 85.6 | | | | | 4 | 8 |

## *Duplicate*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115996 | Analysis Date: | 6/22/2015 | Prep Batch #: | | Matrix: | SURFACE WATER |
| CTLab #: | 598963 | Analysis Time: | 14:18 | Prep Date/Time: | | Method: | E310.2 |
| Parent Sample #: | 595903 | Analyst: | DC | Prep Analyst: | | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Alkalinity | 41.6 | mg/L | 41 | | | | | 1 | 20 |

### *Lab Control Spike Water*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115996 | Analysis Date: | 6/22/2015 | Prep Batch #: | | Matrix: | LIQUID |
| CTLab #: | 598640 | Analysis Time: | 14:14 | Prep Date/Time: | | Method: | E310.2 |
| Parent Sample #: | | Analyst: | MER | Prep Analyst: | | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Alkalinity | 381.0 | mg/L | | | 375.0 | 102 | 92 --- 107 | | |

**AECOM** **Project Name:** **GULL ROCK**

**SDG #:** **0** **Folder #:** **111888** **Project Number:** **60289135**

### *Method Blank Water*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115996 | Analysis Date: | 6/22/2015 | Prep Batch #: | | Matrix: | LIQUID |
| CTLab #: | 598641 | Analysis Time: | 14:15 | Prep Date/Time: | | Method: | E310.2 |
| Parent Sample #: | | Analyst: | MER | Prep Analyst: | | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Alkalinity | 6 | mg/L | | U | 0 | | 15 | | |

## *Matrix Spike Duplicate Water*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115996 | Analysis Date: | 6/22/2015 | Prep Batch #: | | Matrix: | SURFACE WATER |
| CTLab #: | 598965 | Analysis Time: | 14:20 | Prep Date/Time: | | Method: | E310.2 |
| Parent Sample #: | 598964 | Analyst: | DC | Prep Analyst: | | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Alkalinity | 159 | mg/L | 41 | | 100 | 118 | 92 --- 107 | 3 | 20 |

## *Matrix Spike Water*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115996 | Analysis Date: | 6/22/2015 | Prep Batch #: | | Matrix: | SURFACE WATER |
| CTLab #: | 598964 | Analysis Time: | 14:19 | Prep Date/Time: | | Method: | E310.2 |
| Parent Sample #: | 595903 | Analyst: | DC | Prep Analyst: | | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Alkalinity | 164 | mg/L | 41 | | 100 | 123 | 92 --- 107 | | 20 |

## *Duplicate*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115833 | Analysis Date: | 6/17/2015 | Prep Batch #: | 52892 | Matrix: | SURFACE WATER |
| CTLab #: | 596104 | Analysis Time: | 16:08 | Prep Date/Time: | 06/16/2015 12:00 | Method: | SW6010 |
| Parent Sample #: | 595903 | Analyst: | NAH | Prep Analyst: | LJF | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Total Lead | 1.40 | ug/L | <1.40 | U | | | 4.0 | 0 | 20 |

### *Lab Control Spike Water*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115833 | Analysis Date: | 6/17/2015 | Prep Batch #: | 52892 | Matrix: | LIQUID |
| CTLab #: | 596103 | Analysis Time: | 15:32 | Prep Date/Time: | 06/16/2015 12:00 | Method: | SW6010 |
| Parent Sample #: | | Analyst: | NAH | Prep Analyst: | LJF | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Total Lead | 175.0 | ug/L | | | 200.0 | 88 | 80 --- 120 | | |

**AECOM** **Project Name: GULL ROCK**

**SDG #: 0** **Folder #: 111888** **Project Number: 60289135**

### *Method Blank Water*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115833 | Analysis Date: | 6/17/2015 | Prep Batch #: | 52892 | Matrix: | LIQUID |
| CTLab #: | 596102 | Analysis Time: | 15:37 | Prep Date/Time: | 06/16/2015 12:00 | Method: | SW6010 |
| Parent Sample #: | | Analyst: | NAH | Prep Analyst: | LJF | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Total Lead | 1.4 | ug/L | | U | 0 | | 2.0 | | |

## *Matrix Spike Duplicate Water*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115833 | Analysis Date: | 6/17/2015 | Prep Batch #: | 52892 | Matrix: | SURFACE WATER |
| CTLab #: | 596106 | Analysis Time: | 16:17 | Prep Date/Time: | 06/16/2015 12:00 | Method: | SW6010 |
| Parent Sample #: | 596105 | Analyst: | NAH | Prep Analyst: | LJF | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Total Lead | 160 | ug/L | BDL | | 200 | 80 | 80 --- 120 | 3 | 20 |

### *Matrix Spike Water*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115833 | Analysis Date: | 6/17/2015 | Prep Batch #: | 52892 | Matrix: | SURFACE WATER |
| CTLab #: | 596105 | Analysis Time: | 16:13 | Prep Date/Time: | 06/16/2015 12:00 | Method: | SW6010 |
| Parent Sample #: | 595903 | Analyst: | NAH | Prep Analyst: | LJF | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Total Lead | 155 | ug/L | BDL | | 200 | 78 | 80 --- 120 | | |

**AECOM** **Project Name: GULL ROCK**

**SDG #: 0** **Folder #: 111888** **Project Number: 60289135**

## *Duplicate*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115839 | Analysis Date: | 6/17/2015 | Prep Batch #: | 52891 | Matrix: | SOIL |
| CTLab #: | 596030 | Analysis Time: | 01:20 | Prep Date/Time: | 06/16/2015 10:00 | Method: | SW6010 |
| Parent Sample #: | 595908 | Analyst: | NAH | Prep Analyst: | LJF | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 2.8 | mg/kg | 3.3 | | | | 10.0 | 16 | 20 |

## *Lab Control Spike Soil*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115839 | Analysis Date: | 6/17/2015 | Prep Batch #: | 52891 | Matrix: | SOLID |
| CTLab #: | 596029 | Analysis Time: | 00:51 | Prep Date/Time: | 06/16/2015 10:00 | Method: | SW6010 |
| Parent Sample #: | | Analyst: | NAH | Prep Analyst: | LJF | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 26.8 | mg/kg | | | 25.0 | 107 | 80 --- 120 | | |

## *Method Blank Soil*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115839 | Analysis Date: | 6/17/2015 | Prep Batch #: | 52891 | Matrix: | SOLID |
| CTLab #: | 596028 | Analysis Time: | 01:08 | Prep Date/Time: | 06/16/2015 10:00 | Method: | SW6010 |
| Parent Sample #: | | Analyst: | NAH | Prep Analyst: | LJF | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 0.04 | mg/kg | | U | 0 | | 0.125 | | |

## *Matrix Spike Duplicate Soil*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115839 | Analysis Date: | 6/17/2015 | Prep Batch #: | 52891 | Matrix: | SOIL |
| CTLab #: | 596032 | Analysis Time: | 01:29 | Prep Date/Time: | 06/16/2015 10:00 | Method: | SW6010 |
| Parent Sample #: | 596031 | Analyst: | NAH | Prep Analyst: | LJF | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 16.5 | mg/kg | 3.3 | | 25.4 | 52 | 80 --- 120 | 2 | 20 |

## *Matrix Spike Soil*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115839 | Analysis Date: | 6/17/2015 | Prep Batch #: | 52891 | Matrix: | SOIL |
| CTLab #: | 596031 | Analysis Time: | 01:25 | Prep Date/Time: | 06/16/2015 10:00 | Method: | SW6010 |
| Parent Sample #: | 595908 | Analyst: | NAH | Prep Analyst: | LJF | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 18.0 | mg/kg | 3.3 | | 27.2 | 54 | 80 --- 120 | | |

## *Duplicate*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115935 | Analysis Date: | 6/19/2015 | Prep Batch #: | 52930 | Matrix: | TCLP |
| CTLab #: | 597568 | Analysis Time: | 18:32 | Prep Date/Time: | 06/19/2015 07:00 | Method: | SW6010 |
| Parent Sample #: | 595909 | Analyst: | NAH | Prep Analyst: | LJF | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 0.00477 | mg/L | 0.0030 | | | | 4.0 | 46 | 20 |

## *Lab Control Spike Water*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115935 | Analysis Date: | 6/19/2015 | Prep Batch #: | 52930 | Matrix: | LIQUID |
| CTLab #: | 597567 | Analysis Time: | 18:13 | Prep Date/Time: | 06/19/2015 07:00 | Method: | SW6010 |
| Parent Sample #: | | Analyst: | NAH | Prep Analyst: | LJF | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 0.184 | mg/L | | | 0.200 | 92 | 80 --- 120 | | |

### *Method Blank Water*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115935 | Analysis Date: | 6/19/2015 | Prep Batch #: | 52930 | Matrix: | LIQUID |
| CTLab #: | 597566 | Analysis Time: | 18:17 | Prep Date/Time: | 06/19/2015 07:00 | Method: | SW6010 |
| Parent Sample #: | | Analyst: | NAH | Prep Analyst: | LJF | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 0.0014 | mg/L | | U | 0 | | .0020 | | |

### *Matrix Spike Duplicate Water*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115935 | Analysis Date: | 6/19/2015 | Prep Batch #: | 52930 | Matrix: | TCLP |
| CTLab #: | 597570 | Analysis Time: | 18:42 | Prep Date/Time: | 06/19/2015 07:00 | Method: | SW6010 |
| Parent Sample #: | 597569 | Analyst: | NAH | Prep Analyst: | LJF | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 0.132 | mg/L | 0.0030 | | 0.200 | 64 | 80 --- 120 | 5 | 20 |

## *Matrix Spike Water*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analytical Run #: | 115935 | Analysis Date: | 6/19/2015 | Prep Batch #: | 52930 | Matrix: | TCLP |
| CTLab #: | 597569 | Analysis Time: | 18:37 | Prep Date/Time: | 06/19/2015 07:00 | Method: | SW6010 |
| Parent Sample #: | 595909 | Analyst: | NAH | Prep Analyst: | LJF | | |

| Analyte | QC sample result | Units | Parent sample result | Qualifier(s) | Spike Amount Added | % Recovery | Control Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 0.126 | mg/L | 0.0030 | | 0.200 | 62 | 80 --- 120 | | |

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# Sample Condition Report

| | | | | | |
|---|---|---|---|---|---|
| Folder #: 111888 | Print Date / Time: | 06/15/2015 | 15:25 | | |
| Client: AECOM | Received Date / Time / By: | 06/15/2015 | 1000 | TKR | |
| Project Name: GULL ROCK | Log-In Date / Time / By: | 06/15/2015 | 1525 | TKR | |
| Project Phase: | Project #: 60289135 | | | PM: | PML |
| Coolers: 3711 | Temperature: | 5.6 C | On Ice: | **N** | |
| Custody Seals Present : **Y** | COC Present:? **Y** | Complete? | **Y** | | |
| Seal Intact? **Y** | Numbers: | DATED AND SIGNED | | | |
| Ship Method: UPS NEXT DAY AIR | Tracking Number: | J455 345 0136 | | | |
| Adequate Packaging: **Y** | Temp Blank Enclosed? | **Y** | | | |

Notes: SAMPLES RECEIVED IN GOOD CONDITION, BUT IN MELT WATER ONLY.

2 CUSTODY SEALS PRESENT AND INTACT ON COOLER, DATED AND SIGNED.

PAGE 2 OF 2 OF THE COCS ONLY HAD A TRIP BLANK DOCUMENTED ON IT FOR VOC ANALYSIS. THERE WERE NO VOCS ASSOCIATED WITH THE GULL ROCK SAMPLES AND THUS IT WAS NOT LOGGED IN.

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595902** SW-1 | | | | |
| | UNPRES PL | 1 | / | ALK,pH |
| | **Total # of Containers of Type ( *UNPRES PL* ) = 1** | | | |
| **595902** SW-1 | | | | |
| | HNO3 | 1 | Y / | HRD,ICP |
| | **Total # of Containers of Type ( *HNO3* ) = 1** | | | |

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595903** SW-2 | | | | |
| | UNPRES PL | 1 | / | ALK,pH |
| | UNPRES PL | 1 | / | ALK,pH |
| | UNPRES PL | 1 | / | ALK,pH |
| | **Total # of Containers of Type ( *UNPRES PL* ) = 3** | | | |
| **595903** SW-2 | | | | |
| | HNO3 | 1 | Y / | HRD,ICP |
| | HNO3 | 1 | Y / | HRD,ICP |
| | HNO3 | 1 | Y / | HRD,ICP |
| | **Total # of Containers of Type ( *HNO3* ) = 3** | | | |

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595904** SW-3 | | | | |
| | UNPRES PL | 1 | / | ALK,pH |

**Total # of Containers of Type** ( ***UNPRES PL*** ) = **1**

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595904** SW-3 | HNO3 | 1 | Y / | HRD,ICP |

**Total # of Containers of Type** ( ***HNO3*** ) = **1**

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595905** SW-4 | UNPRES PL | 1 | / | ALK,pH |

**Total # of Containers of Type** ( ***UNPRES PL*** ) = **1**

| | | | | |
|---|---|---|---|---|
| **595905** SW-4 | HNO3 | 1 | Y / | HRD,ICP |

**Total # of Containers of Type** ( ***HNO3*** ) = **1**

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595906** DUP-SW | UNPRES PL | 1 | / | ALK,pH |

**Total # of Containers of Type** ( ***UNPRES PL*** ) = **1**

| | | | | |
|---|---|---|---|---|
| **595906** DUP-SW | HNO3 | 1 | Y / | HRD,ICP |

**Total # of Containers of Type** ( ***HNO3*** ) = **1**

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595907** SW-5 | UNPRES PL | 1 | / | ALK,pH |

**Total # of Containers of Type** ( ***UNPRES PL*** ) = **1**

| | | | | |
|---|---|---|---|---|
| **595907** SW-5 | HNO3 | 1 | Y / | HRD,ICP |

**Total # of Containers of Type** ( ***HNO3*** ) = **1**

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595908** G-25 | SOLIDS | 1 | / | %SOL,ICP |

**Total # of Containers of Type** ( ***SOLIDS*** ) = **1**

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595909** G-25 | SOLIDS | 1 | / | ICP |

**Total # of Containers of Type** ( ***SOLIDS*** ) = **1**

| Sample ID / Description | | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|---|
| **595910** | G-21 | SOLIDS | 1 | / | %SOL,ICP |
| | | **Total # of Containers of Type ( *SOLIDS* ) = 1** | | | |

| Sample ID / Description | | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|---|
| **595911** | G-21 | SOLIDS | 1 | / | ICP |
| | | **Total # of Containers of Type ( *SOLIDS* ) = 1** | | | |

| Sample ID / Description | | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|---|
| **595912** | G-22 | SOLIDS | 1 | / | %SOL,ICP |
| | | **Total # of Containers of Type ( *SOLIDS* ) = 1** | | | |

| Sample ID / Description | | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|---|
| **595913** | G-22 | SOLIDS | 1 | / | ICP |
| | | **Total # of Containers of Type ( *SOLIDS* ) = 1** | | | |

| Sample ID / Description | | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|---|
| **595914** | G-26 | SOLIDS | 1 | / | %SOL,ICP |
| | | **Total # of Containers of Type ( *SOLIDS* ) = 1** | | | |

| Sample ID / Description | | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|---|
| **595915** | G-26 | SOLIDS | 1 | / | ICP |
| | | **Total # of Containers of Type ( *SOLIDS* ) = 1** | | | |

| *Condition Code* | *Condition Description* |
|---|---|
| 1 | Sample Received OK |

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***ANALYTICAL RESULTS FOR:***

**MICHELLE FREIMUND**
**AECOM**
**558 MAIN STREET**
**OSHKOSH, WI 54901**

PROJECT SITE: GULL ROCK, MICHIGAN

DOD CONTRACT #:

PROJECT #: 60289135

SDG: 111888

PREPARED: July 3, 2015

TOTAL # OF PAGES IN THIS DOCUMENT: 790

*The data contained in the following report have been reviewed by the appropriate CT Laboratories' LLC staff members. In addition, CT Laboratories LLC certifies that to the best of our knowledge that the analyses reported herein are true, complete and correct within the limits of the methods employed and that they follow the applicable requirements as specified by the project plan, state-specific, NELAC or DOD QSM requirements. The estimated uncertainty of measurement is only available upon request. The reported results relate only to the tested samples. This report shall not be reproduced, except in full, without written approval of CT Laboratories LLC.*

APPROVED BY: ______________________
LABORATORY DIRECTOR

APPROVED BY: Christelle Newsome
QA OFFICER

APPROVED BY: Patrick Letterer
PROJECT MANAGER

Certifications: IL (NELAP 002413), KS (NELAP E-10368), KY (0023), PA (NELAP 68-04201), NJ (NELAP WI001), NC (674), WI (157066030), GA EDP Stipulation (Accreditor: FL NELAP, ACC#: E971111, Scope: Non-potable water solid and chemical materials, biological tissue, Effective: 12/10/2014, Expires: annually), DOD ELAP (A2LA 3806.01), ISO17025 (A2LA 3806.01), LA (NELAP 115843), VA (7608), FL (E871111)

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Table of Contents

## Case Narrative

**Client:** AECOM
**Project:** Gull Rock, Michigan
**Sample Receipt Date:** 06/15/2015
**SDG #:** 111888

Six water and four soil samples were received for pH, alkalinity, hardness, and metals analysis. The assigned sample ID number, date sampled, and date received are indicated in the attached Project Summary. The samples were received intact and at a temperature within method specified acceptance limits. A breakdown of sample receipt information can be found on the Sample Condition Report located in the last section of the data package and any exceptions are noted below.

**Sample Analysis and Quality Control**

***Metals Analysis:***

The samples were analyzed using US EPA SW-846 methodology 6010C. All samples were analyzed within the holding time. The following summaries of quality control procedures are included:

Initial and Continuing Calibration Verification
Blanks Summary
ICP Interference Check Data
Spike Sample Recovery
Duplicates Data
Laboratory Control Sample Data
Analysis Run Log

All analysis results met the method specified quality control criteria with the following exceptions:

**ICP Metals Analyses**

Continuing Calibration Verification (CCV) standards were analyzed at two levels (CCV1 & CCV2) with potentially differing wavelengths. Data associated with CCV's were evaluated based on the concentration of the element in the samples and compared to the appropriate CCV level/wavelength.

Some samples may have been analyzed and/or reanalyzed diluted to obtain results for all target analytes within the calibration range of the instrument.

<u>Analytical Run # 115833</u>

The Serial Dilution (L) for sample # 595903 was not applicable for lead because the parent sample raw result was less than 50 times the Limit of Quantitation (LOQ). A Post Digestion Spike (PDS) was analyzed and was acceptable. The parent sample was reported and not qualified.

The Duplicate (DUP) for sample # 595903 was not applicable for lead because the parent sample result was less than five times the LOQ. A Matrix Spike Duplicate (MSD) was analyzed to demonstrate precision and was acceptable. The parent sample was reported and not qualified.

**Client:** AECOM
**Project:** Gull Rock, Michigan
**Sample Receipt Date:** 06/15/2015
**SDG #:** 111888

***Metals Analysis Continued:***

The Matrix Spike (MS) for sample # 595903 exceeded the recovery limit for lead. A PDS was analyzed and was acceptable. The parent sample was reported and not qualified.

Analytical Run # 115840

Magnesium was detected in the Method Blank (MB) greater than the Method Detection Limit (MDL) but less than ½ the Reporting Limit (RL). Samples were reported and not qualified because the MB result was less than $1/10^{th}$ of the sample results.

The L for sample # 595903 was not acceptable for magnesium because the result exceeded the Relative Percent Difference (RPD) limit. A PDS was analyzed and was acceptable. The parent sample was reported and not qualified.

Analytical Run # 115839

The L for sample # 595908 was not applicable for lead because the parent sample raw result was less than 50 times the LOQ. A PDS was analyzed and was unacceptable. The parent sample was reported and qualified with an "M" flag for lead.

The MS and MSD for sample # 595908 exceeded the recovery limit for lead. A PDS was analyzed and was unacceptable. The parent sample was reported and qualified with an "M" flag for lead.

Analytical Run # 115935

The L for sample # 595909 was not applicable for lead because the parent sample raw result was less than 50 times the LOQ. A PDS was analyzed and was acceptable. The parent sample was reported and not qualified.

The DUP for sample # 595909 was not applicable for lead because the parent sample result was less than five times the LOQ. An MSD was analyzed to demonstrate precision and was acceptable. The parent sample was reported and not qualified.

The MS and MSD for sample # 595909 exceeded the recovery limit for lead. A PDS was analyzed and was acceptable. The parent sample was reported and not qualified.

## *Inorganic Analyses:*

The samples were analyzed using US EPA Methods 9040C and 310.2. All samples were analyzed within the holding time. The following summaries of quality control procedures are included:

**Client:** AECOM
**Project:** Gull Rock, Michigan
**Sample Receipt Date:** 06/15/2015
**SDG #:** 111888

***Inorganics Analysis Continued:***

Duplicate Analysis Data
Laboratory Control Spike Data
Method Blank Data
Initial Calibration Summary
Calibration Check Summary
Analysis Run Log
Prep Log

All analysis results met the method specified quality control criteria with the following exceptions:

**Alkalinity Analyses**

Analytical Run # 115996

The Matrix Spike (MS) and the Matrix Spike Duplicate (MSD) for sample # 595903 had a high recovery. The parent sample result was qualified with an "M" flag.

**pH Analyses**

Analytical Run # 115827

All analysis results for this SDG met the method/project specified quality control criteria.

**% Solids Analyses**

Analytical Run # 115862

All analysis results for this SDG met the method/project specified quality control criteria.

## Data Qualifiers

| Code | Description |
|---|---|
| A | Analyte averaged calibration criteria within acceptable limits. |
| B | Analyte detected in associated Method Blank. |
| C | Toxicity present in BOD sample. |
| D | Diluted Out. |
| E | Safe, No Total Coliform detected. |
| F | Unsafe, Total Coliform detected, no E. Coli detected. |
| G | Unsafe, Total Coliform detected and E. Coli detected. |
| H | Holding time exceeded. |
| J | Estimated value. |
| L | Significant peaks were detected outside the chromatographic window. |
| M | Matrix spike and/or Matrix Spike Duplicate recovery outside acceptance limits. |
| N | Insufficient BOD oxygen depletion. |
| O | Complete BOD oxygen depletion. |
| P | Concentration of analyte differs more than 40% between primary and confirmation analysis. |
| Q | Laboratory Control Sample outside acceptance limits. |
| R | See Narrative at end of report. |
| S | Surrogate standard recovery outside acceptance limits due to apparent matrix effects. |
| T | Sample received with improper preservation or temperature. |
| U | Analyte concentration was not above the detection level. |
| V | Raised Quantitation or Reporting Limit due to limited sample amount or dilution for matrix background interference. |
| W | Sample amount received was below program minimum. |
| X | Analyte exceeded calibration range. |
| Y | Replicate/Duplicate precision outside acceptance limits. |
| Z | Calibration criteria exceeded. |

## MANUAL INTEGRATION REASON CODES

CTLaboratories has identified four general cases with valid reasons supporting the use of manual integration techniques. These codes are used on chromatograms in this data package to document the reasons for manual integrations per CTLaboratories' SOP SS-10 current revision.

**#1**: **Data system failed to select the correct peak or missed the peak entirely.**
In some cases the chromatography system selects and integrates the "wrong peak". In this case the analyst must correct the selection and force the system to integrate the proper peak. In other instances the system may miss the peak completely. In this case the analyst manually integrated the peak

**#2**: **Data System Splits the Peak Incorrectly or Integrates a False Peak as a Rider Peak.**
This phenomenon is common at low concentrations where the signal to noise ratio is low. A single compound (peak) is incorrectly split into multiple peaks or integrated as a main peak with one or more rider peaks resulting in low or high area counts for the target compound.

**#3: Improperly Integrated Isomers and/or coeluting compounds.**
For when the system fails to distinguish coeluting compounds and or isomers. The integration areas and concentrations may be inaccurate, and they must be corrected by manual integration. Prime examples are compounds that are unresolved and integrated improperly when present at low concentrations in standards or samples.

**#4: System Established Incorrect Baseline.**
There are numerous situations in chromatography where the system establishes the baseline incorrectly. Some baseline errors will be obvious to the analyst and may be corrected via manual procedures.

**#5: Miscellaneous.**
Some situations involving integration errors may require in-depth review and technical judgment. These cases should be brought to the attention of the group supervisor. If the form of manual integration is not clearly covered by these four cases, then review and approval by the group supervisor or the *QA/QC* Supervisor will be required.

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## Sample Delivery Group
## 111888

AECOM
MICHELLE FREIMUND
558 MAIN STREET
OSHKOSH, WI 54901

Project Name: GULL ROCK
Project #: 60289135

| CT Sample # | Folder # | Client Sample # | Sample Description | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|---|---|
| 595902 | 111888 | | SW-1 | SURFACE WATER | 06/09/2015 | 06/15/2015 |
| 595903 | 111888 | | SW-2 | SURFACE WATER | 06/09/2015 | 06/15/2015 |
| 595904 | 111888 | | SW-3 | SURFACE WATER | 06/09/2015 | 06/15/2015 |
| 595905 | 111888 | | SW-4 | SURFACE WATER | 06/09/2015 | 06/15/2015 |
| 595906 | 111888 | | DUP-SW | SURFACE WATER | 06/09/2015 | 06/15/2015 |
| 595907 | 111888 | | SW-5 | SURFACE WATER | 06/09/2015 | 06/15/2015 |
| 595908 | 111888 | | G-25 | SOIL | 06/09/2015 | 06/15/2015 |
| 595909 | 111888 | | G-25 | TCLP | 06/09/2015 | 06/15/2015 |
| 595910 | 111888 | | G-21 | SOIL | 06/09/2015 | 06/15/2015 |
| 595911 | 111888 | | G-21 | TCLP | 06/09/2015 | 06/15/2015 |
| 595912 | 111888 | | G-22 | SOIL | 06/09/2015 | 06/15/2015 |
| 595913 | 111888 | | G-22 | TCLP | 06/09/2015 | 06/15/2015 |
| 595914 | 111888 | | G-26 | SOIL | 06/09/2015 | 06/15/2015 |
| 595915 | 111888 | | G-26 | TCLP | 06/09/2015 | 06/15/2015 |

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# QC Batch Cross Reference Summary



AECOM
MICHELLE FREIMUND
558 MAIN STREET
OSHKOSH, WI 54901

| | |
|---|---|
| Project Name: | GULL ROCK |
| Project #: | 60289135 |
| Report Date: | 06/24/2015 |
| Date Received: | 06/15/2015 |
| SDG #: | 111888 |

## *Inorganic Parameters*

| CTI LAB#: | Parameter | Matrix | Prep Batch # | Analytical Run # |
|---|---|---|---|---|
| 595908 | Solids, Percent | SOIL | | 115862 |
| 595910 | Solids, Percent | SOIL | | 115862 |
| 595912 | Solids, Percent | SOIL | | 115862 |
| 595914 | Solids, Percent | SOIL | | 115862 |

| CTI LAB#: | Parameter | Matrix | Prep Batch # | Analytical Run # |
|---|---|---|---|---|
| 595902 | pH | SURFACE WATER | | 115827 |
| 595903 | pH | SURFACE WATER | | 115827 |
| 595904 | pH | SURFACE WATER | | 115827 |
| 595905 | pH | SURFACE WATER | | 115827 |
| 595906 | pH | SURFACE WATER | | 115827 |
| 595907 | pH | SURFACE WATER | | 115827 |

| CTI LAB#: | Parameter | Matrix | Prep Batch # | Analytical Run # |
|---|---|---|---|---|
| 595902 | Alkalinity, QSM | SURFACE WATER | | 115996 |
| 595903 | Alkalinity, QSM | SURFACE WATER | | 115996 |
| 595904 | Alkalinity, QSM | SURFACE WATER | | 115996 |
| 595905 | Alkalinity, QSM | SURFACE WATER | | 115996 |
| 595906 | Alkalinity, QSM | SURFACE WATER | | 115996 |
| 595907 | Alkalinity, QSM | SURFACE WATER | | 115996 |

## *Metal Parameters*

| CTI LAB#: | Parameter | Matrix | Prep Batch # | Analytical Run # |
|---|---|---|---|---|
| 595908 | ICP Metals QSM | SOIL | 52891 | 115839 |
| 595910 | ICP Metals QSM | SOIL | 52891 | 115839 |
| 595912 | ICP Metals QSM | SOIL | 52891 | 115839 |
| 595914 | ICP Metals QSM | SOIL | 52891 | 115839 |

| CTI LAB#: | Parameter | Matrix | Prep Batch # | Analytical Run # |
|---|---|---|---|---|
| 595902 | ICP Metals, Total QSM | SURFACE WATER | 52892 | 115833 |

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| | |
|---|---|
| Project Name: | GULL ROCK |
| Project #: | 60289135 |
| SDG #: | 111888 |

| CTI LAB#: | Parameter | Matrix | Prep Batch # | Analytical Run # |
|---|---|---|---|---|
| 595903 | ICP Metals, Total QSM | SURFACE WATER | 52892 | 115833 |
| 595904 | ICP Metals, Total QSM | SURFACE WATER | 52892 | 115833 |
| 595905 | ICP Metals, Total QSM | SURFACE WATER | 52892 | 115833 |
| 595906 | ICP Metals, Total QSM | SURFACE WATER | 52892 | 115833 |
| 595907 | ICP Metals, Total QSM | SURFACE WATER | 52892 | 115833 |

| CTI LAB#: | Parameter | Matrix | Prep Batch # | Analytical Run # |
|---|---|---|---|---|
| 595902 | Hardness, Total QSM | SURFACE WATER | 52893 | 115840 |
| 595903 | Hardness, Total QSM | SURFACE WATER | 52893 | 115840 |
| 595904 | Hardness, Total QSM | SURFACE WATER | 52893 | 115840 |
| 595905 | Hardness, Total QSM | SURFACE WATER | 52893 | 115840 |
| 595906 | Hardness, Total QSM | SURFACE WATER | 52893 | 115840 |
| 595907 | Hardness, Total QSM | SURFACE WATER | 52893 | 115840 |

| CTI LAB#: | Parameter | Matrix | Prep Batch # | Analytical Run # |
|---|---|---|---|---|
| 595909 | ICP Metals QSM TCLP | TCLP | 52930 | 115935 |
| 595911 | ICP Metals QSM TCLP | TCLP | 52930 | 115935 |
| 595913 | ICP Metals QSM TCLP | TCLP | 52930 | 115935 |
| 595915 | ICP Metals QSM TCLP | TCLP | 52930 | 115935 |

# METALS
# CLP FORMS
# DOCUMENTS

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Sample Description

**DUP-SW**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595906 |
| Analytical Method: | EPA 6010C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115833 | Analysis Date/Time | 06/17/2015 16:36 |
| Analytical Prep Batch #: | 52892 | Prep. Date/Time: | 06/16/2015 12:00 |
| ICAL Calibration #: | | Concentration Units: | ug/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| 7439-92-1 | Total Lead | 2.0 | U | 1.4 | 2.0 | 4.0 | 4.0 |

CT LABORATORIES
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Sample Description

**DUP-SW**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595906 |
| Analytical Method: | SM2340B/6010 | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115840 | Analysis Date/Time | 06/17/2015 16:36 |
| Analytical Prep Batch #: | 52893 | Prep. Date/Time: | 06/16/2015 12:00 |
| ICAL Calibration #: | | Concentration Units: | mg/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| HARD | Total Hardness | 42 | | 0.067 | 0.21 | 0.41 | 0.41 |

CT LABORATORIES
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1

***INORGANIC ANALYSIS DATA SHEET***

Sample Description

**G-21**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SOIL | SDG No.: | 111888 |
| % Solids: | 91.0 | Lab Sample ID: | 595910 |
| Analytical Method: | EPA 6010C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115839 | Analysis Date/Time | 06/17/2015 01:37 |
| Analytical Prep Batch #: | 52891 | Prep. Date/Time: | 06/16/2015 10:00 |
| ICAL Calibration #: | | Concentration Units: | mg/kg |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| 7439-92-1 | Lead | 194 | | 0.044 | 0.14 | 0.27 | 0.27 |

CT LABORATORIES
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Sample Description

**G-21**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | TCLP | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595911 |
| Analytical Method: | EPA 6010C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | 06/18/2015 07:00 |
| Analytical Run #: | 115935 | Analysis Date/Time | 06/19/2015 18:52 |
| Analytical Prep Batch #: | 52930 | Prep. Date/Time: | 06/19/2015 07:00 |
| ICAL Calibration #: | | Concentration Units: | mg/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| 7439-92-1 | Lead | 0.013 | | 0.0014 | 0.0020 | 0.0040 | 0.0040 |

CT LABORATORIES
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Sample Description

**G-22**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SOIL | SDG No.: | 111888 |
| % Solids: | 87.3 | Lab Sample ID: | 595912 |
| Analytical Method: | EPA 6010C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115839 | Analysis Date/Time | 06/17/2015 01:42 |
| Analytical Prep Batch #: | 52891 | Prep. Date/Time: | 06/16/2015 10:00 |
| ICAL Calibration #: | | Concentration Units: | mg/kg |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| 7439-92-1 | Lead | 18.4 | | 0.048 | 0.15 | 0.30 | 0.30 |

CT LABORATORIES
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Sample Description

**G-22**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | TCLP | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595913 |
| Analytical Method: | EPA 6010C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | 06/18/2015 07:00 |
| Analytical Run #: | 115935 | Analysis Date/Time | 06/19/2015 19:10 |
| Analytical Prep Batch #: | 52930 | Prep. Date/Time: | 06/19/2015 07:00 |
| ICAL Calibration #: | | Concentration Units: | mg/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| 7439-92-1 | Lead | 0.0023 | J | 0.0014 | 0.0020 | 0.0040 | 0.0040 |

CT LABORATORIES
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Sample Description

**G-25**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SOIL | SDG No.: | 111888 |
| % Solids: | 95.1 | Lab Sample ID: | 595908 |
| Analytical Method: | EPA 6010C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115839 | Analysis Date/Time | 06/17/2015 01:12 |
| Analytical Prep Batch #: | 52891 | Prep. Date/Time: | 06/16/2015 10:00 |
| ICAL Calibration #: | | Concentration Units: | mg/kg |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| 7439-92-1 | Lead | 3.3 | M | 0.043 | 0.13 | 0.27 | 0.27 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**G-25**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | TCLP | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595909 |
| Analytical Method: | EPA 6010C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | 06/18/2015 07:00 |
| Analytical Run #: | 115935 | Analysis Date/Time | 06/19/2015 18:22 |
| Analytical Prep Batch #: | 52930 | Prep. Date/Time: | 06/19/2015 07:00 |
| ICAL Calibration #: | | Concentration Units: | mg/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| 7439-92-1 | Lead | 0.0030 | J | 0.0014 | 0.0020 | 0.0040 | 0.0040 |

CT LABORATORIES
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Sample Description

**G-26**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SOIL | SDG No.: | 111888 |
| % Solids: | 85.6 | Lab Sample ID: | 595914 |
| Analytical Method: | EPA 6010C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115839 | Analysis Date/Time | 06/17/2015 01:46 |
| Analytical Prep Batch #: | 52891 | Prep. Date/Time: | 06/16/2015 10:00 |
| ICAL Calibration #: | | Concentration Units: | mg/kg |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| 7439-92-1 | Lead | 3.4 | | 0.047 | 0.15 | 0.29 | 0.29 |

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Sample Description

**G-26**

1

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | TCLP | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595915 |
| Analytical Method: | EPA 6010C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | 06/18/2015 07:00 |
| Analytical Run #: | 115935 | Analysis Date/Time | 06/19/2015 19:15 |
| Analytical Prep Batch #: | 52930 | Prep. Date/Time: | 06/19/2015 07:00 |
| ICAL Calibration #: | | Concentration Units: | mg/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| 7439-92-1 | Lead | 0.0020 | U | 0.0014 | 0.0020 | 0.0040 | 0.0040 |

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Sample Description

**SW-1**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595902 |
| Analytical Method: | EPA 6010C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115833 | Analysis Date/Time | 06/17/2015 15:54 |
| Analytical Prep Batch #: | 52892 | Prep. Date/Time: | 06/16/2015 12:00 |
| ICAL Calibration #: | | Concentration Units: | ug/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| 7439-92-1 | Total Lead | 2.0 | U | 1.4 | 2.0 | 4.0 | 4.0 |

CT LABORATORIES
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Sample Description

**SW-1**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595902 |
| Analytical Method: | SM2340B/6010 | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115840 | Analysis Date/Time | 06/17/2015 15:54 |
| Analytical Prep Batch #: | 52893 | Prep. Date/Time: | 06/16/2015 12:00 |
| ICAL Calibration #: | | Concentration Units: | mg/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| HARD | Total Hardness | 43 | | 0.067 | 0.21 | 0.41 | 0.41 |

CT LABORATORIES
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Sample Description

1

***INORGANIC ANALYSIS DATA SHEET***

**SW-2**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595903 |
| Analytical Method: | EPA 6010C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115833 | Analysis Date/Time | 06/17/2015 15:59 |
| Analytical Prep Batch #: | 52892 | Prep. Date/Time: | 06/16/2015 12:00 |
| ICAL Calibration #: | | Concentration Units: | ug/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| 7439-92-1 | Total Lead | 2.0 | U | 1.4 | 2.0 | 4.0 | 4.0 |

CT LABORATORIES
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Sample Description

**SW-2**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595903 |
| Analytical Method: | SM2340B/6010 | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115840 | Analysis Date/Time | 06/17/2015 15:59 |
| Analytical Prep Batch #: | 52893 | Prep. Date/Time: | 06/16/2015 12:00 |
| ICAL Calibration #: | | Concentration Units: | mg/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| HARD | Total Hardness | 42 | | 0.067 | 0.21 | 0.41 | 0.41 |

CT LABORATORIES
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Sample Description

**SW-3**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595904 |
| Analytical Method: | EPA 6010C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115833 | Analysis Date/Time | 06/17/2015 16:27 |
| Analytical Prep Batch #: | 52892 | Prep. Date/Time: | 06/16/2015 12:00 |
| ICAL Calibration #: | | Concentration Units: | ug/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| 7439-92-1 | Total Lead | 2.0 | U | 1.4 | 2.0 | 4.0 | 4.0 |

CT LABORATORIES
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Sample Description

**SW-3**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595904 |
| Analytical Method: | SM2340B/6010 | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115840 | Analysis Date/Time | 06/17/2015 16:27 |
| Analytical Prep Batch #: | 52893 | Prep. Date/Time: | 06/16/2015 12:00 |
| ICAL Calibration #: | | Concentration Units: | mg/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| HARD | Total Hardness | 43 | | 0.067 | 0.21 | 0.41 | 0.41 |

CT LABORATORIES
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Sample Description

**SW-4**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595905 |
| Analytical Method: | EPA 6010C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115833 | Analysis Date/Time | 06/17/2015 16:31 |
| Analytical Prep Batch #: | 52892 | Prep. Date/Time: | 06/16/2015 12:00 |
| ICAL Calibration #: | | Concentration Units: | ug/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| 7439-92-1 | Total Lead | 2.0 | U | 1.4 | 2.0 | 4.0 | 4.0 |

CT LABORATORIES
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Sample Description

**SW-4**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595905 |
| Analytical Method: | SM2340B/6010 | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115840 | Analysis Date/Time | 06/17/2015 16:31 |
| Analytical Prep Batch #: | 52893 | Prep. Date/Time: | 06/16/2015 12:00 |
| ICAL Calibration #: | | Concentration Units: | mg/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| HARD | Total Hardness | 42 | | 0.067 | 0.21 | 0.41 | 0.41 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-5**

1

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595907 |
| Analytical Method: | EPA 6010C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115833 | Analysis Date/Time | 06/17/2015 16:53 |
| Analytical Prep Batch #: | 52892 | Prep. Date/Time: | 06/16/2015 12:00 |
| ICAL Calibration #: | | Concentration Units: | ug/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| 7439-92-1 | Total Lead | 2.0 | U | 1.4 | 2.0 | 4.0 | 4.0 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-5**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595907 |
| Analytical Method: | SM2340B/6010 | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115840 | Analysis Date/Time | 06/17/2015 16:53 |
| Analytical Prep Batch #: | 52893 | Prep. Date/Time: | 06/16/2015 12:00 |
| ICAL Calibration #: | | Concentration Units: | mg/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| HARD | Total Hardness | 42 | | 0.067 | 0.21 | 0.41 | 0.41 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**ICV**

**2A-1**

***INITIAL CALIBRATION VERIFICATION***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115839

Lab Sample ID: 597241

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/16/15 | 15:01 | 500.0 | 510.0 | 102 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**LLQC**

**2A-1**

***LOWER LIMIT OF QUANTITATION CHECK (LLQC)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115839

Lab Sample ID: 597242

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/16/15 | 15:05 | 30.00 | 29.00 | 97 | 80 | 120 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**ICV**

**2A-1**

***INITIAL CALIBRATION VERIFICATION***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115840

Lab Sample ID: 597412

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Calcium | 6/17/15 | 14:27 | 10.00 | 9.81 | 98 | 90 | 110 |
| Magnesium | 6/17/15 | 14:27 | 10.00 | 9.59 | 96 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**LLQC**

**2A-1**

***LOWER LIMIT OF QUANTITATION CHECK (LLQC)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115840

Lab Sample ID: 597413

ICAL Calibration #:

Concentration Units:

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Calcium | 6/17/15 | 14:31 | 1.50 | 1.67 | 111 | 80 | 120 |
| Magnesium | 6/17/15 | 14:31 | 1.50 | 1.50 | 100 | 80 | 120 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**ICV**

**2A-1**

***INITIAL CALIBRATION VERIFICATION***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115833

Lab Sample ID: 597432

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/17/15 | 14:27 | 500.0 | 495.0 | 99 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**LLQC**

**2A-1**

***LOWER LIMIT OF QUANTITATION CHECK (LLQC)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115833

Lab Sample ID: 597433

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/17/15 | 14:31 | 30.00 | 30.70 | 102 | 80 | 120 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**ICV**

**2A-1**

***INITIAL CALIBRATION VERIFICATION***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115935

Lab Sample ID: 598443

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/19/15 | 15:33 | 0.500 | 0.547 | 109 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**LLQC**

**2A-1**

***LOWER LIMIT OF QUANTITATION CHECK (LLQC)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115935

Lab Sample ID: 598444

ICAL Calibration #:

Concentration Units:

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/19/15 | 15:38 | 0.0300 | 0.0339 | 113 | 80 | 120 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV High Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 1 - HIGH RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115840

Lab Sample ID: 597418

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | | **Spiked Conc.** | **Measured Conc.** | **%R**** | **Lower Limit (1)** | **Upper Limit (1)** |
|---|---|---|---|---|---|---|---|
| Calcium | 6/17/15 | 15:41 | 5.00 | 4.81 | 96 | 90 | 110 |
| Magnesium | 6/17/15 | 15:41 | 5.00 | 4.92 | 98 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV Low Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 2 - LOW RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115840

Lab Sample ID: 597419

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Calcium | 6/17/15 | 15:46 | 0.500 | 0.548 | 110 | 90 | 110 |
| Magnesium | 6/17/15 | 15:46 | 0.500 | 0.505 | 101 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV High Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 1 - HIGH RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115840

Lab Sample ID: 597423

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | | **Spiked Conc.** | **Measured Conc.** | **%R**** | **Lower Limit (1)** | **Upper Limit (1)** |
|---|---|---|---|---|---|---|---|
| Calcium | 6/17/15 | 16:40 | 5.00 | 4.74 | 95 | 90 | 110 |
| Magnesium | 6/17/15 | 16:40 | 5.00 | 4.91 | 98 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV Low Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 2 - LOW RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115840

Lab Sample ID: 597424

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Calcium | 6/17/15 | 16:45 | 0.500 | 0.544 | 109 | 90 | 110 |
| Magnesium | 6/17/15 | 16:45 | 0.500 | 0.501 | 100 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV High Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 1 - HIGH RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115840

Lab Sample ID: 597426

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Calcium | 6/17/15 | 17:38 | 5.00 | 4.77 | 95 | 90 | 110 |
| Magnesium | 6/17/15 | 17:38 | 5.00 | 4.89 | 98 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV Low Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 2 - LOW RANGE)***

Lab Name: CT Laboratories Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115840 Lab Sample ID: 597427

ICAL Calibration #: Concentration Units: mg/L

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | | **Spiked Conc.** | **Measured Conc.** | **%R**** | **Lower Limit (1)** | **Upper Limit (1)** |
|---|---|---|---|---|---|---|---|
| Calcium | 6/17/15 | 17:42 | 0.500 | 0.541 | 108 | 90 | 110 |
| Magnesium | 6/17/15 | 17:42 | 0.500 | 0.491 | 98 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV High Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 1 - HIGH RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115935

Lab Sample ID: 598449

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/19/15 | 17:54 | 5.00 | 4.64 | 93 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV Low Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 2 - LOW RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115935

Lab Sample ID: 598450

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | | **Spiked Conc.** | **Measured Conc.** | **%R**** | **Lower Limit (1)** | **Upper Limit (1)** |
|---|---|---|---|---|---|---|---|
| Lead | 6/19/15 | 17:59 | 0.500 | 0.481 | 96 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV High Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 1 - HIGH RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115935

Lab Sample ID: 598454

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | | **Spiked Conc.** | **Measured Conc.** | **%R**** | **Lower Limit (1)** | **Upper Limit (1)** |
|---|---|---|---|---|---|---|---|
| Lead | 6/19/15 | 18:57 | 5.00 | 4.69 | 94 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV Low Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 2 - LOW RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115935

Lab Sample ID: 598455

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/19/15 | 19:01 | 0.500 | 0.489 | 98 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV High Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 1 - HIGH RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115935

Lab Sample ID: 598457

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/19/15 | 19:57 | 5.00 | 4.65 | 93 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV Low Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 2 - LOW RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115935

Lab Sample ID: 598458

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/19/15 | 20:02 | 0.500 | 0.462 | 92 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV High Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 1 - HIGH RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115839

Lab Sample ID: 597247

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | | **Spiked Conc.** | **Measured Conc.** | **%R**** | **Lower Limit (1)** | **Upper Limit (1)** |
|---|---|---|---|---|---|---|---|
| Lead | 6/17/15 | 01:50 | 5000 | 5000 | 100 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV Low Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 2 - LOW RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115839

Lab Sample ID: 597248

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/17/15 | 01:55 | 500.0 | 480.0 | 96 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV High Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 1 - HIGH RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115833

Lab Sample ID: 597438

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/17/15 | 15:41 | 5000 | 4970 | 99 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV Low Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 2 - LOW RANGE)***

Lab Name: CT Laboratories
Contract: AECOM-GULL ROCK
SDG No.: 111888

Analytical Run #: 115833
Lab Sample ID: 597439
ICAL Calibration #:
Concentration Units: ug/L

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | | **Spiked Conc.** | **Measured Conc.** | **%R**** | **Lower Limit (1)** | **Upper Limit (1)** |
|---|---|---|---|---|---|---|---|
| Lead | 6/17/15 | 15:46 | 500.0 | 507.0 | 101 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV High Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 1 - HIGH RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115833

Lab Sample ID: 597443

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/17/15 | 16:40 | 5000 | 5010 | 100 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV Low Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 2 - LOW RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115833

Lab Sample ID: 597444

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/17/15 | 16:45 | 500.0 | 510.0 | 102 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV High Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 1 - HIGH RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115833

Lab Sample ID: 597446

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | | **Spiked Conc.** | **Measured Conc.** | **%R**** | **Lower Limit (1)** | **Upper Limit (1)** |
|---|---|---|---|---|---|---|---|
| Lead | 6/17/15 | 17:38 | 5000 | 5000 | 100 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV Low Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 2 - LOW RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115833

Lab Sample ID: 597447

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/17/15 | 17:42 | 500.0 | 497.0 | 99 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV High Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 1 - HIGH RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115839

Lab Sample ID: 597688

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/16/15 | 23:59 | 5000 | 4790 | 96 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV Low Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 2 - LOW RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115839

Lab Sample ID: 597689

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/17/15 | 00:03 | 500.0 | 473.0 | 95 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV High Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 1 - HIGH RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115839

Lab Sample ID: 597691

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | | **Spiked Conc.** | **Measured Conc.** | **%R**** | **Lower Limit (1)** | **Upper Limit (1)** |
|---|---|---|---|---|---|---|---|
| Lead | 6/17/15 | 00:55 | 5000 | 4870 | 97 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV Low Level**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION (LEVEL 2 - LOW RANGE)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115839

Lab Sample ID: 597692

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/17/15 | 00:59 | 500.0 | 477.0 | 95 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**MRL**

**2B**

***MRL STANDARD CHECK***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115935

Lab Sample ID: 598446

ICAL Calibration #:

Concentration Units:

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Lead | 6/19/15 | 15:51 | 0.0100 | 0.0124 | 124 | 70 | 130 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: 70-130

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**ICB**

**3-1**

***INITIAL CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115839

Lab Sample ID: 597243

Analytical Prep Batch # 0

Preparation Date/Time:

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit |
|---|---|---|---|---|---|
| Lead | 06/16/2015 15:14 | 0.101 | U | 1.4 | 5.0 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**ICB**

**3-1**

***INITIAL CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115840

Lab Sample ID: 597414

Analytical Prep Batch # 0

Preparation Date/Time:

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit |
|---|---|---|---|---|---|
| Calcium | 06/17/2015 14:40 | -0.00662 | U | 0.017 | 0.050 |
| Magnesium | 06/17/2015 14:40 | 0.000534 | U | 0.006 | 0.020 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**ICB**

**3-1**

***INITIAL CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115833

Lab Sample ID: 597434

Analytical Prep Batch # 0

Preparation Date/Time:

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit |
|---|---|---|---|---|---|
| Lead | 06/17/2015 14:40 | 0.698 | U | 1.4 | 2.0 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**ICB**

**3-1**

***INITIAL CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115935

Lab Sample ID: 598445

Analytical Prep Batch # 0

Preparation Date/Time:

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit |
|---|---|---|---|---|---|
| Lead | 06/19/2015 15:47 | 0.00136 | U | 0.0014 | 0.0020 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was
less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**CCB**

**3-2**

***CONTINUING CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115839

Lab Sample ID: 597249

Analytical Prep Batch # 0

Preparation Date/Time:

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit |
|---|---|---|---|---|---|
| Lead | 06/17/2015 01:59 | -0.223 | U | 1.4 | 5.0 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**CCB**

**3-2**

***CONTINUING CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115840

Lab Sample ID: 597420

Analytical Prep Batch # 0

Preparation Date/Time:

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | **Measured Concentration** | **C*** ** | **Detection Limit** ** | **Control Limit** |
|---|---|---|---|---|---|
| Calcium | 06/17/2015 15:50 | -0.00643 | U | 0.017 | 0.050 |
| Magnesium | 06/17/2015 15:50 | 0.000147 | U | 0.006 | 0.020 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was
less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**CCB**

**3-2**

***CONTINUING CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115840

Lab Sample ID: 597425

Analytical Prep Batch # 0

Preparation Date/Time:

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | **Measured Concentration** | **C*** ** | **Detection Limit**** | **Control Limit** |
|---|---|---|---|---|---|
| Calcium | 06/17/2015 16:49 | -0.00787 | U | 0.017 | 0.050 |
| Magnesium | 06/17/2015 16:49 | -0.000184 | U | 0.006 | 0.020 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was
less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**CCB**

**3-2**

***CONTINUING CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115840

Lab Sample ID: 597428

Analytical Prep Batch # 0

Preparation Date/Time:

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit |
|---|---|---|---|---|---|
| Calcium | 06/17/2015 17:46 | -0.00825 | U | 0.017 | 0.050 |
| Magnesium | 06/17/2015 17:46 | -0.000068 | U | 0.006 | 0.020 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was
less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**CCB**

**3-2**

***CONTINUING CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115833

Lab Sample ID: 597440

Analytical Prep Batch # 0

Preparation Date/Time:

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | **Measured Concentration** | **C*** ** | **Detection Limit** ** | **Control Limit** |
|---|---|---|---|---|---|
| Lead | 06/17/2015 15:50 | 0.506 | U | 1.4 | 2.0 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was
less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**CCB**

**3-2**

***CONTINUING CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115833

Lab Sample ID: 597445

Analytical Prep Batch # 0

Preparation Date/Time:

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit |
|---|---|---|---|---|---|
| Lead | 06/17/2015 16:49 | 0.186 | U | 1.4 | 2.0 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**CCB**

**3-2**

***CONTINUING CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115833

Lab Sample ID: 597448

Analytical Prep Batch # 0

Preparation Date/Time:

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit |
|---|---|---|---|---|---|
| Lead | 06/17/2015 17:46 | 1.13 | U | 1.4 | 2.0 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was
less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**CCB**

**3-2**

***CONTINUING CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115839

Lab Sample ID: 597690

Analytical Prep Batch #

Preparation Date/Time:

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit |
|---|---|---|---|---|---|
| Lead | 06/17/2015 00:07 | -0.686 | U | 1.4 | 5.0 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**CCB**

**3-2**

***CONTINUING CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115839

Lab Sample ID: 597693

Analytical Prep Batch #

Preparation Date/Time:

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit |
|---|---|---|---|---|---|
| Lead | 06/17/2015 01:03 | 0.875 | U | 1.4 | 5.0 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**CCB**

**3-2**

***CONTINUING CALIBRATION BLANKS***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| SDG No.: | 111888 | | |
| Analytical Run #: | 115935 | Lab Sample ID: | 598451 |
| Analytical Prep Batch # | 0 | Preparation Date/Time: | |
| ICAL Calibration #: | | Concentration Units: | mg/L |

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit |
|---|---|---|---|---|---|
| Lead | 06/19/2015 18:03 | 0.000197 | U | 0.0014 | 0.0020 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was
less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**CCB**

**3-2**

***CONTINUING CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115935

Lab Sample ID: 598456

Analytical Prep Batch # 0

Preparation Date/Time:

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit |
|---|---|---|---|---|---|
| Lead | 06/19/2015 19:06 | 0.000452 | U | 0.0014 | 0.0020 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**CCB**

**3-2**

***CONTINUING CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115935

Lab Sample ID: 598459

Analytical Prep Batch # 0

Preparation Date/Time:

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit |
|---|---|---|---|---|---|
| Lead | 06/19/2015 20:06 | -0.00184 | U | 0.0014 | 0.0020 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**MB**

**3-3**

***METHOD BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115839

Lab Sample ID: 596028

Analytical Prep Batch # 52891

Preparation Date/Time: 06/16/2015 10:00

ICAL Calibration #:

Concentration Units: mg/kg

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | **Measured Concentration** | **C*** ** | **Detection Limit**** | **Control Limit** |
|---|---|---|---|---|---|
| Lead | 06/17/2015 01:08 | 0.0035 | U | 0.04 | 0.125 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was
less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**MB**

**3-3**

***METHOD BLANKS***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| SDG No.: | 111888 | | |
| Analytical Run #: | 115833 | Lab Sample ID: | 596102 |
| Analytical Prep Batch # | 52892 | Preparation Date/Time: | 06/16/2015 12:00 |
| ICAL Calibration #: | | Concentration Units: | ug/L |

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | **Measured Concentration** | **C*** ** | **Detection Limit**** | **Control Limit** |
|---|---|---|---|---|---|
| Total Lead | 06/17/2015 15:37 | 0.823 | U | 1.4 | 2.0 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**MB**

**3-3**

***METHOD BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115840

Lab Sample ID: 596107

Analytical Prep Batch # 52893

Preparation Date/Time: 06/16/2015 12:00

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit | |
|---|---|---|---|---|---|---|
| Calcium | 06/17/2015 15:37 | 0.0143 | U | 0.017 | 0.050 | |
| Magnesium | 06/17/2015 15:37 | 0.00790 | | 0.006 | 0.020 | FAIL |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was
less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**MB**

**3-3**

***METHOD BLANKS***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| SDG No.: | 111888 | | |
| Analytical Run #: | 115935 | Lab Sample ID: | 597566 |
| Analytical Prep Batch # | 52930 | Preparation Date/Time: | 06/19/2015 07:00 |
| ICAL Calibration #: | | Concentration Units: | mg/L |

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit |
|---|---|---|---|---|---|
| Lead | 06/19/2015 18:17 | -0.000709 | U | 0.0014 | 0.0020 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No:

**4-1**

**ICP INTERFERENCE CHECK SAMPLE (SOL. A)**

**ICSA**

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

ICP ID Number: TJA 6000

SDG No.: 111888

ICS Source: SPEX

Analytical Run #: 115839

Lab Sample ID: 597245

Inorganics MRL Standard Source: SPEX, Ultra,Inorganic Ventures and Mallinkrodt

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Spiked Conc. | Measured Conc. | %R | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|
| Aluminum | 06/16/2015 15:22 | 500000 | 536000 | 107 | 80 | 120 |
| Calcium | 06/16/2015 15:22 | 500000 | 490000 | 98 | 80 | 120 |
| Iron | 06/16/2015 15:22 | 500000 | 454000 | 91 | 80 | 120 |
| Lead | 06/16/2015 15:22 | 0 | -0.363 | | -5 | 5 |
| Magnesium | 06/16/2015 15:22 | 500000 | 468000 | 94 | 80 | 120 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No:

**4-1**

**ICP INTERFERENCE CHECK SAMPLE (SOL. A)**

**ICSA**

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

ICP ID Number: TJA 6000

SDG No.: 111888

ICS Source: SPEX

Analytical Run #: 115840

Lab Sample ID: 597416

Inorganics MRL Standard Source: SPEX, Ultra,Inorganic Ventures and Mallinkrodt

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Spiked Conc. | Measured Conc. | %R | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|
| Aluminum | 06/17/2015 14:49 | 500.0 | 544.0 | 109 | 80 | 120 |
| Calcium | 06/17/2015 14:49 | 500.0 | 499.0 | 100 | 80 | 120 |
| Iron | 06/17/2015 14:49 | 500.0 | 460.0 | 92 | 80 | 120 |
| Magnesium | 06/17/2015 14:49 | 500.0 | 468.0 | 94 | 80 | 120 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No:

**4-1**

**ICP INTERFERENCE CHECK SAMPLE (SOL. A)**

**ICSA**

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

ICP ID Number: TJA 6000

SDG No.: 111888

ICS Source: SPEX

Analytical Run #: 115833

Lab Sample ID: 597436

Inorganics MRL Standard Source: SPEX, Ultra,Inorganic Ventures and Mallinkrodt

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Spiked Conc. | Measured Conc. | %R | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|
| Aluminum | 06/17/2015 14:49 | 500000 | 544000 | 109 | 80 | 120 |
| Calcium | 06/17/2015 14:49 | 500000 | 499000 | 100 | 80 | 120 |
| Iron | 06/17/2015 14:49 | 500000 | 460000 | 92 | 80 | 120 |
| Lead | 06/17/2015 14:49 | 0 | 0 | | -1.5 | 1.5 |
| Magnesium | 06/17/2015 14:49 | 500000 | 468000 | 94 | 80 | 120 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No:

**ICSA**

**4-1**

**ICP INTERFERENCE CHECK SAMPLE (SOL. A)**

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

ICP ID Number: TJA 6000

SDG No.: 111888

ICS Source: SPEX

Analytical Run #: 115935

Lab Sample ID: 598447

Inorganics MRL Standard Source: SPEX, Ultra,Inorganic Ventures and Mallinkrodt

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Spiked Conc. | Measured Conc. | %R | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|
| Aluminum | 06/19/2015 15:56 | 500.0 | 527.0 | 105 | 80 | 120 |
| Calcium | 06/19/2015 15:56 | 500.0 | 504.0 | 101 | 80 | 120 |
| Iron | 06/19/2015 15:56 | 500.0 | 460.0 | 92 | 80 | 120 |
| Lead | 06/19/2015 15:56 | 0 | 0.00000200 | | -0.0015 | 0.0015 |
| Magnesium | 06/19/2015 15:56 | 500.0 | 461.0 | 92 | 80 | 120 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No:

**ICSAB**

**4-2**

**ICP INTERFERENCE CHECK SAMPLE (SOL. AB)**

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

ICP ID Number: TJA 6000

SDG No.: 111888

ICS Source: SPEX, Ultra

Analytical Run #: 115839

Lab Sample ID: 597246

Inorganics MRL Standard Source: SPEX, Ultra,Inorganic Ventures and Mallinkrodt

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Spiked Conc. | Measured Conc. | %R | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|
| Aluminum | 06/16/2015 15:27 | 500000 | 528000 | 106 | 80 | 120 |
| Calcium | 06/16/2015 15:27 | 500000 | 485000 | 97 | 80 | 120 |
| Iron | 06/16/2015 15:27 | 500000 | 445000 | 89 | 80 | 120 |
| Lead | 06/16/2015 15:27 | 500.0 | 519.0 | 104 | 80 | 120 |
| Magnesium | 06/16/2015 15:27 | 500000 | 460000 | 92 | 80 | 120 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No: **ICSAB**

**4-2**

**ICP INTERFERENCE CHECK SAMPLE (SOL. AB)**

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

ICP ID Number: TJA 6000

SDG No.: 111888

ICS Source: SPEX, Ultra

Analytical Run #: 115840

Lab Sample ID: 597417

Inorganics MRL Standard Source: SPEX, Ultra,Inorganic Ventures and Mallinkrodt

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Spiked Conc. | Measured Conc. | %R | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|
| Aluminum | 06/17/2015 14:53 | 500.0 | 567.0 | 113 | 80 | 120 |
| Calcium | 06/17/2015 14:53 | 500.0 | 516.0 | 103 | 80 | 120 |
| Iron | 06/17/2015 14:53 | 500.0 | 464.0 | 93 | 80 | 120 |
| Magnesium | 06/17/2015 14:53 | 500.0 | 465.0 | 93 | 80 | 120 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No:

**4-2**

**ICP INTERFERENCE CHECK SAMPLE (SOL. AB)**

**ICSAB**

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

ICP ID Number: TJA 6000

SDG No.: 111888

ICS Source: SPEX, Ultra

Analytical Run #: 115833

Lab Sample ID: 597437

Inorganics MRL Standard Source: SPEX, Ultra,Inorganic Ventures and Mallinkrodt

ICAL Calibration #:

Concentration Units: ug/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Spiked Conc. | Measured Conc. | %R | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|
| Aluminum | 06/17/2015 14:53 | 500000 | 567000 | 113 | 80 | 120 |
| Calcium | 06/17/2015 14:53 | 500000 | 516000 | 103 | 80 | 120 |
| Iron | 06/17/2015 14:53 | 500000 | 464000 | 93 | 80 | 120 |
| Lead | 06/17/2015 14:53 | 500.0 | 485.0 | 97 | 80 | 120 |
| Magnesium | 06/17/2015 14:53 | 500000 | 465000 | 93 | 80 | 120 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No:

**4-2**

**ICP INTERFERENCE CHECK SAMPLE (SOL. AB)**

**ICSAB**

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

ICP ID Number: TJA 6000

SDG No.: 111888

ICS Source: SPEX, Ultra

Analytical Run #: 115935

Lab Sample ID: 598448

Inorganics MRL Standard Source: SPEX, Ultra,Inorganic Ventures and Mallinkrodt

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Spiked Conc. | Measured Conc. | %R | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|
| Aluminum | 06/19/2015 16:01 | 500.0 | 524.0 | 105 | 80 | 120 |
| Calcium | 06/19/2015 16:01 | 500.0 | 496.0 | 99 | 80 | 120 |
| Iron | 06/19/2015 16:01 | 500.0 | 450.0 | 90 | 80 | 120 |
| Lead | 06/19/2015 16:01 | 0.500 | 0.580 | 116 | 80 | 120 |
| Magnesium | 06/19/2015 16:01 | 500.0 | 459.0 | 92 | 80 | 120 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**G-25**

**5A**

***SPIKE SAMPLE RECOVERY***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | SOLID | SDG No.: | 111888 |
| % Solids for Sample: | 95.1 | Concentration Units: | mg/kg |
| Sample No | 596031 | Parent Sample No.: | 595908 |
| Analytical Prep Batch # | 52891 | Analytical Preparation Date/Time: | 06/16/2015 10:00 |
| Analytical Run #: | 115839 | ICAL Calibration #: | |

| Analysis Type | *Initial Analysis* | Analysis Date: ----- | 06/17/2015 | Analysis Time: -------- | 01:25 |
|---|---|---|---|---|---|

| **Analyte** | **Control Limit (%R)** | **Spike Result** | **C (Spike)** | **Parent Result** | **C (Parent)** | **Spike Amount** | **%R** | **Q** | **M** | |
|---|---|---|---|---|---|---|---|---|---|---|
| Lead | 80-120 | 18.0 | | 3.3 | | 27.2 | 54 | | P | *FAIL* |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

**5A**

***SPIKE SAMPLE RECOVERY***

Sample Description

**SW-2**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solids for Sample: | | Concentration Units: | ug/L |
| Sample No | 596105 | Parent Sample No.: | 595903 |
| Analytical Prep Batch # | 52892 | Analytical Preparation Date/Time: | 06/16/2015 12:00 |
| Analytical Run #: | 115833 | ICAL Calibration #: | |

Analysis Type *Initial Analysis* Analysis Date: ----- 06/17/2015 Analysis Time: -------- 16:13

| **Analyte** | **Control Limit (%R)** | **Spike Result** | **C (Spike)** | **Parent Result** | **C (Parent)** | **Spike Amount** | **%R** | **Q** | **M** | |
|---|---|---|---|---|---|---|---|---|---|---|
| Total Lead | 80-120 | 155 | | BDL | U | 200 | 78 | | P | *FAIL* |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-2**

**5A**

***SPIKE SAMPLE RECOVERY***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solids for Sample: | | Concentration Units: | mg/L |
| Sample No | 596110 | Parent Sample No.: | 595903 |
| Analytical Prep Batch # | 52893 | Analytical Preparation Date/Time: | 06/16/2015 12:00 |
| Analytical Run #: | 115840 | ICAL Calibration #: | |

| Analysis Type | *Initial Analysis* | Analysis Date: ----- | 06/17/2015 | Analysis Time: -------- | 16:13 |
|---|---|---|---|---|---|

| **Analyte** | **Control Limit (%R)** | **Spike Result** | **C (Spike)** | **Parent Result** | **C (Parent)** | **Spike Amount** | **%R** | **Q** | **M** |
|---|---|---|---|---|---|---|---|---|---|
| Calcium | 80-120 | 204 | | 13 | | 200 | 96 | | P |
| Magnesium | 80-120 | 88.5 | | 2.7 | | 100 | 86 | | P |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**G-25**

**5A**

***SPIKE SAMPLE RECOVERY***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

Matrix: LIQUID

SDG No.: 111888

% Solids for Sample:

Concentration Units: mg/L

Sample No 597569

Parent Sample No.: 595909

Analytical Prep Batch # 52930

Analytical Preparation Date/Time: 06/19/2015 07:00

Analytical Run #: 115935

ICAL Calibration #:

Analysis Type *Initial Analysis* Analysis Date: ----- 06/19/2015 Analysis Time: -------- 18:37

| **Analyte** | **Control Limit (%R)** | **Spike Result** | **C (Spike)** | **Parent Result** | **C (Parent)** | **Spike Amount** | **%R** | **Q** | **M** | |
|---|---|---|---|---|---|---|---|---|---|---|
| Lead | 80-120 | 0.126 | | 0.0030 | J | 0.200 | 62 | | P | *FAIL* |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-2**

**5B**

***POST DIGESTION SPIKE SAMPLE RECOVERY***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solids for Sample: | | Concentration Units: | mg/L |
| Sample No | 597422 | Parent Sample No.: | 595903 |
| Analytical Prep Batch # | 0 | Analytical Preparation Date/Time: | |
| Analytical Run #: | 115840 | ICAL Calibration #: | |

| Analysis Type | *Initial Analysis* | Analysis Date: ----- | 06/17/2015 | Analysis Time: -------- | 16:22 |
|---|---|---|---|---|---|

| **Analyte** | **Control Limit (%R)** | **Spike Result** | **C (Spike)** | **Parent Result** | **C (Parent)** | **Spike Amount** | **%R** | **Q** | **M** |
|---|---|---|---|---|---|---|---|---|---|
| Calcium | 80-120 | 403 | | 13 | | 400 | 98 | | P |
| Magnesium | 80-120 | 174 | | 2.7 | | 200 | 86 | | P |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-2**

**5B**

***POST DIGESTION SPIKE SAMPLE RECOVERY***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solids for Sample: | | Concentration Units: | ug/L |
| Sample No | 597442 | Parent Sample No.: | 595903 |
| Analytical Prep Batch # | 0 | Analytical Preparation Date/Time: | |
| Analytical Run #: | 115833 | ICAL Calibration #: | |

| Analysis Type | *Initial Analysis* | Analysis Date: ----- | 06/17/2015 | Analysis Time: -------- | 16:22 |
|---|---|---|---|---|---|

| **Analyte** | **Control Limit (%R)** | **Spike Result** | **C (Spike)** | **Parent Result** | **C (Parent)** | **Spike Amount** | **%R** | **Q** | **M** |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 80-120 | 877 | | BDL | U | 1000 | 88 | | P |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**G-25**

**5B**

***POST DIGESTION SPIKE SAMPLE RECOVERY***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | SOLID | SDG No.: | 111888 |
| % Solids for Sample: | 95.1 | Concentration Units: | ug/L |
| Sample No | 597682 | Parent Sample No.: | 595908 |
| Analytical Prep Batch # | | Analytical Preparation Date/Time: | |
| Analytical Run #: | 115839 | ICAL Calibration #: | |

| Analysis Type | *Initial Analysis* | Analysis Date: ----- | 06/17/2015 | Analysis Time: -------- | 01:33 |
|---|---|---|---|---|---|

| **Analyte** | **Control Limit (%R)** | **Spike Result** | **C (Spike)** | **Parent Result** | **C (Parent)** | **Spike Amount** | **%R** | **Q** | **M** | |
|---|---|---|---|---|---|---|---|---|---|---|
| Lead | 80-120 | 677 | | 124 | | 1000 | 55 | | P | *FAIL* |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

**5B**

***POST DIGESTION SPIKE SAMPLE RECOVERY***

Sample Description

**G-25**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solids for Sample: | | Concentration Units: | mg/L |
| Sample No | 598453 | Parent Sample No.: | 595909 |
| Analytical Prep Batch # | 0 | Analytical Preparation Date/Time: | |
| Analytical Run #: | 115935 | ICAL Calibration #: | |

Analysis Type *Initial Analysis* Analysis Date: ----- 06/19/2015 Analysis Time: -------- 18:47

| Analyte | Control Limit (%R) | Spike Result | C (Spike) | Parent Result | C (Parent) | Spike Amount | %R | Q | M |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 80-120 | 0.885 | | 0.0030 | J | 1 | 88 | | P |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**G-25**

**5C**

***SPIKE DUPLICATE SAMPLE RECOVERY***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | SOLID | SDG No.: | 111888 |
| % Solids for Sample: | 95.1 | Concentration Units: | mg/kg |
| Sample No | 596032 | Parent Sample No.: | 596031 |
| Analytical Prep Batch # | 52891 | Analytical Preparation Date/Time: | 06/16/2015 10:00 |
| Analytical Run #: | 115839 | ICAL Calibration #: | |

| Analysis Type | *Initial Analysis* | Analysis Date: ----- | 06/17/2015 | Analysis Time: -------- | 01:29 |
|---|---|---|---|---|---|

| **Analyte** | **Control Limit (%R)** | **Spike Result** | **C (Spike)** | **Parent Result** | **C (Parent)** | **Spike Amount** | **%R** | **Q** | **M** | |
|---|---|---|---|---|---|---|---|---|---|---|
| Lead | 80-120 | 16.5 | | 3.3 | | 25.4 | 52 | | P | *FAIL* |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-2**

**5C**

***SPIKE DUPLICATE SAMPLE RECOVERY***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solids for Sample: | | Concentration Units: | ug/L |
| Sample No | 596106 | Parent Sample No.: | 596105 |
| Analytical Prep Batch # | 52892 | Analytical Preparation Date/Time: | 06/16/2015 12:00 |
| Analytical Run #: | 115833 | ICAL Calibration #: | |

| Analysis Type | *Initial Analysis* | Analysis Date: ----- | 06/17/2015 | Analysis Time: -------- | 16:17 |
|---|---|---|---|---|---|

| **Analyte** | **Control Limit (%R)** | **Spike Result** | **C (Spike)** | **Parent Result** | **C (Parent)** | **Spike Amount** | **%R** | **Q** | **M** |
|---|---|---|---|---|---|---|---|---|---|
| Total Lead | 80-120 | 160 | | BDL | U | 200 | 80 | | P |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-2**

**5C**

***SPIKE DUPLICATE SAMPLE RECOVERY***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solids for Sample: | | Concentration Units: | mg/L |
| Sample No | 596111 | Parent Sample No.: | 596110 |
| Analytical Prep Batch # | 52893 | Analytical Preparation Date/Time: | 06/16/2015 12:00 |
| Analytical Run #: | 115840 | ICAL Calibration #: | |

Analysis Type *Initial Analysis* Analysis Date: ----- 06/17/2015 Analysis Time: -------- 16:17

| Analyte | Control Limit (%R) | Spike Result | C (Spike) | Parent Result | C (Parent) | Spike Amount | %R | Q | M |
|---|---|---|---|---|---|---|---|---|---|
| Calcium | 80-120 | 208 | | 13 | | 200 | 98 | | P |
| Magnesium | 80-120 | 90.9 | | 2.7 | | 100 | 88 | | P |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**G-25**

**5C**

***SPIKE DUPLICATE SAMPLE RECOVERY***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solids for Sample: | | Concentration Units: | mg/L |
| Sample No | 597570 | Parent Sample No.: | 597569 |
| Analytical Prep Batch # | 52930 | Analytical Preparation Date/Time: | 06/19/2015 07:00 |
| Analytical Run #: | 115935 | ICAL Calibration #: | |

| Analysis Type | *Initial Analysis* | Analysis Date: ----- | 06/19/2015 | Analysis Time: -------- | 18:42 |
|---|---|---|---|---|---|

| **Analyte** | **Control Limit (%R)** | **Spike Result** | **C (Spike)** | **Parent Result** | **C (Parent)** | **Spike Amount** | **%R** | **Q** | **M** | |
|---|---|---|---|---|---|---|---|---|---|---|
| Lead | 80-120 | 0.132 | | 0.0030 | J | 0.200 | 64 | | P | *FAIL* |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

6

***DUPLICATES***

Sample Description

**G-25**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | SOLID | SDG No.: | 111888 |
| % Solid for Sample: | 95.1 | Concentration Units: | mg/kg |
| Analytical Prep Batch # | 1 | Analytical Preparation Date/Time | 52891 |
| Analytical Run #: | 115839 | ICAL Calibration #: | |
| Sample #: | 596030 | Parent Sample #: | 595908 |

Analysis Type *Initial Analysis*

| Analyte | Analysis Date/Tim | | RPD Limit | Original Parent Conc. (S) | C | Duplicate Conc. (D) | C | RPD | Q | M |
|---|---|---|---|---|---|---|---|---|---|---|
| Lead | 06/17/2015 | 01:20 | 20 | 3.3 | | 2.8 | | 16 | | P |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-2**

**6**

***DUPLICATES***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solid for Sample: | | Concentration Units: | ug/L |
| Analytical Prep Batch # | 1 | Analytical Preparation Date/Time | 52892 |
| Analytical Run #: | 115833 | ICAL Calibration #: | |
| Sample #: | 596104 | Parent Sample #: | 595903 |

Analysis Type *Initial Analysis*

| **Analyte** | **Analysis Date/Tim** | | **RPD Limit** | **Original Parent Conc. (S)** | **C** | **Duplicate Conc. (D)** | **C** | **RPD** | **Q** | **M** |
|---|---|---|---|---|---|---|---|---|---|---|
| Total Lead | 06/17/2015 | 16:08 | 20 | 1.4 | U | 1.4 | U | 0 | | P |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-2**

**6**

***DUPLICATES***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

Matrix: LIQUID

SDG No.: 111888

% Solid for Sample:

Concentration Units: mg/L

Analytical Prep Batch # 1

Analytical Preparation Date/Time 52893

Analytical Run #: 115840

ICAL Calibration #:

Sample #: 596109

Parent Sample #: 595903

Analysis Type *Initial Analysis*

| **Analyte** | **Analysis Date/Tim** | | **RPD Limit** | **Original Parent Conc. (S)** | **C** | **Duplicate Conc. (D)** | **C** | **RPD** | **Q** | **M** |
|---|---|---|---|---|---|---|---|---|---|---|
| Calcium | 06/17/2015 | 16:08 | 20 | 13 | | 12.7 | | 2 | | P |
| Magnesium | 06/17/2015 | 16:08 | 20 | 2.7 | | 2.75 | | 2 | | P |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**G-25**

**6**

***DUPLICATES***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solid for Sample: | | Concentration Units: | mg/L |
| Analytical Prep Batch # | 1 | Analytical Preparation Date/Time | 52930 |
| Analytical Run #: | 115935 | ICAL Calibration #: | |
| Sample #: | 597568 | Parent Sample #: | 595909 |

Analysis Type *Initial Analysis*

| **Analyte** | **Analysis Date/Tim** | | **RPD Limit** | **Original Parent Conc. (S)** | **C** | **Duplicate Conc. (D)** | **C** | **RPD** | **Q** | **M** | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lead | 06/19/2015 | 18:32 | 20 | 0.0030 | J | 0.00477 | | 46 | | P | *FAIL* |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**G-25**

**6A**

***MATRIX SPIKE DUPLICATES***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | SOLID | SDG No.: | 111888 |
| % Solid for Sample: | 95.1 | Concentration Units: | mg/kg |
| Analytical Prep Batch # | 52891 | Analytical Preparation Date/Time | 06/16/2015 10:00 |
| Analytical Run #: | 115839 | ICAL Calibration #: | |
| Sample #: | 596032 | Parent Sample #: | 596031 |

Analysis Type *Initial Analysis*

| **Analyte** | **Analysis Date/Tim** | | **RPD Limit** | **Matrix Spik Parent Conc. (S)** | **C** | **Matrix Spike Duplicate Conc. (D)** | **C** | **RPD** | **Q** | **M** |
|---|---|---|---|---|---|---|---|---|---|---|
| Lead | 06/17/2015 | 01:29 | 20 | 18.0 | | 16.5 | | 2 | | P |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-2**

**6A**

***MATRIX SPIKE DUPLICATES***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

Matrix: LIQUID

SDG No.: 111888

% Solid for Sample:

Concentration Units: ug/L

Analytical Prep Batch # 52892

Analytical Preparation Date/Time 06/16/2015 12:00

Analytical Run #: 115833

ICAL Calibration #:

Sample #: 596106

Parent Sample #: 596105

Analysis Type *Initial Analysis*

| **Analyte** | **Analysis Date/Tim** | | **RPD Limit** | **Matrix Spik Parent Conc. (S)** | **C** | **Matrix Spike Duplicate Conc. (D)** | **C** | **RPD** | **Q** | **M** |
|---|---|---|---|---|---|---|---|---|---|---|
| Total Lead | 06/17/2015 | 16:17 | 20 | 155 | | 160 | | 3 | | P |

CT LABORATORIES
delivering more than data from your environmental analyses

**6A**

***MATRIX SPIKE DUPLICATES***

Sample Description

**SW-2**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solid for Sample: | | Concentration Units: | mg/L |
| Analytical Prep Batch # | 52893 | Analytical Preparation Date/Time | 06/16/2015 12:00 |
| Analytical Run #: | 115840 | ICAL Calibration #: | |
| Sample #: | 596111 | Parent Sample #: | 596110 |

Analysis Type *Initial Analysis*

| **Analyte** | **Analysis Date/Tim** | | **RPD Limit** | **Matrix Spik Parent Conc. (S)** | **C** | **Matrix Spike Duplicate Conc. (D)** | **C** | **RPD** | **Q** | **M** |
|---|---|---|---|---|---|---|---|---|---|---|
| Calcium | 06/17/2015 | 16:17 | 20 | 204 | | 208 | | 2 | | P |
| Magnesium | 06/17/2015 | 16:17 | 20 | 88.5 | | 90.9 | | 3 | | P |

CT LABORATORIES
delivering more than data from your environmental analyses

**6A**

***MATRIX SPIKE DUPLICATES***

Sample Description

**G-25**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solid for Sample: | | Concentration Units: | mg/L |
| Analytical Prep Batch # | 52930 | Analytical Preparation Date/Time | 06/19/2015 07:00 |
| Analytical Run #: | 115935 | ICAL Calibration #: | |
| Sample #: | 597570 | Parent Sample #: | 597569 |

Analysis Type *Initial Analysis*

| **Analyte** | **Analysis Date/Tim** | **RPD Limit** | **Matrix Spik Parent Conc. (S)** | **C** | **Matrix Spike Duplicate Conc. (D)** | **C** | **RPD** | **Q** | **M** |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 06/19/2015 18:42 | 20 | 0.126 | | 0.132 | | 5 | | P |

CT LABORATORIES
delivering more than data from your environmental analyses

**7-1**

***LABORATORY CONTROL SAMPLE - AQUEOUS***

Sample No:

**LCS**

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

LCS Source: SPEX and Ultra

SDG No.: 111888

Concentration Units: ug/L

Analytical Run #: 115833

Sample No.:#: 596103

Analytical Prep Batch #: 52892

Preparation Date/Time: 06/16/2015 12:00

ICAL Calibration #:

Analysis Type ------------ Initial Analysis

| Analyte | Analysis Date/Time | Control Limit (%R) | Spike Result | C | Spike Amount | %R | Q | M |
|---|---|---|---|---|---|---|---|---|
| Total Lead | 06/17/2015 15:32 | 80-120 | 175.0 | | 200.0 | 88 | | P |

CT LABORATORIES
delivering more than data from your environmental analyses

7-1

Sample No:

***LABORATORY CONTROL SAMPLE - AQUEOUS***

**LCS**

Lab Name: CT Laboratories

Contract AECOM-GULL ROCK

LCS Source: SPEX and Ultra

SDG No.: 111888

Concentration Units: mg/L

Analytical Run #: 115840

Sample No.:#: 596108

Analytical Prep Batch #: 52893

Preparation Date/Time: 06/16/2015 12:00

ICAL Calibration #:

Analysis Type ------------ Initial Analysis

| Analyte | Analysis Date/Time | | Control Limit (%R) | Spike Result | C | Spike Amount | %R | Q | M |
|---|---|---|---|---|---|---|---|---|---|
| Calcium | 06/17/2015 | 15:32 | 80-120 | 193.0 | | 200.0 | 96 | | P |
| Magnesium | 06/17/2015 | 15:32 | 80-120 | 88.80 | | 100.0 | 89 | | P |

CT LABORATORIES
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7-1

Sample No:

***LABORATORY CONTROL SAMPLE - AQUEOUS***

**LCS**

Lab Name: CT Laboratories

Contract AECOM-GULL ROCK

LCS Source: SPEX and Ultra

SDG No.: 111888

Concentration Units: mg/L

Analytical Run #: 115935

Sample No.:#: 597567

Analytical Prep Batch #: 52930

Preparation Date/Time: 06/19/2015 07:00

ICAL Calibration #:

Analysis Type ------------ Initial Analysis

| Analyte | Analysis Date/Time | Control Limit (%R) | Spike Result | C | Spike Amount | %R | Q | M |
|---|---|---|---|---|---|---|---|---|
| Lead | 06/19/2015 18:13 | 80-120 | 0.184 | | 0.200 | 92 | | P |

CT LABORATORIES
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**7-2**

***LABORATORY CONTROL SAMPLE - SOLID***

Sample No:

**LCS**

Lab Name: CT Laboratories

Contract AECOM-GULL ROCK

LCS Source: SPEX and Ultra

SDG No.: 111888

Concentration Units: mg/kg

Analytical Run #: 115839

Sample No.:#: 596029

Analytical Prep Batch #: 52891

Preparation Date/Time: 06/16/2015 10:00

ICAL Calibration #:

Analysis Type ------------ Initial Analysis

| Analyte | Analysis Date/Time | | Control Limit (%R) | Spike Result | C | Spike Amount | %R | Q | M |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 06/17/2015 | 00:51 | 80-120 | 26.8 | | 25.0 | 107 | | P |

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Sample Description

**SW-2**

**9**

***ICP SERIAL DILUTION***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

Matrix: LIQUID

SDG No.: 111888

Concentration Units: ug/L

Sample No.: 597421

Parent Sample No.: 595903

LIMS Run #: 115840

ICAL Calibration #:.:

Analysis Type ----------- Initial Analysis

| **Analyte** | **Analysis Date/Time** | **Initial Sample Result (I)** | **C (I)** | **Serial Dilution Result (S)** | **C (S)** | **% Diff.** | **Q** | **M** | |
|---|---|---|---|---|---|---|---|---|---|
| Calcium | 06/17/2015 16:04 | 12500. | | 13650 | | 9 | | P | |
| Magnesium | 06/17/2015 16:04 | 2720. | | 3295 | | 21 | | P | *FAIL* |

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Sample Description

**SW-2**

**9**

***ICP SERIAL DILUTION***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

Matrix: LIQUID

SDG No.: 111888

Concentration Units: ug/L

Sample No.: 597441

Parent Sample No.: 595903

LIMS Run #: 115833

ICAL Calibration #:.:

Analysis Type ----------- Initial Analysis

| Analyte | Analysis Date/Time | Initial Sample Result (I) | C (I) | Serial Dilution Result (S) | C (S) | % Diff. | Q | M | |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 06/17/2015 16:04 | BDL | U | 7 | U | 0 | | P | *INVALID* |

9

***ICP SERIAL DILUTION***

Sample Description

**G-25**

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

Matrix: SOLID

SDG No.: 111888

Concentration Units: ug/L

Sample No.: 597683

Parent Sample No.: 595908

LIMS Run #: 115839

ICAL Calibration #:.:

Analysis Type ----------- Initial Analysis

| Analyte | Analysis Date/Time | Initial Sample Result (I) | C (I) | Serial Dilution Result (S) | C (S) | % Diff. | Q | M | |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 06/17/2015 01:16 | 124 | | 160.5 | | 29 | | P | *INVALID* |

CT LABORATORIES
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Sample Description

**G-25**

**9**

***ICP SERIAL DILUTION***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

Matrix: LIQUID

SDG No.: 111888

Concentration Units: ug/L

Sample No.: 598452

Parent Sample No.: 595909

LIMS Run #: 115935

ICAL Calibration #:.:

Analysis Type ----------- Initial Analysis

| Analyte | Analysis Date/Time | Initial Sample Result (I) | C (I) | Serial Dilution Result (S) | C (S) | % Diff. | Q | M | |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 06/19/2015 18:27 | 3.00 | | 4.19 | | 40 | | P | *INVALID* |

CT LABORATORIES
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10
***METHOD DETECTION LIMITS (ANNUALLY)***

Lab Name: CT Laboratories    Contract: AECOM-GULL ROCK

ICP ID Number: TJA    SDG No.: 111888

Matrix: LIQUID

| **Analyte** | **Wavelength (nm)** | **Background** | **CRDL (ug/L)** | **MDL ( mg/L)** | **M** |
|---|---|---|---|---|---|
| Lead | 220.35 | | | 0.0014 | P |
| Total Hardness | | | | 0.067 | P |

CT LABORATORIES
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**10**

***METHOD DETECTION LIMITS (ANNUALLY)***

Lab Name: CT Laboratories    Contract: AECOM-GULL ROCK

ICP ID Number: TJA    SDG No.: 111888

Matrix: LIQUID

| **Analyte** | **Wavelength (nm)** | **Background** | **CRDL (ug/L)** | **MDL ( ug/L )** | **M** |
|---|---|---|---|---|---|
| Total Lead | 220.35 | | | 1.4 | P |

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**10**

***METHOD DETECTION LIMITS (ANNUALLY)***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

ICP ID Number: TJA

SDG No.: 111888

Matrix: SOLID

| **Analyte** | **Wavelength (nm)** | **Background** | **CRDL (ug/L)** | **MDL ( mg/k)** | **M** |
|---|---|---|---|---|---|
| Lead | 220.35 | | | 0.04 | P |

ICP INTERELEMENT CORRECTION FACTORS (ANNUAL)

ICP ID NUMBER: TA ICAP6000 / ICAP6500

| Element, Wavelength and Order | Use? | # IECs | IEC | k1 |
|---|---|---|---|---|
| Ag 328.068 {103} | ☒ | 1 | Fe | 0.000006 |
| Al 308.215 {109} | ☒ | None | | |
| Al 309.271 {109} | ☒ | None | | |
| Al 396.152 { 85} | ☒ | None | | |
| Al 167.079 {502} | ☒ | 1 | Fe | 0.000627 |
| As 193.759 {474} | ☒ | 3 | Fe | -0.000324 |
| | | | Mo | 0.000000 |
| | | | Co | 0.000000 |
| As 189.042 {479} | ☒ | 1 | Fe | 0.000027 |
| Ba 455.403 { 74} | ☒ | 1 | Fe | -0.000000 |
| Ba 493.409 { 68} | ☒ | 1 | Fe | 0.000106 |
| Be 313.042 {108} | ☒ | 1 | Fe | 0.000000 |
| Be 234.861 {144} | ☒ | 1 | Fe | 0.000101 |
| Ca 315.887 {107} | ☒ | None | | |
| Ca 317.933 {106} | ☒ | None | | |
| Ca 393.366 { 86} | ☒ | None | | |
| Ca 396.847 { 85} | ☒ | None | | |
| Cd 226.502 {449} | ☒ | 2 | Fe | 0.000381 |
| | | | Ag | -0.049000 |
| Cd 228.802 {447} | ☒ | 1 | Fe | 0.000100 |
| Co 228.616 {447} | ☒ | 6 | Ti | -0.002110 |
| | | | Mo | -0.001300 |
| | | | Cr | -0.000235 |
| | | | Ba | 0.000315 |
| | | | Ni | 0.000000 |
| | | | Fe | 0.000017 |
| Co 238.892 {141} | ☒ | 1 | Fe | 0.000242 |
| Cr 267.716 {126} | ☒ | 1 | Fe | 0.000010 |
| Cr 283.563 {119} | ☒ | 1 | Fe | 0.000949 |
| Cu 224.700 {450} | ☒ | 2 | Fe | 0.000062 |
| | | | Ag | -0.050000 |
| Cu 324.754 {104} | ☒ | 1 | Fe | 0.000200 |
| Cu 327.396 {103} | ☒ | 1 | Fe | -0.000016 |
| Fe 234.349 {144} | ☒ | None | | |
| Fe 239.562 {141} | ☒ | None | | |
| Fe 259.940 {130} | ☒ | None | | |
| Mg 202.582 {466} | ☒ | None | | |
| Mg 279.079 {121} | ☒ | None | | |
| Mg 280.270 {120} | ☒ | None | | |
| Mn 257.610 {131} | ☒ | 1 | Al | -0.000055 |
| Mn 259.373 {130} | ☒ | 1 | Mg | 0.001246 |
| Mo 203.844 {465} | ☒ | 1 | Fe | -0.000027 |
| Mo 202.030 {467} | ☒ | 1 | Fe | -0.000020 |
| Mo 204.598 {465} | ☒ | 1 | Fe | -0.000100 |

CT LABORATORIES

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ICP INTERELEMENT CORRECTION FACTORS (ANNUAL)

ICP ID NUMBER: TA ICAP6000 / ICAP6500

| Element, Wavelength and Order | Use? | # IECs | IEC | k1 |
|---|---|---|---|---|
| Ni 221.647 {452} | ☒ | 1 | Ca | 0.000022 |
| Ni 231.604 {445} | ☒ | 4 | Fe | 0.000117 |
| | | | Co | -0.050000 |
| | | | Ag | -0.050000 |
| | | | Mo | -0.000200 |
| Pb 216.999 {455} | ☒ | 2 | Al | 0.000478 |
| | | | Na | 0.000000 |
| Pb 220.353 {153} | ☒ | 1 | Fe | 0.000024 |
| Pb 220.353 {453} | ☒ | 9 | Fe | 0.000071 |
| | | | Si | 0.000940 |
| | | | Tl | 0.000640 |
| | | | Cu | 0.000370 |
| | | | Ni | 0.000109 |
| | | | Al | 0.000000 |
| | | | Co | -0.000149 |
| | | | Mn | 0.000074 |
| | | | Ti | 0.000004 |
| Sb 206.833 {463} | ☒ | 1 | Fe | 0.000032 |
| Sb 217.581 {455} | ☒ | 1 | Fe | -0.000048 |
| Se 196.090 {172} | ☒ | 1 | Fe | -0.000205 |
| Se 196.090 {472} | ☒ | 1 | Fe | 0.000022 |
| Se 206.279 {463} | ☒ | 1 | Fe | 0.001119 |
| Tl 276.787 {122} | ☒ | 1 | Mg | 0.006492 |
| Tl 190.856 {477} | ☒ | 10 | Ti | 0.000050 |
| | | | Al | -0.000002 |
| | | | V | 0.000586 |
| | | | Mn | 0.000398 |
| | | | Mo | -0.000120 |
| | | | Be | -0.000013 |
| | | | Fe | -0.000033 |
| | | | Sr | -0.000027 |
| | | | Co | 0.000016 |
| | | | Cr | 0.000251 |
| V 290.882 {116} | ☒ | 1 | Fe | 0.000170 |
| V 292.402 {115} | ☒ | 1 | Fe | 0.000041 |
| Zn 206.200 {463} | ☒ | 1 | Fe | 0.000173 |
| Zn 213.856 {458} | ☒ | 1 | Fe | 0.000380 |
| Y 360.073 { 94}* | ☒ | None | | |
| Na 330.298 {102} | ☒ | 1 | Fe | 0.000991 |
| Si 251.611 {134} | ☒ | 1 | Fe | -0.000042 |
| Ti 334.941 {101} | ☒ | 1 | Fe | 0.000050 |
| Ti 337.280 {100} | ☒ | 1 | Fe | 0.000006 |
| Sr 407.771 { 83} | ☒ | 1 | Fe | 0.000039 |
| Sr 421.552 { 80} | ☒ | 1 | Fe | 0.000039 |

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ICP INTERELEMENT CORRECTION FACTORS (ANNUAL)

ICP ID NUMBER: TA ICAP6000 / ICAP6500

| Element, Wavelength and Order | Use? | # IECs | IEC | k1 |
|---|---|---|---|---|
| Sn 189.989 {477} | ☒ | 1 | Fe | 0.000011 |
| Sn 283.999 {119} | ☒ | 1 | Fe | -0.003092 |
| B 249.678 {135} | ☒ | 1 | Fe | -0.000918 |
| B 249.773 {135} | ☒ | 1 | Fe | 0.000199 |
| Li 670.784 { 50} | ☒ | 1 | Fe | 0.000029 |
| K 766.490 { 44} | ☒ | 1 | Fe | 0.006630 |

| Element, Wavelength and Order | Use? | # IECs | IEC | k1 |
|---|---|---|---|---|
| K 766.490 { 44} | ☒ | 1 | Fe | 0.000178 |
| Na 330.237 {102} | ☒ | 1 | Fe | -0.004289 |
| Na 589.592 { 57} | ☒ | 1 | Fe | 0.000173 |
| Y 360.073 { 94} | ☒ | None | | |
| Y 320.332 {105}* | ☒ | None | | |
| Al 308.215 {109} | ☒ | 1 | Fe | 0.000000 |
| Al 396.152 { 85} | ☒ | None | | |
| Mg 285.213 {118} | ☒ | None | | |
| Ca 317.933 {106} | ☒ | None | | |
| Fe 234.349 {144} | ☒ | None | | |

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## ICP LINEAR RANGES (QUARTERLY)

Lab Name: CT Laboratories    Contract: AECOM-GULL ROCK

ICP ID Number: TA    SDG No.: 111888

| Analyte | Integ. Time (Sec.) | Concentration (ug/L) | M |
|---|---|---|---|
| Aluminum | 15.00 | 1000000 | P |
| Antimony | 15.00 | 10000 | P |
| Arsenic | 15.00 | 10000 | P |
| Barium | 15.00 | 10000 | P |
| Beryllium | 15.00 | 1000 | P |
| Boron | 15.00 | 1000 | P |
| Cadmium | 15.00 | 1000 | P |
| Calcium | 15.00 | 1000000 | P |
| Chromium | 15.00 | 100000 | P |
| Cobalt | 15.00 | 10000 | P |
| Copper | 15.00 | 100000 | P |
| Iron | 15.00 | 1000000 | P |
| Lead | 15.00 | 100000 | P |
| Lithium | 15.00 | 10000 | P |
| Magnesium | 15.00 | 1000000 | P |
| Manganese | 15.00 | 100000 | P |
| Molybdenum | 15.00 | 10000 | P |
| Nickel | 15.00 | 10000 | P |
| Potassium | 15.00 | 200000 | P |
| Selenium | 15.00 | 10000 | P |
| Silicon | 15.00 | 1000 | P |
| Silver | 15.00 | 100 | P |
| Sodium | 15.00 | 200000 | P |
| Strontium | 15.00 | 10000 | P |
| Thallium | 15.00 | 10000 | P |
| Tin | 15.00 | 10000 | P |
| Titanium | 15.00 | 1000 | P |
| Tungsten | 15.00 | 10000 | P |
| Vanadium | 15.00 | 10000 | P |
| Zinc | 15.00 | 100000 | P |

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***PREPARATION LOG***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Project: | AECOM-GULL ROCK |
| Method: | EPA 3050B | SDG No.: | 111888 |
| Preparation Batch #: | 52891 | Preparation Date/Time: | 06/16/2015 / 10:00 |

| Lab Sample # | QC Type | Sample Description | Matrix | **Weight (g for solid/soil) or Volume (mL for liquid/aqueous)** |
|---|---|---|---|---|
| 595908 | Normal Sample | G-25 | SOIL | 1.96 |
| 595910 | Normal Sample | G-21 | SOIL | 2.02 |
| 595912 | Normal Sample | G-22 | SOIL | 1.92 |
| 595914 | Normal Sample | G-26 | SOIL | 2.00 |
| 596028 | Method Blank | | SOLID | 2.00 |
| 596029 | Lab Control Spike | | SOLID | 2.00 |
| 596030 | Lab Duplicate | G-25 | SOIL | 1.95 |
| 596031 | Matrix Spike | G-25 | SOIL | 1.93 |
| 596032 | Matrix Spike Duplicate | G-25 | SOIL | 2.07 |

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***PREPARATION LOG***

Lab Name: CT Laboratories

Project: AECOM-GULL ROCK

Method: EPA 3010A

SDG No.: 111888

Preparation Batch #: 52892

Preparation Date/Time: 06/16/2015 / 12:00

| Lab Sample # | QC Type | Sample Description | Matrix | **Weight (g for solid/soil) or Volume (mL for liquid/aqueous)** |
|---|---|---|---|---|
| 595902 | Normal Sample | SW-1 | SURFACE WATER | 50.0 |
| 595903 | Normal Sample | SW-2 | SURFACE WATER | 50.0 |
| 595904 | Normal Sample | SW-3 | SURFACE WATER | 50.0 |
| 595905 | Normal Sample | SW-4 | SURFACE WATER | 50.0 |
| 595906 | Normal Sample | DUP-SW | SURFACE WATER | 50.0 |
| 595907 | Normal Sample | SW-5 | SURFACE WATER | 50.0 |
| 596102 | Method Blank | | LIQUID | 50.0 |
| 596103 | Lab Control Spike | | LIQUID | 50.0 |
| 596104 | Lab Duplicate | SW-2 | SURFACE WATER | 50.0 |
| 596105 | Matrix Spike | SW-2 | SURFACE WATER | 50.0 |
| 596106 | Matrix Spike Duplicate | SW-2 | SURFACE WATER | 50.0 |

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**PREPARATION LOG**

Lab Name: CT Laboratories

Project: AECOM-GULL ROCK

Method: EPA 3010A

SDG No.: 111888

Preparation Batch #: 52893

Preparation Date/Time: 06/16/2015 / 12:00

| Lab Sample # | QC Type | Sample Description | Matrix | Weight (g for solid/soil) or Volume (mL for liquid/aqueous) |
|---|---|---|---|---|
| 595902 | Normal Sample | SW-1 | SURFACE WATER | 50.0 |
| 595903 | Normal Sample | SW-2 | SURFACE WATER | 50.0 |
| 595904 | Normal Sample | SW-3 | SURFACE WATER | 50.0 |
| 595905 | Normal Sample | SW-4 | SURFACE WATER | 50.0 |
| 595906 | Normal Sample | DUP-SW | SURFACE WATER | 50.0 |
| 595907 | Normal Sample | SW-5 | SURFACE WATER | 50.0 |
| 596107 | Method Blank | | LIQUID | 50.0 |
| 596108 | Lab Control Spike | | LIQUID | 50.0 |
| 596109 | Lab Duplicate | SW-2 | SURFACE WATER | 50.0 |
| 596110 | Matrix Spike | SW-2 | SURFACE WATER | 50.0 |
| 596111 | Matrix Spike Duplicate | SW-2 | SURFACE WATER | 50.0 |

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## *PREPARATION LOG*

Lab Name: CT Laboratories

Project: AECOM-GULL ROCK

Method: EPA 3010A

SDG No.: 111888

Preparation Batch #: 52930

Preparation Date/Time: 06/19/2015 / 07:00

| Lab Sample # | QC Type | Sample Description | Matrix | **Weight (g for solid/soil) or Volume (mL for liquid/aqueous)** |
|---|---|---|---|---|
| 595909 | Normal Sample | G-25 | TCLP | 50.0 |
| 595911 | Normal Sample | G-21 | TCLP | 50.0 |
| 595913 | Normal Sample | G-22 | TCLP | 50.0 |
| 595915 | Normal Sample | G-26 | TCLP | 50.0 |
| 597566 | Method Blank | | LIQUID | 50.0 |
| 597567 | Lab Control Spike | | LIQUID | 50.0 |
| 597568 | Lab Duplicate | G-25 | TCLP | 50.0 |
| 597569 | Matrix Spike | G-25 | TCLP | 50.0 |
| 597570 | Matrix Spike Duplicate | G-25 | TCLP | 50.0 |

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***ANALYSIS RUN LOG***

Lab Name: CT Laboratories

Lab Code: CTL

Instrument ID Number: TJA

Start & End Date: 06/17/2015 to 06/17/2015

Contract: AECOM-GULL ROCK

SDG No.: 111888

Method Number: P

Analytical Run #: 115833

| Sample Number | Analysis or QC Type | DF | Analysis Date/ Time | Al | Sb | As | Ba | Be | B | Cd | Ca | Cr | Co | Cu | Fe | Pb | Mg | Mn | Hg | Mo | Li | Ni | K | Se | Si | Ag | Na | Sr | Tl | Sn | W | V | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 597432 | ICV | 1.00 | 6/17 14:27 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597433 | ICVLL | 1.00 | 6/17 14:31 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597434 | ICB | 1.00 | 6/17 14:40 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597436 | ICSA | 1.00 | 6/17 14:49 | X | | | | | | | X | | | | X | X | X | | | | | | | | | | | | | | | | |
| 597437 | ICSAB | 1.00 | 6/17 14:53 | X | | | | | | | X | | | | X | X | X | | | | | | | | | | | | | | | | |
| 596103 | LCSW | 1.00 | 6/17 15:32 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 596102 | MBW | 1.00 | 6/17 15:37 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597438 | CCV1 | 1.00 | 6/17 15:41 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597439 | CCV2 | 1.00 | 6/17 15:46 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597440 | CCB | 1.00 | 6/17 15:50 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 595902 | Initial | 1.00 | 6/17 15:54 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 595903 | Initial | 1.00 | 6/17 15:59 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597441 | L | 5 | 6/17 16:04 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 596104 | DUP | 1.00 | 6/17 16:08 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 596105 | MSW | 1.00 | 6/17 16:13 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 596106 | MSDW | 1.00 | 6/17 16:17 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597442 | PDSW | 1.00 | 6/17 16:22 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 595904 | Initial | 1.00 | 6/17 16:27 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 595905 | Initial | 1.00 | 6/17 16:31 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 595906 | Initial | 1.00 | 6/17 16:36 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597443 | CCV1 | 1.00 | 6/17 16:40 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597444 | CCV2 | 1.00 | 6/17 16:45 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597445 | CCB | 1.00 | 6/17 16:49 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 595907 | Initial | 1.00 | 6/17 16:53 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597446 | CCV1 | 1.00 | 6/17 17:38 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597447 | CCV2 | 1.00 | 6/17 17:42 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597448 | CCB | 1.00 | 6/17 17:46 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |

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**ANALYSIS RUN LOG**

Lab Name: CT Laboratories

Lab Code: CTL

Instrument ID Number: TJA

Start & End Date: 06/16/2015 to 06/17/2015

Contract: AECOM-GULL ROCK

SDG No.: 111888

Method Number: P

Analytical Run #: 115839

| Sample Number | Analysis or QC Type | DF | Analysis Date/ Time | Al | Sb | As | Ba | Be | B | Cd | Ca | Cr | Co | Cu | Fe | Pb | Mg | Mn | Hg | Mo | Li | Ni | K | Se | Si | Ag | Na | Sr | Tl | Sn | W | V | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 597241 | ICV | 1.00 | 6/16 15:01 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597242 | ICVLL | 1.00 | 6/16 15:05 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597243 | ICB | 1.00 | 6/16 15:14 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597245 | ICSA | 1.00 | 6/16 15:22 | X | | | | | | | X | | | | X | X | X | | | | | | | | | | | | | | | | |
| 597246 | ICSAB | 1.00 | 6/16 15:27 | X | | | | | | | X | | | | X | X | X | | | | | | | | | | | | | | | | |
| 597688 | CCV1 | 1.00 | 6/16 23:59 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597689 | CCV2 | 1.00 | 6/17 00:03 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597690 | CCB | 1.00 | 6/17 00:07 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 596029 | LCSS | 1.00 | 6/17 00:51 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597691 | CCV1 | 1.00 | 6/17 00:55 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597692 | CCV2 | 1.00 | 6/17 00:59 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597693 | CCB | 1.00 | 6/17 01:03 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 596028 | MBS | 1.00 | 6/17 01:08 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 595908 | Initial | 1.00 | 6/17 01:12 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597683 | L | 5 | 6/17 01:16 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 596030 | DUP | 1.00 | 6/17 01:20 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 596031 | MSS | 1.00 | 6/17 01:25 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 596032 | MSDS | 1.00 | 6/17 01:29 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597682 | PDSS | 1.00 | 6/17 01:33 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 595910 | Initial | 1.00 | 6/17 01:37 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 595912 | Initial | 1.00 | 6/17 01:42 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 595914 | Initial | 1.00 | 6/17 01:46 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597247 | CCV1 | 1.00 | 6/17 01:50 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597248 | CCV2 | 1.00 | 6/17 01:55 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597249 | CCB | 1.00 | 6/17 01:59 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |

CT LABORATORIES
*delivering more than data from your environmental analyses*



***ANALYSIS RUN LOG***

Lab Name: CT Laboratories

Lab Code: CTL

Instrument ID Number: TJA

Start & End Date: 06/17/2015 to 06/17/2015

Contract: AECOM-GULL ROCK

SDG No.: 111888

Method Number: P

Analytical Run #: 115840

| Sample Number | Analysis or QC Type | DF | Analysis Date/ Time | Al | Sb | As | Ba | Be | B | Cd | Ca | Cr | Co | Cu | Fe | Pb | Mg | Mn | Hg | Mo | Li | Ni | K | Se | Si | Ag | Na | Sr | Tl | Sn | W | V | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 597412 | ICV | 1.00 | 6/17 14:27 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 597413 | ICVLL | 1.00 | 6/17 14:31 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 597414 | ICB | 1.00 | 6/17 14:40 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 597416 | ICSA | 1.00 | 6/17 14:49 | X | | | | | | | X | | | | X | | X | | | | | | | | | | | | | | | | |
| 597417 | ICSAB | 1.00 | 6/17 14:53 | X | | | | | | | X | | | | X | | X | | | | | | | | | | | | | | | | |
| 596108 | LCSW | 1.00 | 6/17 15:32 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 596107 | MBW | 1.00 | 6/17 15:37 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 597418 | CCV1 | 1.00 | 6/17 15:41 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 597419 | CCV2 | 1.00 | 6/17 15:46 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 597420 | CCB | 1.00 | 6/17 15:50 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 595902 | Initial | 1.00 | 6/17 15:54 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 595903 | Initial | 1.00 | 6/17 15:59 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 597421 | L | 5 | 6/17 16:04 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 596109 | DUP | 1.00 | 6/17 16:08 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 596110 | MSW | 1.00 | 6/17 16:13 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 596111 | MSDW | 1.00 | 6/17 16:17 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 597422 | PDSW | 1.00 | 6/17 16:22 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 595904 | Initial | 1.00 | 6/17 16:27 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 595905 | Initial | 1.00 | 6/17 16:31 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 595906 | Initial | 1.00 | 6/17 16:36 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 597423 | CCV1 | 1.00 | 6/17 16:40 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 597424 | CCV2 | 1.00 | 6/17 16:45 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 597425 | CCB | 1.00 | 6/17 16:49 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 595907 | Initial | 1.00 | 6/17 16:53 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 597426 | CCV1 | 1.00 | 6/17 17:38 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 597427 | CCV2 | 1.00 | 6/17 17:42 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |
| 597428 | CCB | 1.00 | 6/17 17:46 | | | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | |

CT LABORATORIES
delivering more than data from your environmental analyses



***ANALYSIS RUN LOG***

Lab Name: CT Laboratories

Lab Code: CTL

Instrument ID Number: TJA

Start & End Date: 06/19/2015 to 06/19/2015

Contract: AECOM-GULL ROCK

SDG No.: 111888

Method Number: P

Analytical Run #: 115935

| Sample Number | Analysis or QC Type | DF | Analysis Date/ Time | Al | Sb | As | Ba | Be | B | Cd | Ca | Cr | Co | Cu | Fe | Pb | Mg | Mn | Hg | Mo | Li | Ni | K | Se | Si | Ag | Na | Sr | Tl | Sn | W | V | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 598443 | ICV | 1.00 | 6/19 15:33 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 598444 | ICVLL | 1.00 | 6/19 15:38 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 598445 | ICB | 1.00 | 6/19 15:47 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 598446 | MRL | 1.00 | 6/19 15:51 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 598447 | ICSA | 1.00 | 6/19 15:56 | X | | | | | | | X | | | | X | X | X | | | | | | | | | | | | | | | | |
| 598448 | ICSAB | 1.00 | 6/19 16:01 | X | | | | | | | X | | | | X | X | X | | | | | | | | | | | | | | | | |
| 598449 | CCV1 | 1.00 | 6/19 17:54 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 598450 | CCV2 | 1.00 | 6/19 17:59 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 598451 | CCB | 1.00 | 6/19 18:03 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597567 | LCSW | 1.00 | 6/19 18:13 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597566 | MBW | 1.00 | 6/19 18:17 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 595909 | Initial | 1.00 | 6/19 18:22 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 598452 | L | 5 | 6/19 18:27 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597568 | DUP | 1.00 | 6/19 18:32 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597569 | MSW | 1.00 | 6/19 18:37 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 597570 | MSDW | 1.00 | 6/19 18:42 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 598453 | PDSW | 1.00 | 6/19 18:47 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 595911 | Initial | 1.00 | 6/19 18:52 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 598454 | CCV1 | 1.00 | 6/19 18:57 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 598455 | CCV2 | 1.00 | 6/19 19:01 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 598456 | CCB | 1.00 | 6/19 19:06 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 595913 | Initial | 1.00 | 6/19 19:10 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 595915 | Initial | 1.00 | 6/19 19:15 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 598457 | CCV1 | 1.00 | 6/19 19:57 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 598458 | CCV2 | 1.00 | 6/19 20:02 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| 598459 | CCB | 1.00 | 6/19 20:06 | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | |

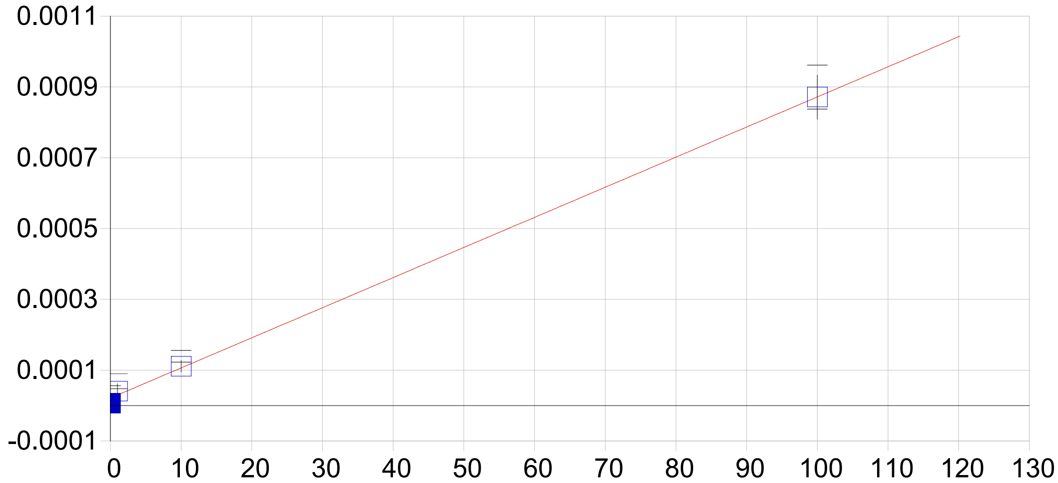
# METALS
# RAW DATA
# DOCUMENTS

| Element, Wavelength and Order | Date of Fit | Date of Cal. | Type of Fit | Weighting | A0 | A1 | A2 | n (Exponent) | Correlation | Std Error of Est | Predicted MDL | Predicted MQL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ag 328.068 ▯103▯ | 06/17/2015 11:19:48 | 06/16/2015 14:29:48 | Linear | None | 0.000021 | 0.000009 | 0.000000 | 1.000000 | 0.999647 | 0.000013 | 3.078452 | 10.261508 |
| Ag 338.289 ▯100▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:38 | Linear | None | 0.000021 | 0.000001 | 0.000000 | 1.000000 | 0.999514 | 0.000025 | 7.679028 | 25.596761 |
| Al 308.215 ▯109▯ | 06/17/2015 11:19:48 | 06/16/2015 14:57:03 | Linear | 1/Conc | 0.000052 | 0.000000 | 0.000000 | 1.000000 | 0.999556 | 0.000018 | 18.217329 | 60.724431 |
| Al 309.271 ▯109▯ | 06/17/2015 11:19:48 | 06/16/2015 14:47:18 | Linear | 1/Conc | 0.001133 | 0.000004 | 0.000000 | 1.000000 | 0.999973 | 0.000012 | 13.197331 | 43.991104 |
| Al 396.152 ▯ 85▯ | 06/17/2015 11:19:48 | 06/16/2015 14:57:03 | Linear | 1/Var | -0.000080 | 0.000010 | 0.000000 | 1.000000 | 0.999157 | 0.000097 | 7.518185 | 25.060617 |
| Al 167.079 ▯502▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:38 | Linear | None | 0.000001 | 0.000000 | 0.000000 | 1.000000 | 0.999986 | 0.000001 | 1.834413 | 6.114709 |
| As 193.759 ▯474▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:38 | Linear | 1/Var | 0.000000 | 0.000000 | 0.000000 | 1.000000 | 0.999695 | 0.000000 | 6.613720 | 22.045733 |
| As 189.042 ▯479▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:04 | Linear | None | -0.000000 | 0.000000 | 0.000000 | 1.000000 | 0.999998 | 0.000000 | 20.288994 | 67.629980 |
| Ba 455.403 ▯ 74▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:39 | Linear | None | 43.516766 | 43.397984 | 0.000000 | 1.000000 | 0.999999 | 23.161995 | 0.163680 | 0.545600 |
| Ba 493.409 ▯ 68▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:04 | Linear | 1/Var | -0.004298 | 0.000507 | 0.000000 | 1.000000 | 0.999821 | 0.000201 | 0.575593 | 1.918643 |
| Be 313.042 ▯108▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:39 | Linear | 1/Conc | 0.000007 | 0.000228 | 0.000000 | 1.000000 | 0.999912 | 0.000002 | 0.090843 | 0.302810 |
| Be 234.861 ▯144▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:39 | Linear | 1/Conc | 0.000004 | 0.000003 | 0.000000 | 1.000000 | 0.999966 | 0.000000 | 0.916494 | 3.054979 |
| Ca 315.887 ▯107▯ | 06/17/2015 11:19:48 | 06/16/2015 14:57:03 | Curvilin | 1/Conc | 0.000360 | 0.000004 | 0.000000 | 1.000000 | 0.999927 | 0.000084 | 7.338221 | 24.460737 |
| Ca 317.933 ▯106▯ | 06/17/2015 11:19:48 | 06/16/2015 14:57:03 | Linear | 1/Var | 0.003504 | 0.000001 | 0.000000 | 1.000000 | 0.995042 | 0.000470 | 3.926686 | 13.088954 |
| Ca 393.366 ▯ 86▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:39 | Linear | None | 0.012920 | 0.001194 | 0.000000 | 1.000000 | 0.999951 | 0.006875 | 0.045046 | 0.150152 |
| Ca 396.847 ▯ 85▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:04 | Linear | None | 0.000517 | 0.000123 | 0.000000 | 1.000000 | 0.999999 | 0.001247 | 0.077446 | 0.258155 |
| Cd 214.438 ▯457▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:39 | Linear | None | 0.000141 | 0.000108 | 0.000000 | 1.000000 | 0.999985 | 0.000219 | 0.073544 | 0.245146 |
| Cd 226.502 ▯149▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:39 | Linear | None | 0.000007 | 0.000003 | 0.000000 | 1.000000 | 0.999972 | 0.000012 | 4.479698 | 14.932328 |
| Cd 226.502 ▯449▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:39 | Linear | None | 0.000013 | 0.000010 | 0.000000 | 1.000000 | 0.999987 | 0.000020 | 0.193324 | 0.644414 |
| Cd 228.802 ▯447▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:39 | Linear | None | 0.000164 | 0.000101 | 0.000000 | 1.000000 | 0.999986 | 0.000238 | 0.120451 | 0.401505 |
| Co 228.616 ▯147▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:39 | Linear | None | -0.000002 | 0.000003 | 0.000000 | 1.000000 | 0.999978 | 0.000009 | 4.422777 | 14.742591 |
| Co 228.616 ▯447▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:39 | Linear | 1/Conc | -0.000001 | 0.000010 | 0.000000 | 1.000000 | 0.999948 | 0.000000 | 0.214335 | 0.714448 |
| Co 238.892 ▯141▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:04 | Linear | 1/Var | -0.000001 | 0.000001 | 0.000000 | 1.000000 | 0.999665 | 0.000001 | 4.668243 | 15.560809 |
| Cr 267.716 ▯126▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:39 | Linear | None | 0.000001 | 0.000002 | 0.000000 | 1.000000 | 0.999988 | 0.000004 | 2.544903 | 8.483010 |
| Cr 283.563 ▯119▯ | 06/17/2015 11:19:48 | 06/16/2015 14:42:27 | Linear | 1/Conc | 0.000009 | 0.000002 | 0.000000 | 1.000000 | 0.999975 | 0.000001 | 2.366937 | 7.889789 |
| Cu 224.700 ▯450▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:05 | Linear | 1/Conc | -0.000007 | 0.000003 | 0.000000 | 1.000000 | 0.999977 | 0.000000 | 0.481125 | 1.603750 |
| Cu 324.754 ▯104▯ | 06/17/2015 11:19:48 | 06/16/2015 14:42:27 | Linear | None | 0.000314 | 0.000003 | 0.000000 | 1.000000 | 1.000000 | 0.000088 | 2.603753 | 8.679177 |
| Cu 327.396 ▯103▯ | 06/17/2015 11:19:48 | 06/16/2015 14:42:27 | Linear | 1/Conc | -0.000029 | 0.000001 | 0.000000 | 1.000000 | 0.999973 | 0.000001 | 7.771964 | 25.906545 |
| Fe 234.349 ▯144▯ | 06/17/2015 11:19:48 | 06/16/2015 14:57:03 | Full Fit | 1/Var | 0.000003 | 0.000000 | 0.000000 | 1.000000 | 0.999774 | 0.000002 | 15.177534 | 50.591780 |
| Fe 239.562 ▯141▯ | 06/17/2015 11:19:48 | 06/16/2015 14:47:18 | Curvilin | 1/Conc | 0.000002 | 0.000000 | 0.000000 | 1.000000 | 0.999990 | 0.000001 | 6.839217 | 22.797389 |
| Fe 259.940 ▯130▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:05 | Linear | None | 0.000004 | 0.000001 | 0.000000 | 1.000000 | 0.999986 | 0.000034 | 2.829275 | 9.430916 |
| Mg 202.582 ▯466▯ | 06/17/2015 11:19:48 | 06/16/2015 14:57:04 | Full Fit | 1/Conc | -0.000007 | 0.000001 | 0.000000 | 0.910000 | 0.999958 | 0.000005 | 1.489002 | 4.963342 |
| Mg 279.079 ▯121▯ | 06/17/2015 11:19:48 | 06/16/2015 14:57:04 | Full Fit | None | -0.000027 | 0.000000 | 0.000000 | 1.020000 | 0.999999 | 0.000088 | 34.448491 | 114.828303 |
| Mg 280.270 ▯120▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:05 | Linear | 1/Conc | 0.000047 | 0.000020 | 0.000000 | 1.000000 | 0.999956 | 0.000006 | 0.134729 | 0.449095 |
| Mn 257.610 ▯131▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:05 | Linear | 1/Conc | 0.000002 | 0.000024 | 0.000000 | 1.000000 | 0.999882 | 0.000003 | 0.504231 | 1.680769 |
| Mn 259.373 ▯130▯ | 06/17/2015 11:19:48 | 06/16/2015 14:42:27 | Linear | 1/Conc | 0.000027 | 0.000045 | 0.000000 | 1.000000 | 0.999725 | 0.000502 | 0.498783 | 1.662610 |
| Mn 293.930 ▯115▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:05 | Linear | 1/Conc | -0.000002 | 0.000002 | 0.000000 | 1.000000 | 0.999890 | 0.000000 | 2.908771 | 9.695904 |
| Mo 203.844 ▯465▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:40 | Linear | 1/Conc | 0.000019 | 0.000008 | 0.000000 | 1.000000 | 0.999214 | 0.000000 | 0.905251 | 3.017502 |
| Mo 202.030 ▯467▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:40 | Linear | 1/Var | 0.000008 | 0.000007 | 0.000000 | 1.000000 | 0.999331 | 0.000001 | 0.763291 | 2.544302 |
| Mo 204.598 ▯465▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:05 | Linear | None | -0.000003 | 0.000001 | 0.000000 | 1.000000 | 0.999999 | 0.000008 | 1.214651 | 4.048835 |
| Ni 221.647 ▯452▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:05 | Linear | 1/Conc | 0.000019 | 0.000032 | 0.000000 | 1.000000 | 0.999988 | 0.000007 | 0.391242 | 1.304140 |
| Ni 231.604 ▯146▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:05 | Linear | 1/Conc | 0.000006 | 0.000000 | 0.000000 | 1.000000 | 0.999763 | 0.000000 | 22.783102 | 75.943675 |
| Ni 231.604 ▯445▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:05 | Linear | 1/Conc | 0.000004 | 0.000008 | 0.000000 | 1.000000 | 0.999975 | 0.000000 | 0.435427 | 1.451424 |
| Pb 216.999 ▯455▯ | 06/17/2015 11:19:48 | 06/16/2015 14:42:27 | Curvilin | 1/Conc | 0.000005 | 0.000001 | 0.000000 | 1.000000 | 0.999964 | 0.000000 | 3.509442 | 11.698139 |

| Element, Wavelength and Order | Date of Fit | Date of Cal. | Type of Fit | Weighting | A0 | A1 | A2 | n (Exponent) | Correlation | Std Error of Est | Predicted MDL | Predicted MQL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pb 220.353 ▯153▯ | 06/17/2015 11:19:48 | 06/16/2015 14:42:27 | Linear | 1/Var | -0.000003 | 0.000000 | 0.000000 | 1.000000 | 0.999562 | 0.000001 | 54.740367 | 182.467890 |
| Pb 220.353 ▯453▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:41 | Linear | 1/Conc | 0.000000 | 0.000002 | 0.000000 | 1.000000 | 0.999730 | 0.000000 | 1.575508 | 5.251693 |
| Pb 283.306 ▯119▯ | 06/17/2015 11:19:48 | 06/16/2015 14:42:28 | Linear | 1/Conc | 0.000002 | 0.000000 | 0.000000 | 1.000000 | 0.999882 | 0.000000 | 76.460531 | 254.868437 |
| Sb 206.833 ▯463▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Linear | 1/Conc | 0.000000 | 0.000001 | 0.000000 | 1.000000 | 0.999999 | 0.000000 | 2.608652 | 8.695507 |
| Sb 217.581 ▯455▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:41 | Linear | 1/Conc | -0.000000 | 0.000001 | 0.000000 | 1.000000 | 0.999930 | 0.000000 | 1.935014 | 6.450048 |
| Se 196.090 ▯172▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Linear | None | 0.000020 | 0.000000 | 0.000000 | 1.000000 | 0.998914 | 0.000005 | 593.342791 | 1977.80930 |
| Se 196.090 ▯472▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Linear | 1/Conc | -0.000000 | 0.000000 | 0.000000 | 1.000000 | 0.999955 | 0.000000 | 7.033544 | 23.445148 |
| Se 206.279 ▯463▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Linear | None | -0.000007 | 0.000000 | 0.000000 | 1.000000 | 0.999999 | 0.000003 | 19.675898 | 65.586326 |
| Tl 190.856 ▯476▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:41 | Linear | 1/Var | 0.000001 | 0.000001 | 0.000000 | 1.000000 | 0.999408 | 0.000001 | 2.167467 | 7.224889 |
| Tl 190.856 ▯477▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:41 | Linear | 1/Var | -0.000000 | 0.000000 | 0.000000 | 1.000000 | 0.999953 | 0.000000 | 7.712373 | 25.707910 |
| Tl 276.787 ▯122▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Linear | None | 0.000008 | 0.000000 | 0.000000 | 1.000000 | 0.999972 | 0.000013 | 78.649117 | 262.163723 |
| V 290.882 ▯116▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Linear | 1/Conc | 0.000020 | 0.000002 | 0.000000 | 1.000000 | 0.999796 | 0.000002 | 2.825016 | 9.416721 |
| V 292.402 ▯115▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:41 | Linear | None | 0.000038 | 0.000017 | 0.000000 | 1.000000 | 0.999992 | 0.000027 | 2.612460 | 8.708200 |
| Zn 206.200 ▯463▯ | 06/17/2015 11:19:48 | 06/16/2015 14:42:28 | Linear | 1/Conc | 0.000000 | 0.000006 | 0.000000 | 1.000000 | 0.997834 | 0.000184 | 0.274109 | 0.913695 |
| Zn 213.856 ▯457▯ | 06/17/2015 11:19:48 | 06/16/2015 14:42:28 | Curvilin | 1/Conc | 0.000034 | 0.000073 | -0.000000 | 1.000000 | 0.999998 | 0.000012 | 0.117659 | 0.392196 |
| Zn 213.856 ▯458▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Linear | 1/Var | 0.000004 | 0.000003 | 0.000000 | 1.000000 | 0.999745 | 0.000002 | 0.480672 | 1.602241 |
| Y 224.306 ▯450▯▯ | 06/17/2015 11:19:48 | 06/16/2015 13:55:08 | Linear | 1/Conc | 0.000000 | 0.000000 | 0.000000 | 1.000000 | 0.000000 | 0.000000 | -1.000000 | -1.000000 |
| Y 371.030 ▯ 91▯▯ | 06/17/2015 11:19:48 | 06/16/2015 13:55:08 | Linear | 1/Conc | 0.000000 | 0.000000 | 0.000000 | 1.000000 | 0.000000 | 0.000000 | -1.000000 | -1.000000 |
| Na 330.298 ▯102▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Linear | 1/Conc | -0.000002 | 0.000000 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 508.161272 | 1693.87090 |
| Na 588.995 ▯ 57▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Linear | 1/Conc | -0.001209 | 0.000012 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 3.963492 | 13.211641 |
| Si 251.611 ▯134▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Linear | None | 0.000005 | 0.000001 | 0.000000 | 1.000000 | 0.999979 | 0.000034 | 6.540594 | 21.801981 |
| Ti 334.941 ▯101▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Linear | 1/Conc | 0.000001 | 0.000009 | 0.000000 | 1.000000 | 0.999883 | 0.000001 | 0.895862 | 2.986207 |
| Ti 337.280 ▯100▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Linear | 1/Conc | -0.000010 | 0.000008 | 0.000000 | 1.000000 | 0.999884 | 0.000001 | 1.260177 | 4.200591 |
| Sr 407.771 ▯ 83▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Linear | 1/Conc | -0.000957 | 0.000160 | 0.000000 | 1.000000 | 0.999975 | 0.000005 | 0.090000 | 0.299999 |
| Sr 421.552 ▯ 80▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Linear | 1/Conc | -0.000029 | 0.000152 | 0.000000 | 1.000000 | 0.999958 | 0.000005 | 0.091609 | 0.305363 |
| Sn 189.989 ▯477▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Curvilin | 1/Conc | 0.000006 | 0.000003 | -0.000000 | 1.000000 | 0.999993 | 0.000000 | 1.250135 | 4.167116 |
| Sn 189.989 ▯478▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Curvilin | 1/Conc | 0.000001 | 0.000001 | 0.000000 | 1.000000 | 0.999968 | 0.000000 | 4.100314 | 13.667714 |
| Sn 283.999 ▯119▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Linear | 1/Conc | 0.000000 | 0.000000 | 0.000000 | 1.000000 | 0.999790 | 0.000000 | 31.956271 | 106.520903 |
| B 249.678 ▯135▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:06 | Linear | 1/Conc | 0.000004 | 0.000001 | 0.000000 | 1.000000 | 0.999521 | 0.000000 | 5.000896 | 16.669653 |
| B 249.773 ▯135▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:07 | Linear | 1/Conc | -0.000001 | 0.000001 | 0.000000 | 1.000000 | 0.999600 | 0.000001 | 3.320012 | 11.066707 |
| Li 670.784 ▯ 50▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:07 | Linear | 1/Conc | 0.000067 | 0.000034 | 0.000000 | 1.000000 | 0.999744 | 0.000010 | 0.963748 | 3.212493 |
| ▯ 766.490 ▯ 44▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:07 | Linear | 1/Conc | 0.000090 | 0.000001 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 19.097745 | 63.659150 |
| ▯ 769.896 ▯ 44▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:07 | Linear | 1/Conc | 0.000148 | 0.000001 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 45.361524 | 151.205079 |
| P 177.495 ▯489▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:07 | Linear | 1/Conc | -0.000020 | 0.000001 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 4.080704 | 13.602345 |
| P 213.618 ▯158▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:07 | Linear | 1/Conc | 0.000004 | 0.000000 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 101.823120 | 339.410401 |
| P 213.618 ▯457▯ | 06/17/2015 11:19:48 | 06/16/2015 14:38:07 | Linear | 1/Conc | -0.000032 | 0.000001 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 5.454151 | 18.180502 |
| S 180.731 ▯486▯ | 06/17/2015 11:19:48 | 06/16/2015 14:47:19 | Linear | 1/Conc | -0.000026 | 0.000002 | 0.000000 | 1.000000 | 0.955789 | 0.000860 | 3.170962 | 10.569872 |
| S 182.034 ▯485▯ | 06/17/2015 11:19:48 | 06/16/2015 14:47:19 | Linear | 1/Conc | -0.000011 | 0.000001 | 0.000000 | 1.000000 | 0.953638 | 0.000491 | 5.400133 | 18.000444 |
| S 182.624 ▯484▯ | 06/17/2015 11:19:48 | 06/16/2015 14:47:19 | Linear | None | -0.008069 | 0.000000 | 0.000000 | 1.000000 | 0.936025 | 0.012096 | 11.657839 | 38.859464 |
| ▯ 239.709 ▯140▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:42 | Linear | 1/Conc | 0.000003 | 0.000000 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 34.502259 | 115.007531 |
| ▯ 245.148 ▯137▯ | 06/17/2015 11:19:48 | 06/16/2015 14:33:42 | Linear | 1/Conc | -0.000002 | 0.000000 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 136.640754 | 455.469179 |

| Element, Wavelength and Order | Status | Reslope | | QC Norm | |
|---|---|---|---|---|---|
| | | Slope | Y-int | Slope factor | Offset |
| Ag 328.068 ▯103▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ag 338.289 ▯100▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Al 308.215 ▯109▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Al 309.271 ▯109▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Al 396.152 ▯ 85▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Al 167.079 ▯502▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| As 193.759 ▯474▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| As 189.042 ▯479▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ba 455.403 ▯ 74▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ba 493.409 ▯ 68▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Be 313.042 ▯108▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Be 234.861 ▯144▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ca 315.887 ▯107▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ca 317.933 ▯106▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ca 393.366 ▯ 86▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ca 396.847 ▯ 85▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cd 214.438 ▯457▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cd 226.502 ▯149▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cd 226.502 ▯449▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cd 228.802 ▯447▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Co 228.616 ▯147▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Co 228.616 ▯447▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Co 238.892 ▯141▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cr 267.716 ▯126▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cr 283.563 ▯119▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cu 224.700 ▯450▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cu 324.754 ▯104▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cu 327.396 ▯103▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Fe 234.349 ▯144▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Fe 239.562 ▯141▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Fe 259.940 ▯130▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mg 202.582 ▯466▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mg 279.079 ▯121▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mg 280.270 ▯120▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mn 257.610 ▯131▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mn 259.373 ▯130▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mn 293.930 ▯115▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mo 203.844 ▯465▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mo 202.030 ▯467▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mo 204.598 ▯465▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ni 221.647 ▯452▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ni 231.604 ▯146▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ni 231.604 ▯445▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Pb 216.999 ▯455▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |

| Element, Wavelength and Order | Status | Reslope | | QC Norm | |
|---|---|---|---|---|---|
| | | Slope | Y-int | Slope factor | Offset |
| Pb 220.353 □153□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Pb 220.353 □453□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Pb 283.306 □119□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sb 206.833 □463□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sb 217.581 □455□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Se 196.090 □172□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Se 196.090 □472□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Se 206.279 □463□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Tl 190.856 □476□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Tl 190.856 □477□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Tl 276.787 □122□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| V 290.882 □116□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| V 292.402 □115□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Zn 206.200 □463□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Zn 213.856 □457□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Zn 213.856 □458□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Y 224.306 □450□□ | □ arnin | 1.000000 | 0.000000 | 1 | 0 |
| Y 371.030 □ 91□□ | □ arnin | 1.000000 | 0.000000 | 1 | 0 |
| Na 330.298 □102□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Na 588.995 □ 57□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Si 251.611 □134□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Ti 334.941 □101□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Ti 337.280 □100□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sr 407.771 □ 83□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sr 421.552 □ 80□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sn 189.989 □477□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sn 189.989 □478□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sn 283.999 □119□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| B 249.678 □135□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| B 249.773 □135□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Li 670.784 □ 50□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| □ 766.490 □ 44□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| □ 769.896 □ 44□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| P 177.495 □489□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| P 213.618 □158□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| P 213.618 □457□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| S 180.731 □486□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| S 182.034 □485□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| S 182.624 □484□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| □ 239.709 □140□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| □ 245.148 □137□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |

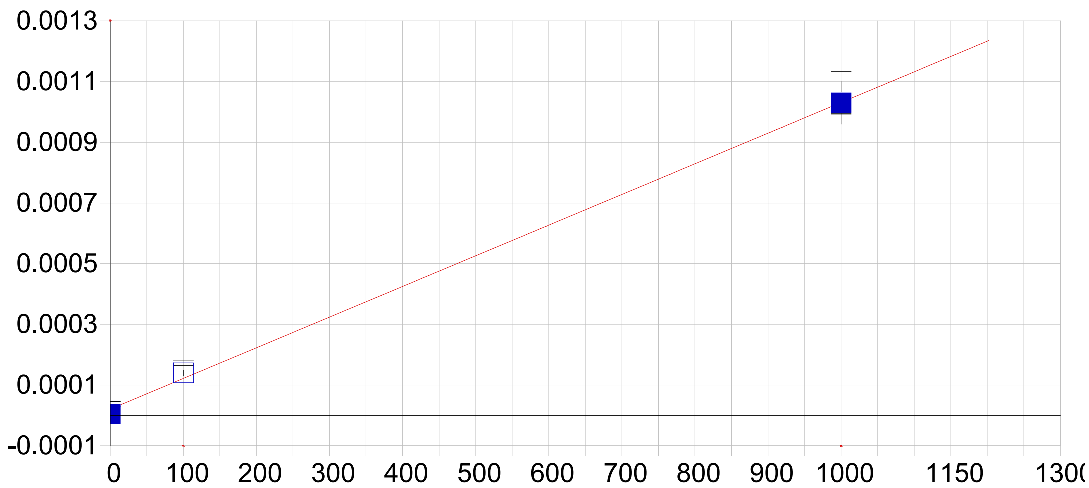



**Ag 328.068 {103}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000021 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000009 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999647 | Status: | OK. |
| Std Error of Est: | 0.000013 | | |
| Predicted MDL: | 3.078452 | | |
| Predicted MQL: | 10.261508 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -1.7435 | -1.74 | .000 | .00001 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.533 | .533 | 5.33 | .00011 | .000 | 1 |
| CalStd8=100 | 100.00 | 99.934 | -.066 | -.066 | .00087 | .000 | 1 |
| CalStd3=1 | 1.0000 | 2.2762 | 1.28 | 128. | .00004 | .000 | 1 |

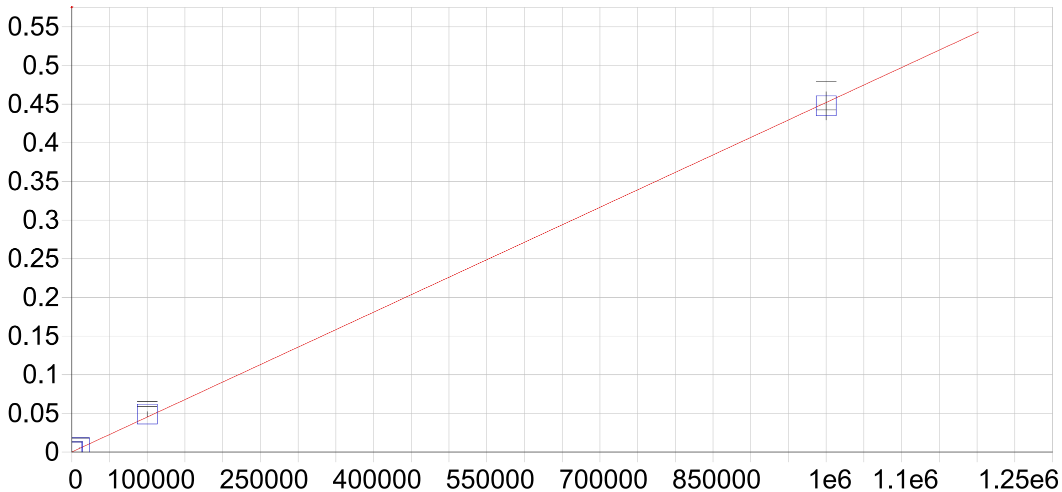



**Ag 338.289 {100}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000021 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999514 | Status: | O . |
| Std Error o Est: | 0.000025 | | |
| Predicted MDL: | 7.679028 | | |
| Predicted MQL: | 25.596761 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -16.233 | -16.2 | .000 | .00000 | .000 | 1 |
| CalStd8=100 | 100.00 | 118.03 | 18.0 | 18.0 | .00014 | .000 | 1 |
| CalStd9=100 | 1000.0 | 998.20 | -1.80 | -.180 | .00103 | .000 | 1 |

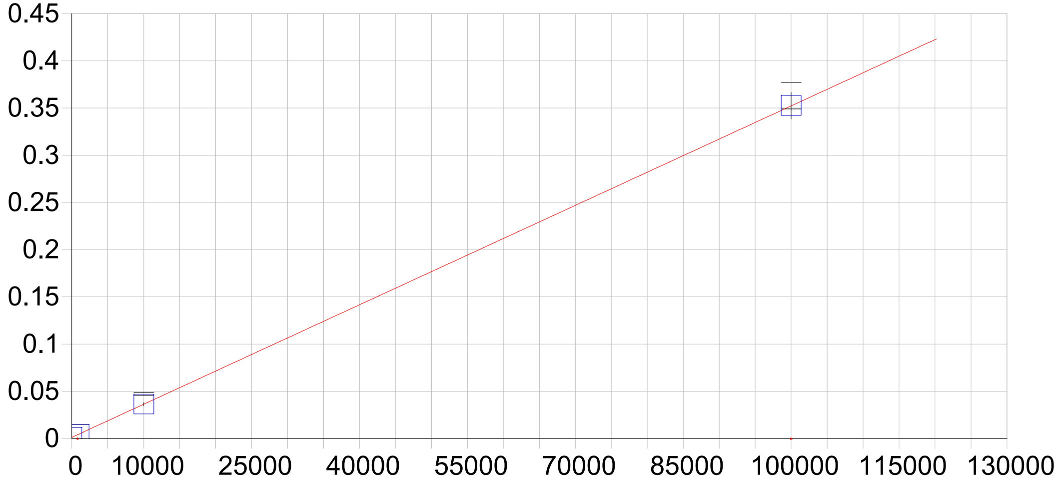



**Al 308.215 {109}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000052 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999556 | Status: | OK. |
| Std Error of Est: | 0.000018 | | |
| Predicted MDL: | 18.217329 | | |
| Predicted MQL: | 60.724431 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.27066 | -.271 | .000 | .00005 | .000 | 1 |
| CalStd10=10 | 10000. | 11547. | 1550. | 15.5 | .00527 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1044.8 | 44.8 | 4.48 | .00052 | .000 | 1 |
| CalStd12-100 | 100000. | 108080. | 8080. | 8.08 | .04892 | .003 | 1 |
| CalStd14-100 | 1000000. | 990330. | -9670. | -.967 | .44780 | .018 | 1 |

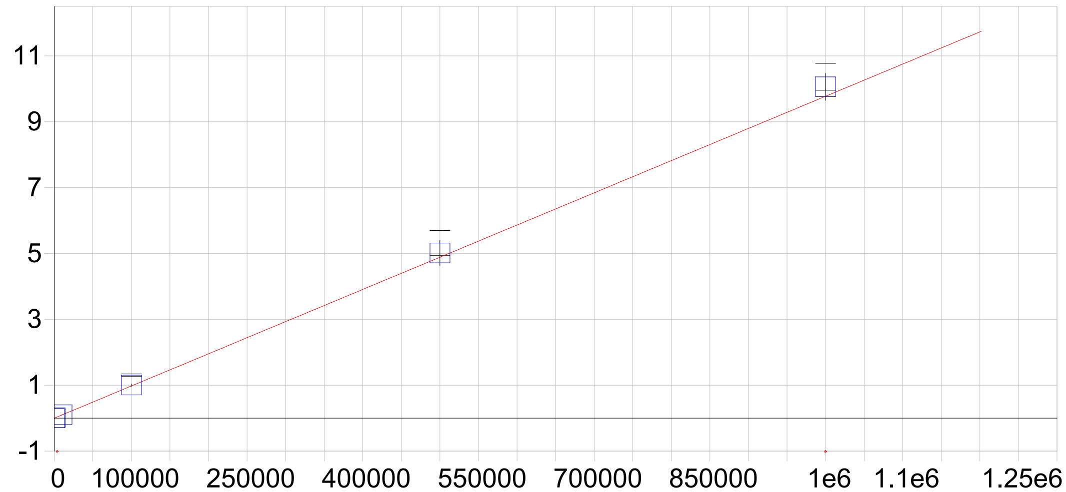



**Al 309.271 {109}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.001133 | Re-Slope: | 1.000000 |
| A1 (ain): | 0.000004 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Eponent): | 1.000000 | | |
| Correlation: | 0.999973 | Status: | O . |
| Std Error o Est: | 0.000012 | | |
| Predicted MDL: | 13.197331 | | |
| Predicted MQL: | 43.991104 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .07537 | .075 | .000 | .00113 | .000 | 1 |
| CalStd10=10 | 10000. | 10007. | 6.93 | .069 | .03627 | .002 | 1 |
| CalStd9=100 | 1000.0 | 923.24 | -76.8 | -7.68 | .00438 | .000 | 1 |
| CalStd12-100 | 100000. | 100070. | 69.8 | .070 | .35253 | .014 | 1 |

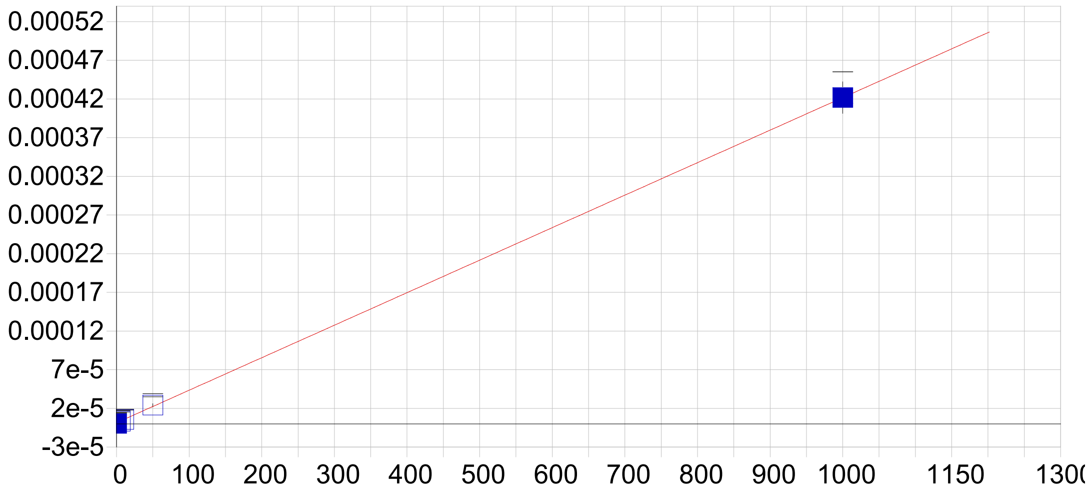



**Al 396.152 { 85}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000080 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000010 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999157 | Status: | O . |
| Std Error o Est: | 0.000097 | | |
| Predicted MDL: | 7.518185 | | |
| Predicted MQL: | 25.060617 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .72560 | .726 | .000 | -.00007 | .000 | 1 |
| CalStd14-100 | 1000000. | 1029200. | 29200. | 2.92 | 10.061 | .407 | 1 |
| CalStd13=50 | 500000. | 512750. | 12800. | 2.55 | 5.0125 | .384 | 1 |
| CalStd10=10 | 10000. | 10319. | 319. | 3.19 | .10080 | .005 | 1 |
| CalStd12-100 | 100000. | 102240. | 2240. | 2.24 | .99940 | .042 | 1 |
| CalStd9=100 | 1000.0 | 939.54 | -60.5 | -6.05 | .00910 | .000 | 1 |

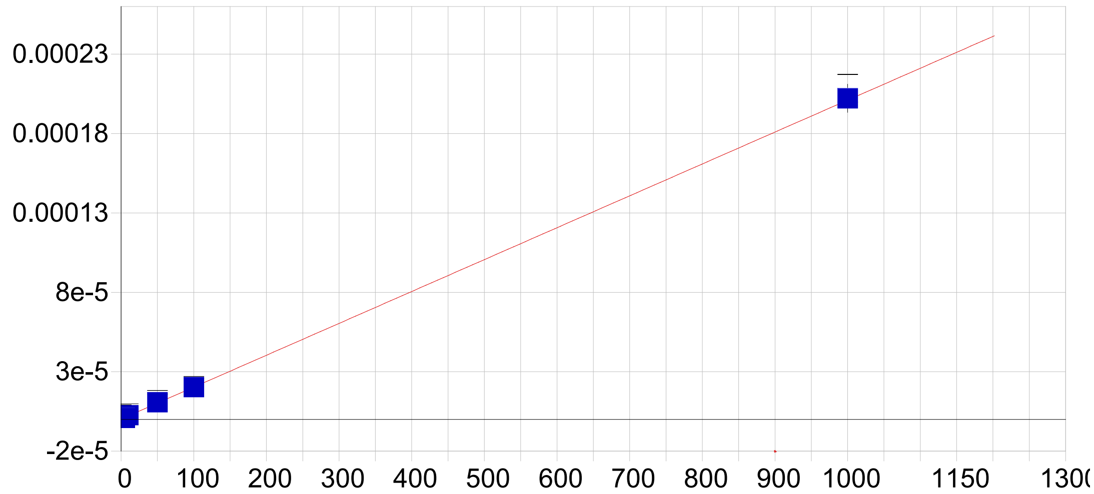



**Al 167.079 {502}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000001 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999986 | Status: | O . |
| Std Error o Est: | 0.000001 | | |
| Predicted MDL: | 1.834413 | | |
| Predicted MQL: | 6.114709 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -2.3950 | -2.39 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.82 | -.184 | -.018 | .00042 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.6951 | -.305 | -3.05 | .00001 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.0541 | -.946 | -18.9 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 53.829 | 3.83 | 7.66 | .00002 | .000 | 1 |

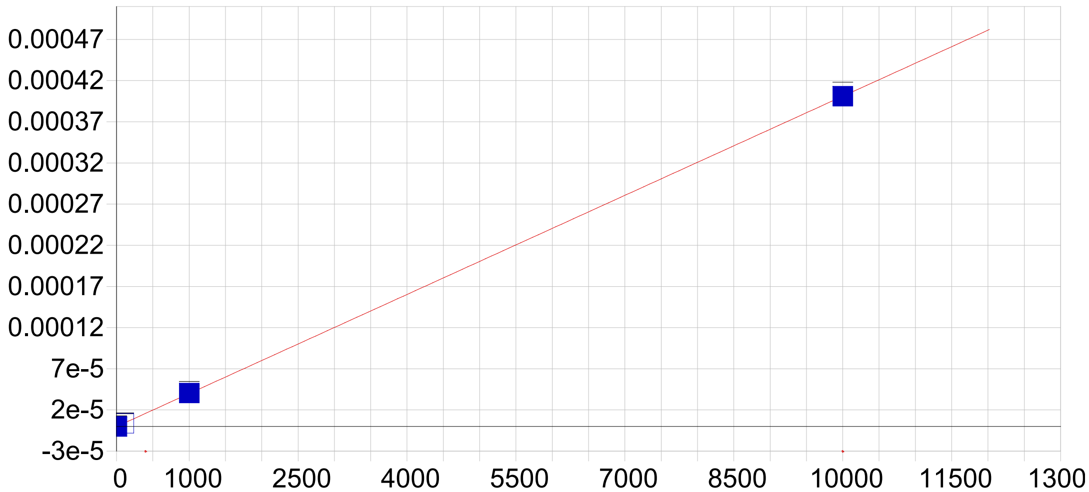



**As 193.759 {474}**

Date of Fit: 06/17/2015 13:02:43 Type of Fit: Linear Weighting: 1/Var

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000000 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999695 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 6.613720 | | |
| Predicted MQL: | 22.045733 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 2.7935 | 2.79 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1005.2 | 5.21 | .521 | .00020 | .000 | 1 |
| CalStd7=50 | 50.000 | 52.344 | 2.34 | 4.69 | .00001 | .000 | 1 |
| CalStd5=10 | 10.000 | 11.785 | 1.79 | 17.9 | .00000 | .000 | 1 |
| CalStd8=100 | 100.00 | 99.502 | -.498 | -.498 | .00002 | .000 | 1 |
| CalStd4=5 | 5.0000 | 3.2070 | -1.79 | -35.9 | .00000 | .000 | 1 |

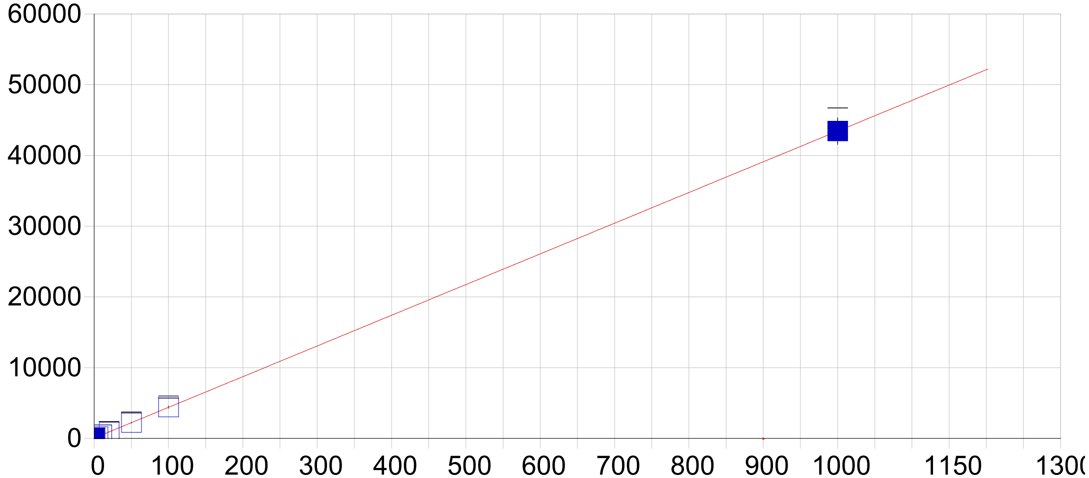



**As 189.042 {479}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O set): | -0.000000 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999998 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 20.288994 | | |
| Predicted MQL: | 67.629980 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 4.8194 | 4.82 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1009.7 | 9.74 | .974 | .00004 | .000 | 1 |
| CalStd10=10 | 10000. | 9999.1 | -.948 | -.009 | .00040 | .000 | 1 |
| CalStd8=100 | 100.00 | 98.002 | -2.00 | -2.00 | .00000 | .000 | 1 |
| CalStd4=5 | 5.0000 | -6.6138 | -11.6 | -232. | .00000 | .000 | 1 |

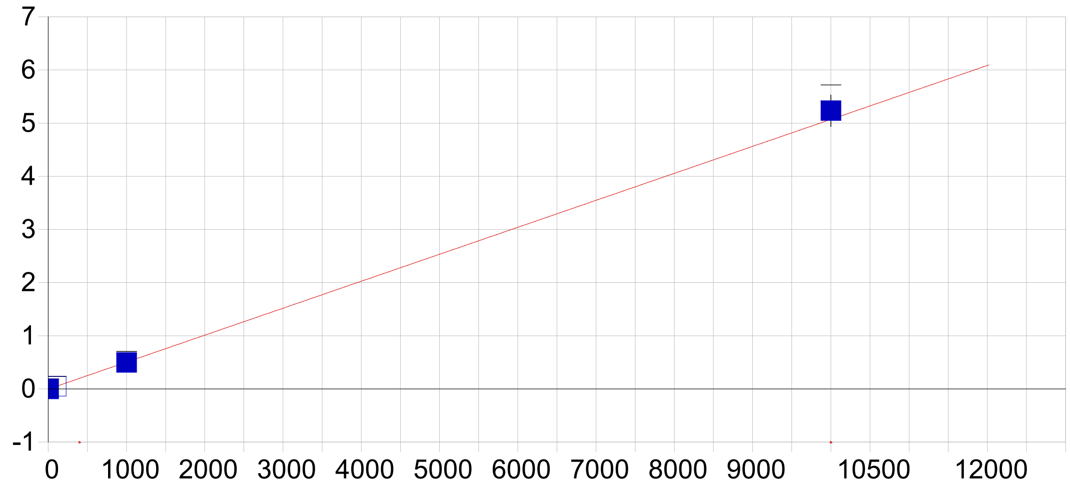



**Ba 455.403 { 74}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O set): | 43.516766 | Re-Slope: | 1.000000 |
| A1 ( ain): | 43.397984 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999999 | Status: | O . |
| Std Error o Est: | 23.161995 | | |
| Predicted MDL: | 0.163680 | | |
| Predicted MQL: | 0.545600 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.53493 | -.535 | .000 | 20.302 | 6.05 | 1 |
| CalStd7=50 | 50.000 | 50.473 | .473 | .947 | 2234.0 | 78.4 | 1 |
| CalStd5=10 | 10.000 | 10.471 | .471 | 4.71 | 497.96 | 14.3 | 1 |
| CalStd6=20 | 20.000 | 20.352 | .352 | 1.76 | 926.74 | 42.6 | 1 |
| CalStd8=100 | 100.00 | 100.70 | .703 | .703 | 4413.8 | 172. | 1 |
| CalStd4=5 | 5.0000 | 4.6405 | -.360 | -7.19 | 244.90 | 10.1 | 1 |
| CalStd9=100 | 1000.0 | 999.90 | -.103 | -.010 | 43437. | 1870. | 1 |
| CalStd3=1 | 1.0000 | .48078 | -.519 | -51.9 | 64.381 | 4.32 | 1 |
| CalStd2=0.5 | .50000 | .01691 | -.483 | -96.6 | 44.251 | 2.43 | 1 |

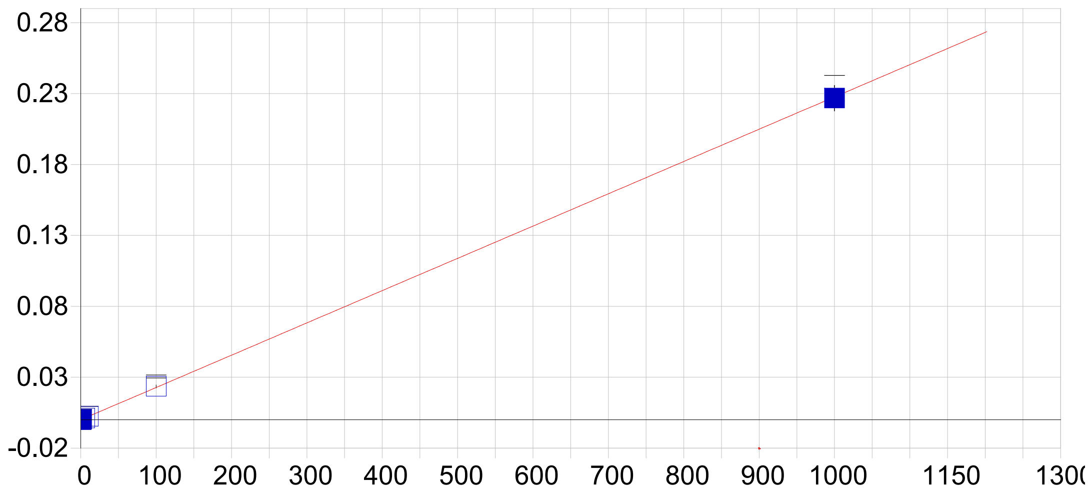



**Ba 493.409 { 68}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.004298 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000507 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Eponent): | 1.000000 | | |
| Correlation: | 0.999821 | Status: | O . |
| Std Error o Est: | 0.000201 | | |
| Predicted MDL: | 0.575593 | | |
| Predicted MQL: | 1.918643 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .05804 | .058 | .000 | -.00427 | .000 | 1 |
| CalStd9=100 | 1000.0 | 983.07 | -16.9 | -1.69 | .49453 | .021 | 1 |
| CalStd10=10 | 10000. | 10321. | 321. | 3.21 | 5.2329 | .297 | 1 |
| CalStd8=100 | 100.00 | 100.37 | .371 | .371 | .04663 | .002 | 1 |
| CalStd4=5 | 5.0000 | 4.8285 | -.172 | -3.43 | -.00185 | .000 | 1 |

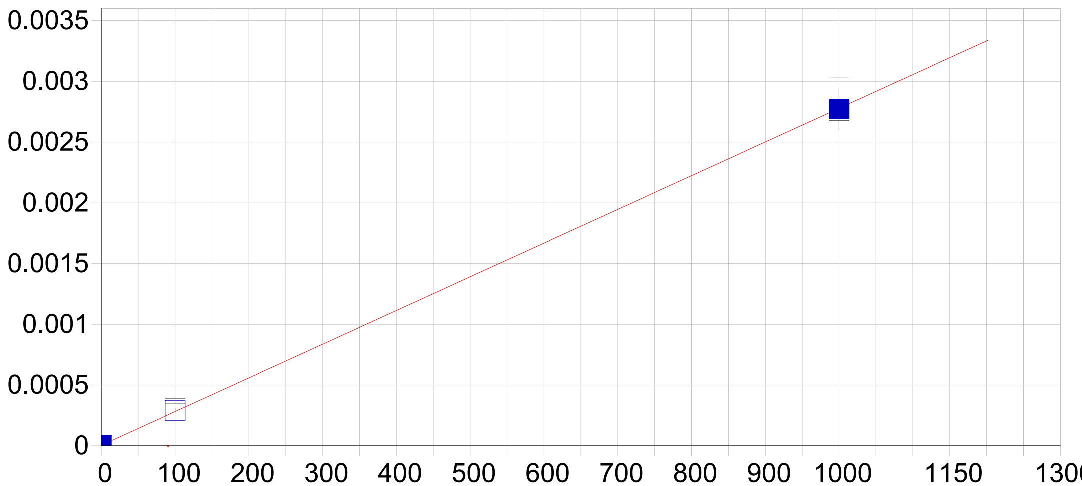



**Be 313.042 {108}**

Date o Fit: 06/17/2015 13:02:43 Type o Fit: Linear eighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000007 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000228 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999912 | Status: | O . |
| Std Error o Est: | 0.000002 | | |
| Predicted MDL: | 0.090843 | | |
| Predicted MQL: | 0.302810 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00004 | .000 | .000 | .00001 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.646 | .646 | 6.46 | .00243 | .000 | 1 |
| CalStd8=100 | 100.00 | 103.10 | 3.10 | 3.10 | .02348 | .001 | 1 |
| CalStd2=0.5 | .50000 | .55763 | .058 | 11.5 | .00013 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.0794 | .079 | 1.59 | .00116 | .000 | 1 |
| CalStd1=0.25 | .25000 | .15545 | -.095 | -37.8 | .00004 | .000 | 1 |
| CalStd9=100 | 1000.0 | 996.21 | -3.79 | -.379 | .22681 | .009 | 1 |
| CalStd3=1 | 1.0000 | 1.0032 | .003 | .322 | .00024 | .000 | 1 |

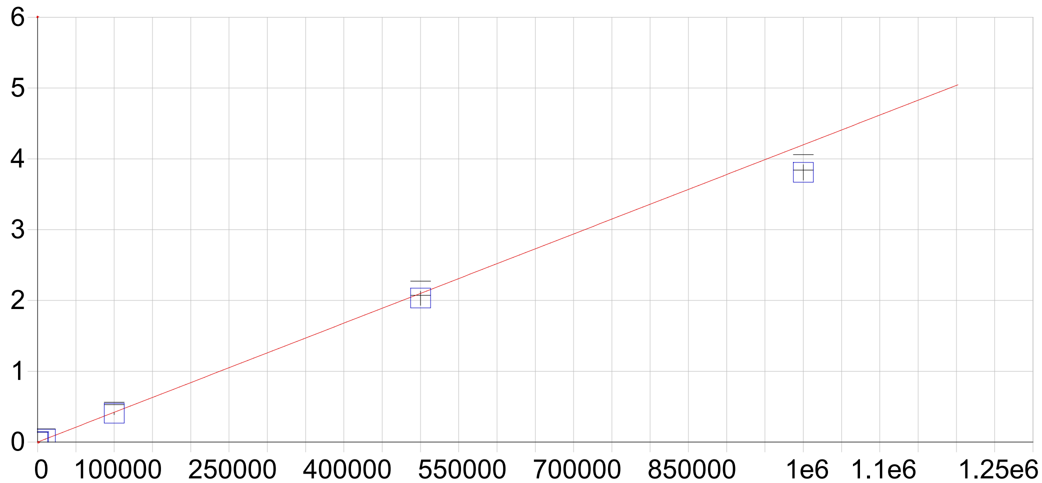



**Be 234.861 {144}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000004 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999966 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 0.916494 | | |
| Predicted MQL: | 3.054979 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00234 | -.002 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 997.40 | -2.60 | -.260 | .00277 | .000 | 1 |
| CalStd8=100 | 100.00 | 102.60 | 2.60 | 2.60 | .00029 | .000 | 1 |

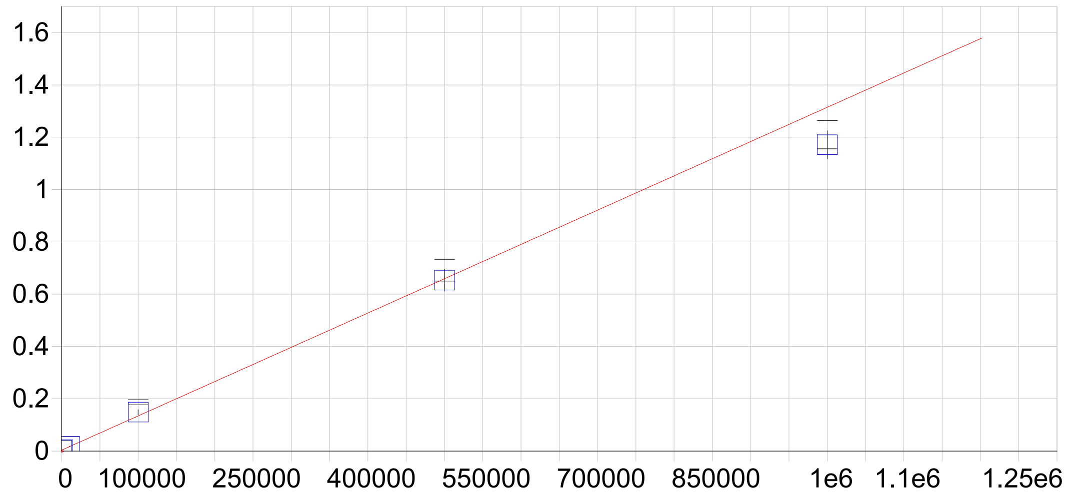



**Ca 315.887 {107}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Curvilinear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000360 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000004 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Eponent): | 1.000000 | | |
| Correlation: | 0.999927 | Status: | O . |
| Std Error o Est: | 0.000084 | | |
| Predicted MDL: | 7.338221 | | |
| Predicted MQL: | 24.460737 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .16952 | .170 | .000 | .00036 | .000 | 1 |
| CalStd10=10 | 10000. | 9571.4 | -429. | -4.29 | .04054 | .002 | 1 |
| CalStd13=50 | 500000. | 483790. | -16200. | -3.24 | 2.0315 | .101 | 1 |
| CalStd14-100 | 1000000. | 907080. | -92900. | -9.29 | 3.8086 | .109 | 1 |
| CalStd9=100 | 1000.0 | 891.82 | -108. | -10.8 | .00410 | .000 | 1 |
| CalStd12-100 | 100000. | 96176. | -3820. | -3.82 | .40414 | .017 | 1 |

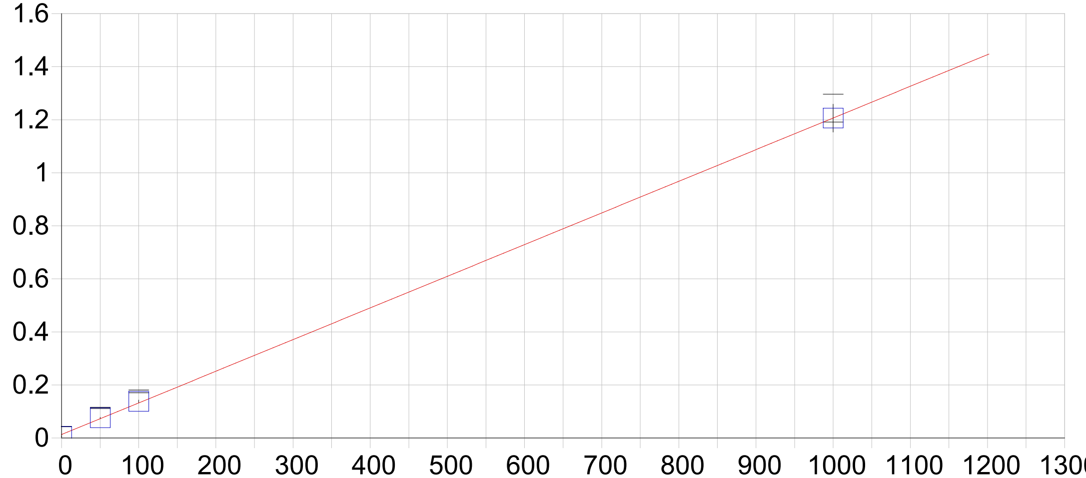



**Ca 317.933 {106}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.003504 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.995042 | Status: | OK. |
| Std Error of Est: | 0.000470 | | |
| Predicted MDL: | 3.926686 | | |
| Predicted MQL: | 13.088954 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -53.075 | -53.1 | .000 | .00343 | .000 | 1 |
| CalStd10=10 | 10000. | 11068. | 1070. | 10.7 | .01802 | .001 | 1 |
| CalStd13=50 | 500000. | 495410. | -4590. | -.918 | .65313 | .042 | 1 |
| CalStd14-100 | 1000000. | 890520. | -109000. | -10.9 | 1.1712 | .054 | 1 |
| CalStd9=100 | 1000.0 | 1024.5 | 24.5 | 2.45 | .00485 | .000 | 1 |
| CalStd12-100 | 100000. | 110680. | 10700. | 10.7 | .14864 | .010 | 1 |

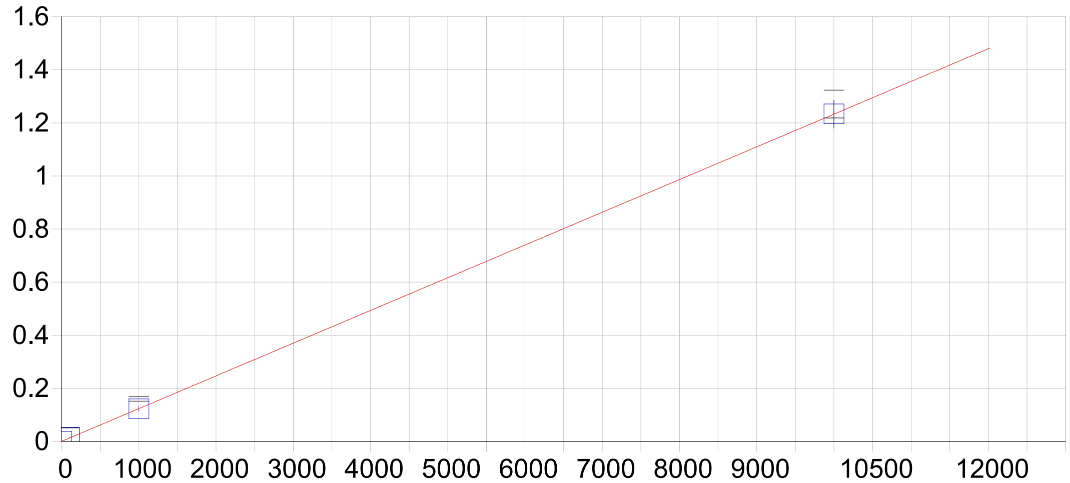



**Ca 393.366 { 86}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.012920 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.001194 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Eponent): | 1.000000 | | |
| Correlation: | 0.999951 | Status: | O . |
| Std Error o Est: | 0.006875 | | |
| Predicted MDL: | 0.045046 | | |
| Predicted MQL: | 0.150152 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -6.3306 | -6.33 | .000 | .00536 | .001 | 1 |
| CalStd7=50 | 50.000 | 52.417 | 2.42 | 4.83 | .07549 | .003 | 1 |
| CalStd9=100 | 1000.0 | 999.43 | -.569 | -.057 | 1.2059 | .052 | 1 |
| CalStd8=100 | 100.00 | 104.48 | 4.48 | 4.48 | .13764 | .005 | 1 |

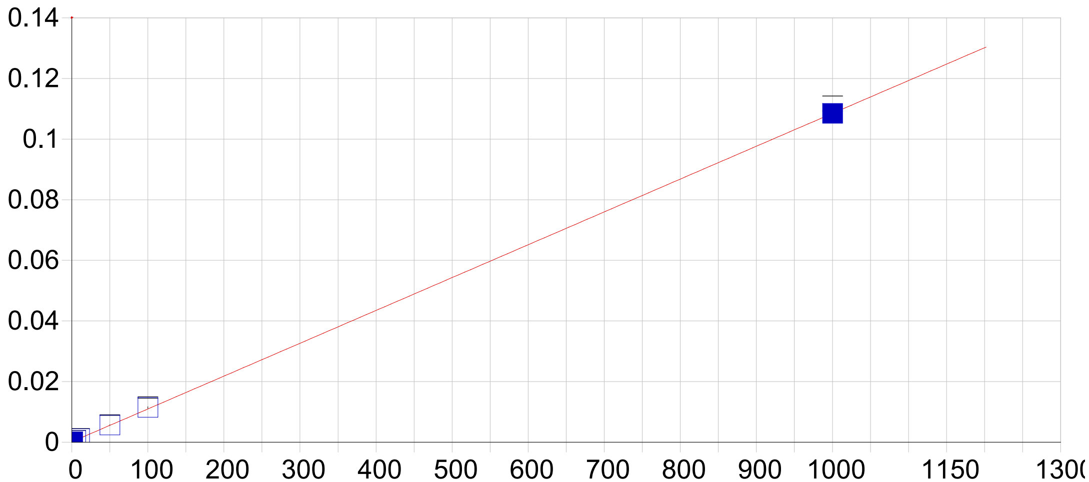



**Ca 396.847 { 85}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000517 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000123 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999999 | Status: | O . |
| Std Error o Est: | 0.001247 | | |
| Predicted MDL: | 0.077446 | | |
| Predicted MQL: | 0.258155 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .02249 | .022 | .000 | .00052 | .000 | 1 |
| CalStd10=10 | 10000. | 10001. | .962 | .010 | 1.2330 | .052 | 1 |
| CalStd8=100 | 100.00 | 109.59 | 9.59 | 9.59 | .01402 | .001 | 1 |
| CalStd9=100 | 1000.0 | 989.42 | -10.6 | -1.06 | .12245 | .008 | 1 |

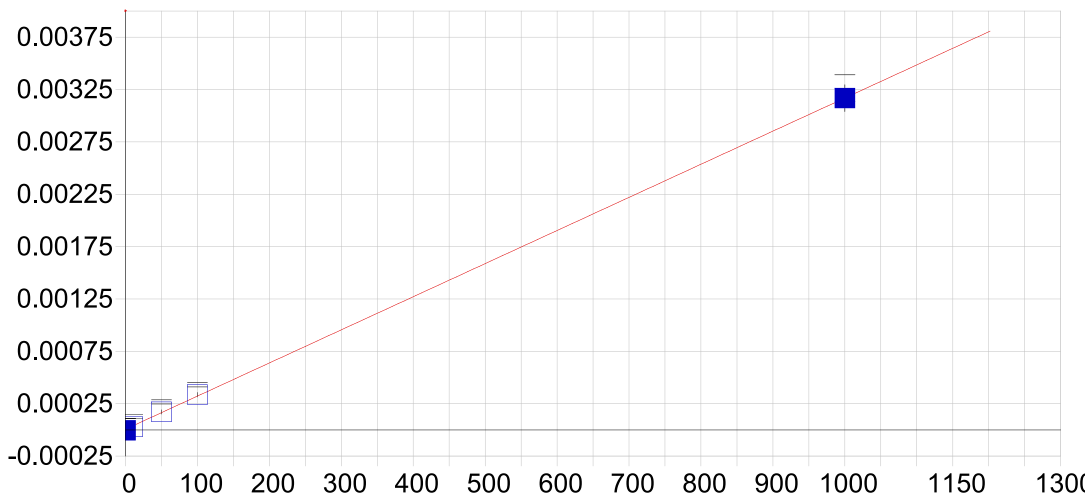



**Cd 214.438 {457}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000141 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000108 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999985 | Status: | O . |
| Std Error o Est: | 0.000219 | | |
| Predicted MDL: | 0.073544 | | |
| Predicted MQL: | 0.245146 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -1.0923 | -1.09 | .000 | .00002 | .000 | 1 |
| CalStd7=50 | 50.000 | 50.719 | .719 | 1.44 | .00564 | .000 | 1 |
| CalStd3=1 | 1.0000 | -.05199 | -1.05 | -105. | .00014 | .000 | 1 |
| CalStd2=0.5 | .50000 | -.55999 | -1.06 | -212. | .00008 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.1011 | -.899 | -18.0 | .00059 | .000 | 1 |
| CalStd8=100 | 100.00 | 104.40 | 4.40 | 4.40 | .01145 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.4504 | -.550 | -5.50 | .00116 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.54 | -.464 | -.046 | .10844 | .002 | 1 |

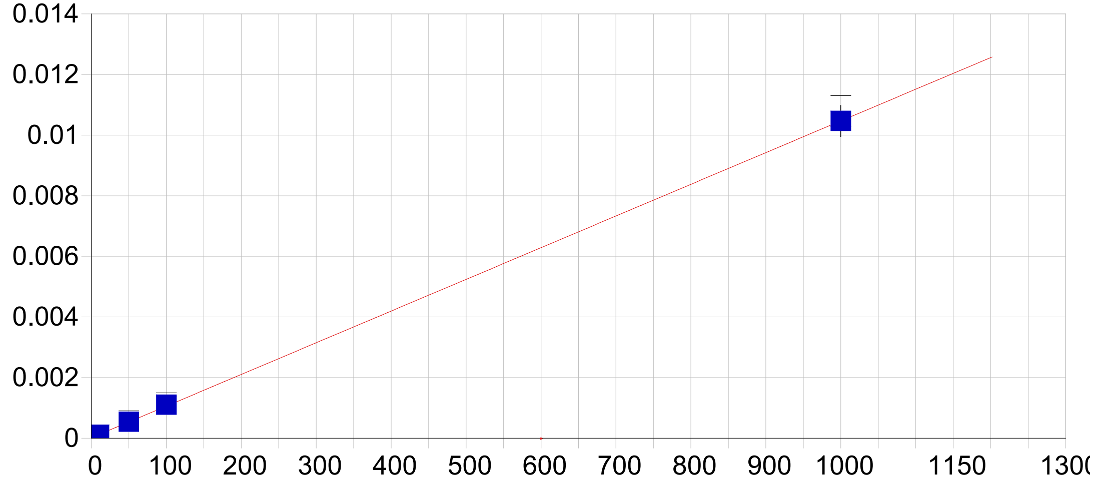



**Cd 226.502 {149}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000007 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999972 | Status: | O . |
| Std Error o Est: | 0.000012 | | |
| Predicted MDL: | 4.479698 | | |
| Predicted MQL: | 14.932328 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -3.4622 | -3.46 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 52.268 | 2.27 | 4.54 | .00017 | .000 | 1 |
| CalStd8=100 | 100.00 | 104.21 | 4.21 | 4.21 | .00034 | .000 | 1 |
| CalStd5=10 | 10.000 | 7.4913 | -2.51 | -25.1 | .00003 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.49 | -.510 | -.051 | .00317 | .000 | 1 |

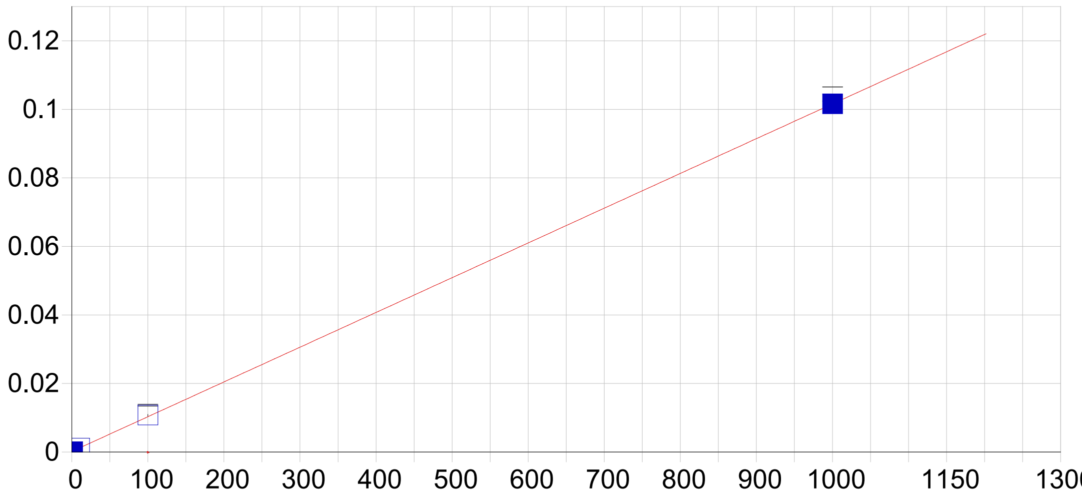



**Cd 226.502 {449}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000013 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000010 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999987 | Status: | OK. |
| Std Error of Est: | 0.000020 | | |
| Predicted MDL: | 0.193324 | | |
| Predicted MQL: | 0.644414 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -1.0588 | -1.06 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 50.529 | .529 | 1.06 | .00054 | .000 | 1 |
| CalStd3=1 | 1.0000 | .09356 | -.906 | -90.6 | .00001 | .000 | 1 |
| CalStd2=0.5 | .50000 | -.40776 | -.908 | -182. | .00001 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.1167 | -.883 | -17.7 | .00006 | .000 | 1 |
| CalStd8=100 | 100.00 | 104.27 | 4.27 | 4.27 | .00110 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.3989 | -.601 | -6.01 | .00011 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.56 | -.442 | -.044 | .01047 | .001 | 1 |

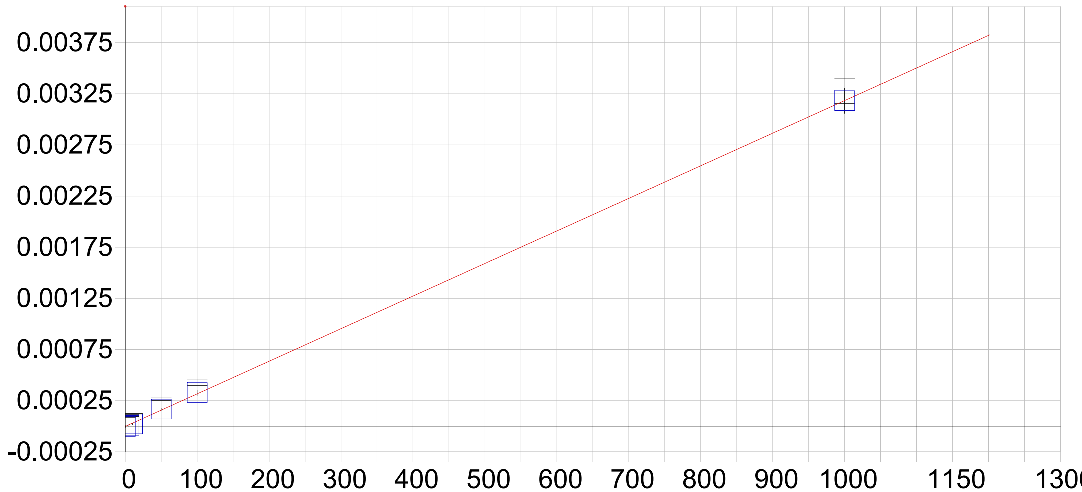



**Cd 228.802 {447}**

| | | | | | |
|---|---|---|---|---|---|
| Date o▯ Fit: | 06/17/2015 13:02:43 | Type o▯ Fit: | Linear | ▯ eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O▯▯set): | 0.000164 | Re-Slope: | 1.000000 |
| A1 (▯ ain): | 0.000101 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E▯ ponent): | 1.000000 | | |
| Correlation: | 0.999986 | Status: | O▯ . |
| Std Error o▯ Est: | 0.000238 | | |
| Predicted MDL: | 0.120451 | | |
| Predicted MQL: | 0.401505 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -1.0878 | -1.09 | .000 | .00005 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.58 | -.418 | -.042 | .10154 | .002 | 1 |
| CalStd8=100 | 100.00 | 104.25 | 4.25 | 4.25 | .01074 | .000 | 1 |
| CalStd2=0.5 | .50000 | -.53096 | -1.03 | -206. | .00011 | .000 | 1 |
| CalStd3=1 | 1.0000 | -.12004 | -1.12 | -112. | .00015 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.4035 | -.597 | -5.97 | .00112 | .000 | 1 |

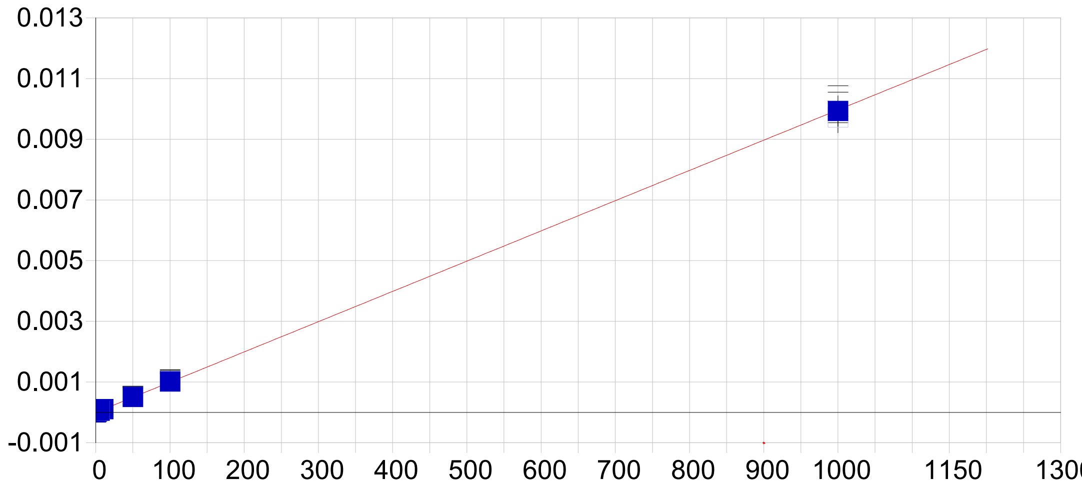



**Co 228.616 {147}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000002 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999978 | Status: | OK. |
| Std Error of Est: | 0.000009 | | |
| Predicted MDL: | 4.422777 | | |
| Predicted MQL: | 14.742591 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.58457 | -.585 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 52.916 | 2.92 | 5.83 | .00017 | .000 | 1 |
| CalStd5=10 | 10.000 | 7.0272 | -2.97 | -29.7 | .00002 | .000 | 1 |
| CalStd4=5 | 5.0000 | 2.6719 | -2.33 | -46.6 | .00001 | .000 | 1 |
| CalStd8=100 | 100.00 | 103.42 | 3.42 | 3.42 | .00033 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.55 | -.446 | -.045 | .00318 | .000 | 1 |

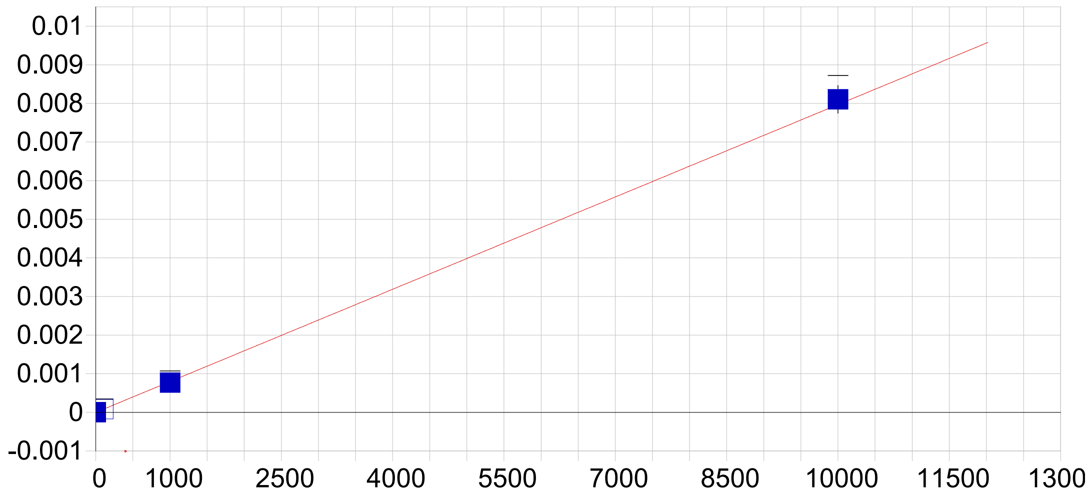



**Co 228.616 {447}**

Date of Fit: 06/17/2015 13:02:43 Type of Fit: Linear Weighting: 1/Conc

A0 (Offset): -0.000001 Re-Slope: 1.000000
A1 (Gain): 0.000010 Y-int: 0.000000
A2 (Curvature): 0.000000
n (Exponent): 1.000000
Correlation: 0.999948 Status: OK .
Std Error of Est: 0.000000
Predicted MDL: 0.214335
Predicted MQL: 0.714448

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00023 | .000 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 51.015 | 1.01 | 2.03 | .00050 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.362 | .362 | 3.62 | .00010 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.1799 | .180 | 3.60 | .00005 | .000 | 1 |
| CalStd8=100 | 100.00 | 102.18 | 2.18 | 2.18 | .00100 | .000 | 1 |
| CalStd9=100 | 1000.0 | 996.15 | -3.85 | -.385 | .00972 | .001 | 1 |
| CalStd3=1 | 1.0000 | 1.1146 | .115 | 11.5 | .00001 | .000 | 1 |

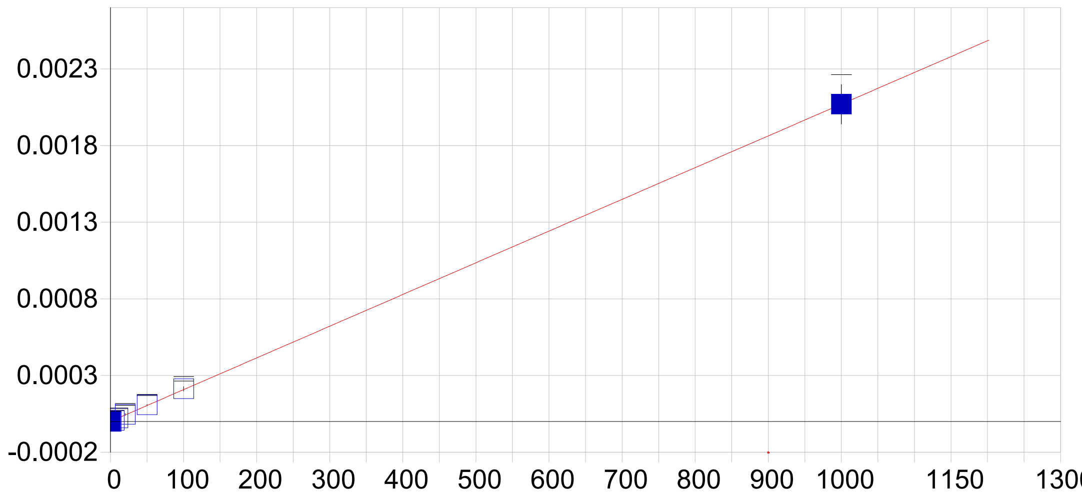



**Co 238.892 {141}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000001 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999665 | Status: | O . |
| Std Error o Est: | 0.000001 | | |
| Predicted MDL: | 4.668243 | | |
| Predicted MQL: | 15.560809 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.03836 | -.038 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 962.96 | -37.0 | -3.70 | .00077 | .000 | 1 |
| CalStd10=10 | 10000. | 10170. | 170. | 1.70 | .00811 | .000 | 1 |
| CalStd8=100 | 100.00 | 102.17 | 2.17 | 2.17 | .00008 | .000 | 1 |

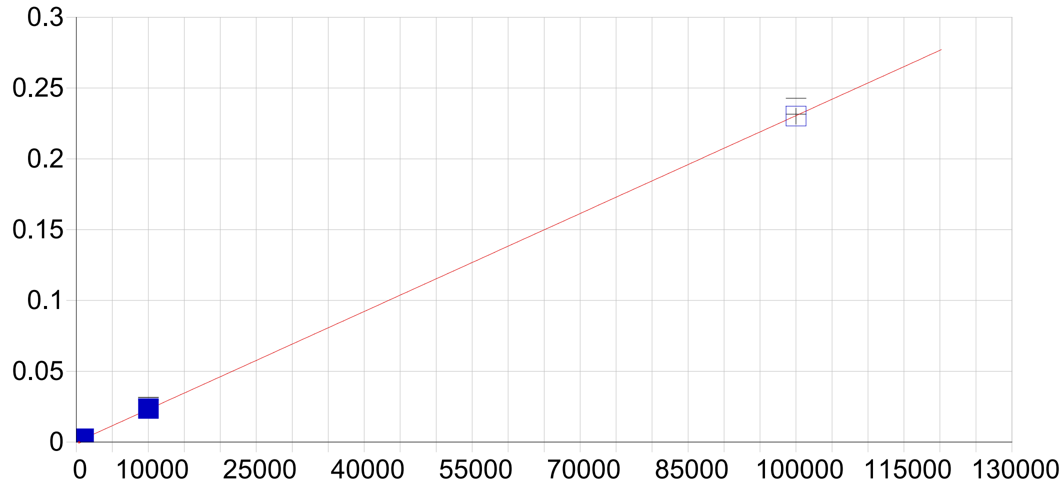



**Cr 267.716 {126}**

| | | | | | |
|---|---|---|---|---|---|
| Date o□ Fit: | 06/17/2015 13:02:43 | Type o□ Fit: | Linear | □ eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O□□set): | 0.000001 | Re-Slope: | 1.000000 |
| A1 (□ ain): | 0.000002 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E□ ponent): | 1.000000 | | |
| Correlation: | 0.999988 | Status: | O□ . |
| Std Error o□ Est: | 0.000004 | | |
| Predicted MDL: | 2.544903 | | |
| Predicted MQL: | 8.483010 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -1.0782 | -1.08 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.067 | .067 | .675 | .00002 | .000 | 1 |
| CalStd7=50 | 50.000 | 51.657 | 1.66 | 3.31 | .00011 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.66 | -.340 | -.034 | .00207 | .000 | 1 |
| CalStd6=20 | 20.000 | 21.469 | 1.47 | 7.35 | .00005 | .000 | 1 |
| CalStd8=100 | 100.00 | 102.40 | 2.40 | 2.40 | .00021 | .000 | 1 |
| CalStd3=1 | 1.0000 | -.82812 | -1.83 | -183. | .00000 | .000 | 1 |
| CalStd4=5 | 5.0000 | 2.6495 | -2.35 | -47.0 | .00001 | .000 | 1 |

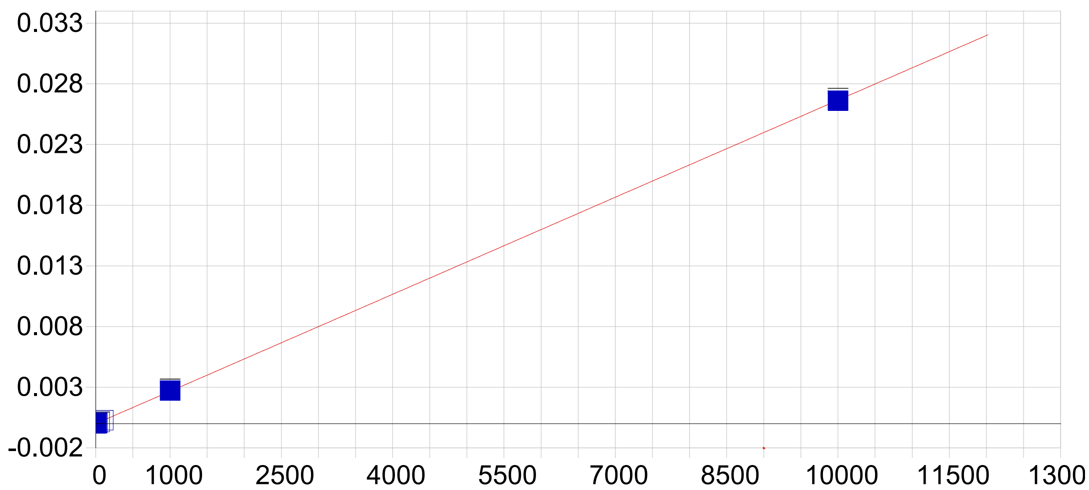



**Cr 283.563 {119}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000009 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000002 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999975 | Status: | OK . |
| Std Error of Est: | 0.000001 | | |
| Predicted MDL: | 2.366937 | | |
| Predicted MQL: | 7.889789 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00044 | .000 | .000 | .00001 | .000 | 1 |
| CalStd7=50 | 50.000 | 50.103 | .103 | .207 | .00012 | .000 | 1 |
| CalStd8=100 | 100.00 | 99.649 | -.351 | -.351 | .00024 | .000 | 1 |
| CalStd9=100 | 1000.0 | 973.33 | -26.7 | -2.67 | .00226 | .000 | 1 |
| CalStd10=10 | 10000. | 10211. | 211. | 2.11 | .02357 | .001 | 1 |
| CalStd11-100 | 100000. | 99816. | -184. | -.184 | .23013 | .006 | 1 |

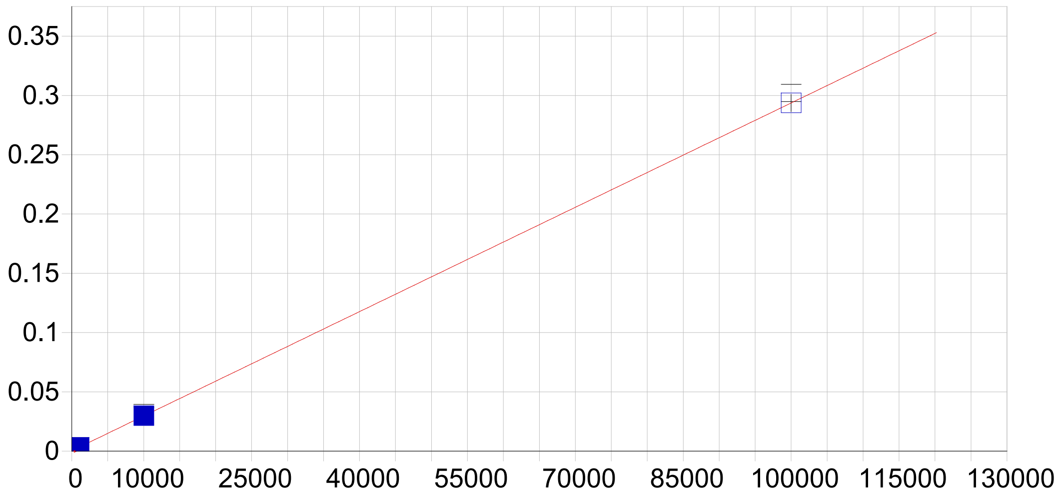



**Cu 224.700 {450}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000007 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999977 | Status: | OK. |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 0.481125 | | |
| Predicted MQL: | 1.603750 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00015 | .000 | .000 | -.00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1017.5 | 17.5 | 1.75 | .00271 | .000 | 1 |
| CalStd7=50 | 50.000 | 50.467 | .467 | .934 | .00013 | .000 | 1 |
| CalStd8=100 | 100.00 | 102.54 | 2.54 | 2.54 | .00027 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.4257 | -.574 | -5.74 | .00002 | .000 | 1 |
| CalStd10=10 | 10000. | 9980.5 | -19.5 | -.195 | .02661 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.7372 | -.263 | -5.26 | .00001 | .000 | 1 |
| CalStd6=20 | 20.000 | 19.631 | -.369 | -1.84 | .00005 | .000 | 1 |
| CalStd3=1 | 1.0000 | 1.2274 | .227 | 22.7 | .00000 | .000 | 1 |

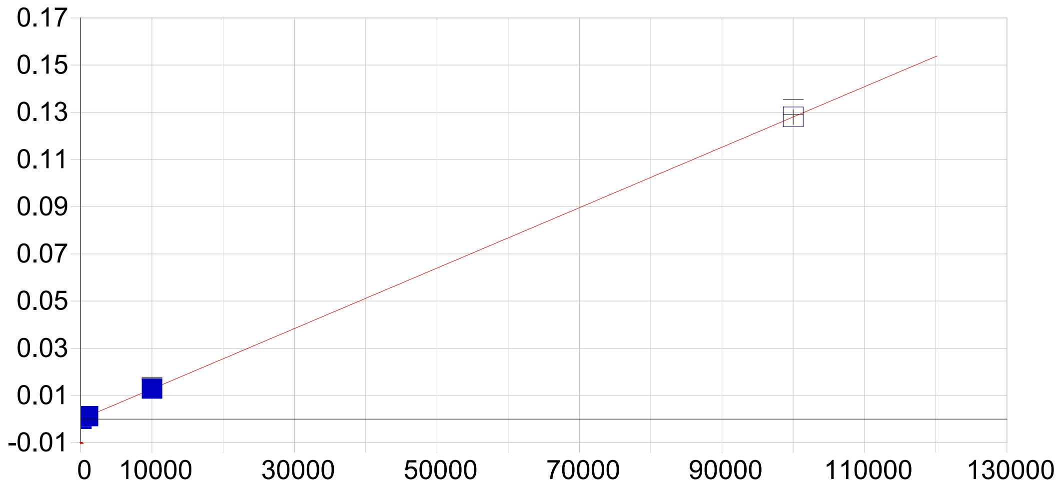



**Cu 324.754 {104}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000314 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | OK . |
| Std Error of Est: | 0.000088 | | |
| Predicted MDL: | 2.603753 | | |
| Predicted MQL: | 8.679177 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 7.5383 | 7.54 | .000 | .00034 | .000 | 1 |
| CalStd9=100 | 1000.0 | 959.82 | -40.2 | -4.02 | .00313 | .000 | 1 |
| CalStd8=100 | 100.00 | 103.26 | 3.26 | 3.26 | .00062 | .000 | 1 |
| CalStd10=10 | 10000. | 10032. | 32.2 | .322 | .02975 | .001 | 1 |
| CalStd11-100 | 100000. | 99997. | -2.82 | -.003 | .29368 | .007 | 1 |

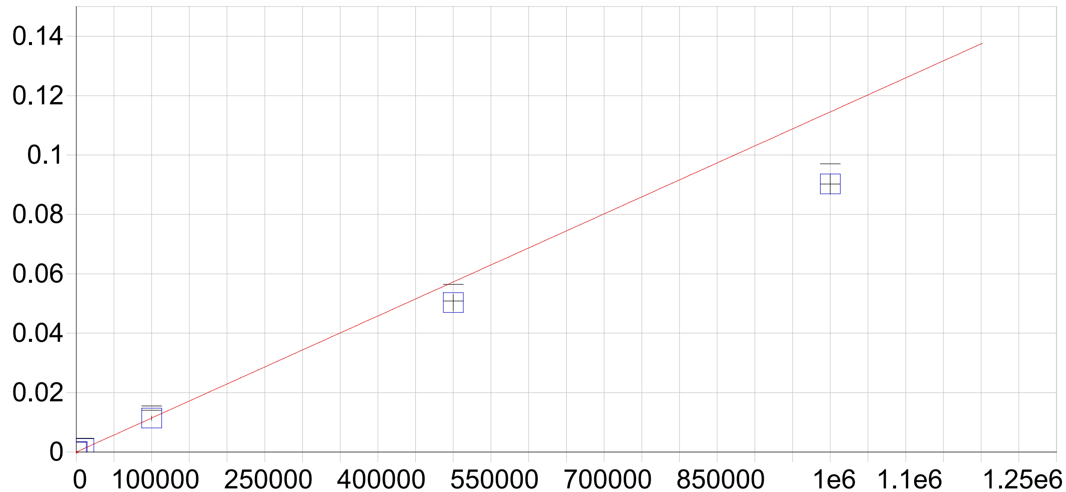



**Cu 327.396 {103}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000029 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999973 | Status: | OK . |
| Std Error of Est: | 0.000001 | | |
| Predicted MDL: | 7.771964 | | |
| Predicted MQL: | 25.906545 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00464 | .005 | .000 | -.00003 | .000 | 1 |
| CalStd6=20 | 20.000 | 20.355 | .355 | 1.77 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 41.566 | -8.43 | -16.9 | .00002 | .000 | 1 |
| CalStd8=100 | 100.00 | 96.952 | -3.05 | -3.05 | .00010 | .000 | 1 |
| CalStd9=100 | 1000.0 | 940.36 | -59.6 | -5.96 | .00118 | .000 | 1 |
| CalStd10=10 | 10000. | 10091. | 90.7 | .907 | .01289 | .001 | 1 |
| CalStd11-100 | 100000. | 99980. | -19.9 | -.020 | .12800 | .003 | 1 |

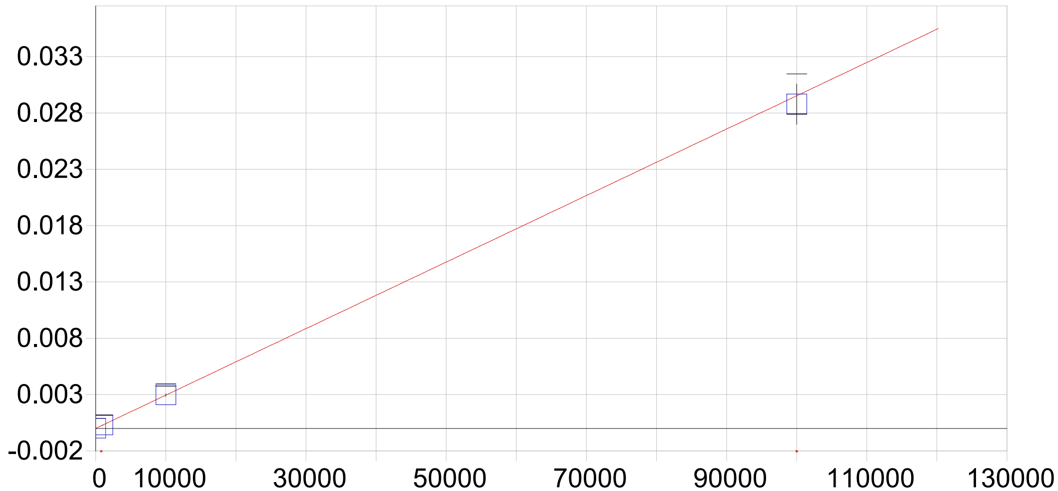



**Fe 234.349 {144}**

Date of Fit: 06/17/2015 13:02:43 | Type of Fit: Full Fit | Weighting: 1/Var

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000003 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999774 | Status: | OK . |
| Std Error of Est: | 0.000002 | | |
| Predicted MDL: | 15.177534 | | |
| Predicted MQL: | 50.591780 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 1.5952 | 1.60 | .000 | .00000 | .000 | 1 |
| CalStd10=10 | 10000. | 10194. | 194. | 1.94 | .00117 | .000 | 1 |
| CalStd13=50 | 500000. | 438880. | -61100. | -12.2 | .05027 | .003 | 1 |
| CalStd14-100 | 1000000. | 787910. | -212000. | -21.2 | .09025 | .003 | 1 |
| CalStd9=100 | 1000.0 | 959.66 | -40.3 | -4.03 | .00011 | .000 | 1 |
| CalStd12-100 | 100000. | 99520. | -480. | -.480 | .01140 | .001 | 1 |

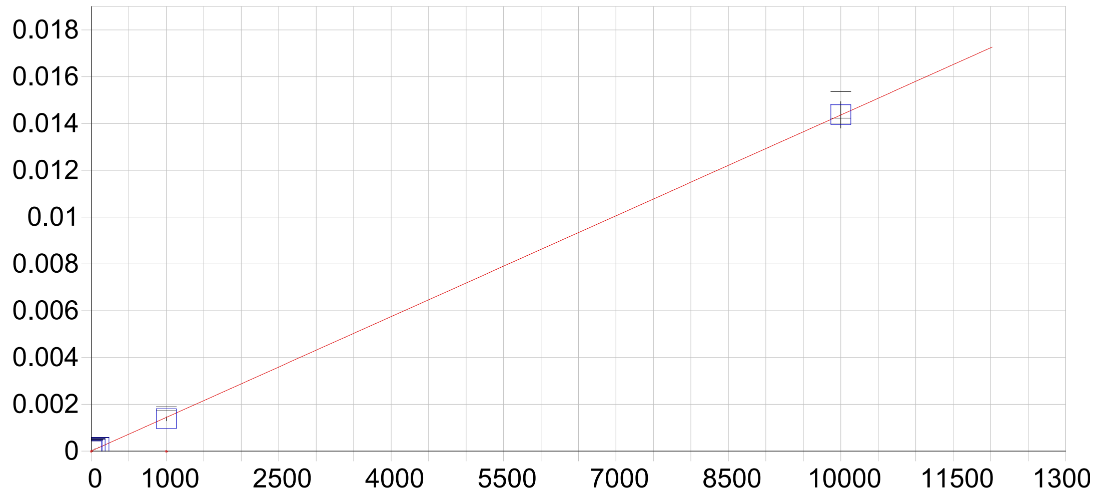



**Fe 239.562 {141}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Curvilinear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000002 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999990 | Status: | OK . |
| Std Error of Est: | 0.000001 | | |
| Predicted MDL: | 6.839217 | | |
| Predicted MQL: | 22.797389 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .03781 | .038 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 957.31 | -42.7 | -4.27 | .00028 | .000 | 1 |
| CalStd10=10 | 10000. | 10022. | 21.6 | .216 | .00296 | .000 | 1 |
| CalStd12-100 | 100000. | 97487. | -2510. | -2.51 | .02878 | .002 | 1 |

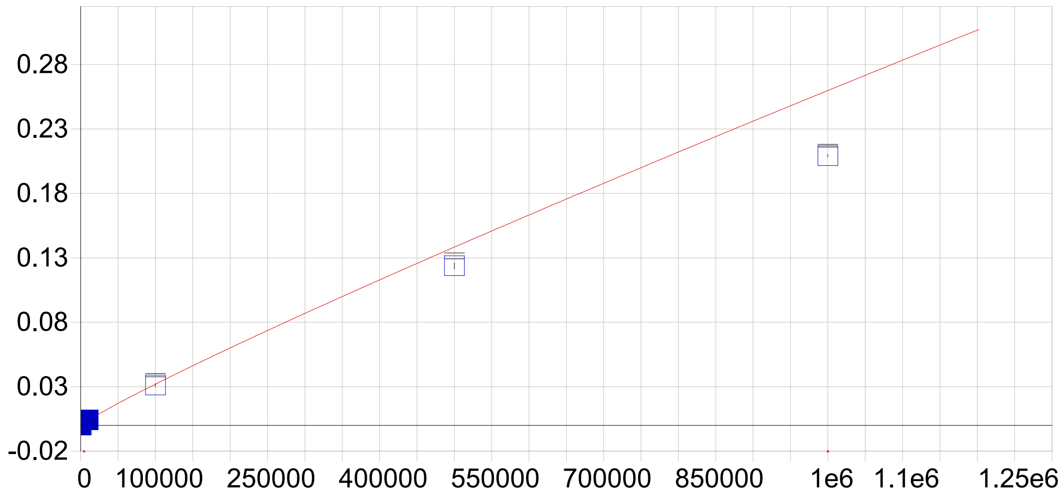



**Fe 259.940 {130}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000004 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999986 | Status: | OK . |
| Std Error of Est: | 0.000034 | | |
| Predicted MDL: | 2.829275 | | |
| Predicted MQL: | 9.430916 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 4.0889 | 4.09 | .000 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 957.48 | -42.5 | -4.25 | .00138 | .000 | 1 |
| CalStd7=50 | 50.000 | 65.173 | 15.2 | 30.3 | .00010 | .000 | 1 |
| CalStd8=100 | 100.00 | 108.48 | 8.48 | 8.48 | .00016 | .000 | 1 |
| CalStd6=20 | 20.000 | 30.702 | 10.7 | 53.5 | .00005 | .000 | 1 |
| CalStd10=10 | 10000. | 10004. | 4.07 | .041 | .01437 | .001 | 1 |

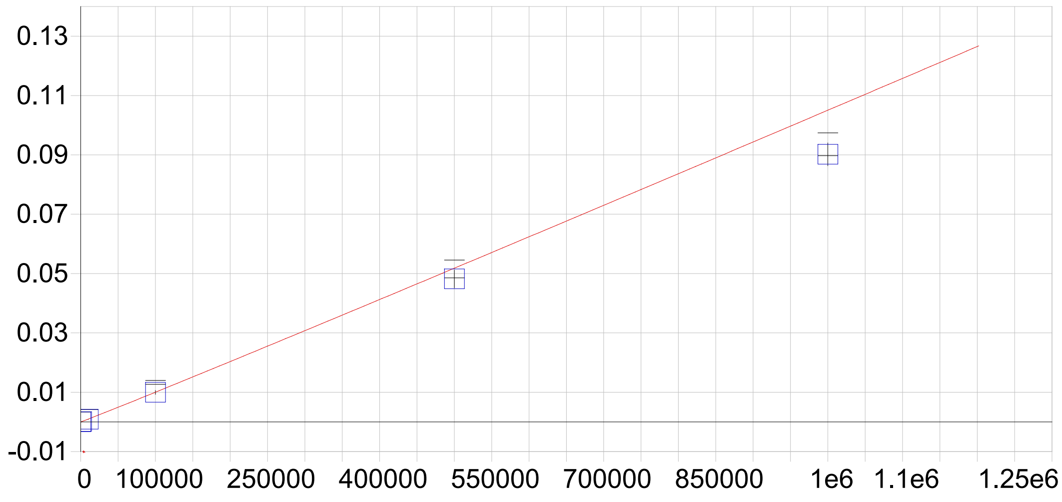



**Mg 202.582 {466}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Full Fit | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000007 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 0.910000 | | |
| Correlation: | 0.999958 | Status: | O . |
| Std Error o Est: | 0.000005 | | |
| Predicted MDL: | 1.489002 | | |
| Predicted MQL: | 4.963342 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .04783 | .048 | .000 | -.00001 | .000 | 1 |
| CalStd13=50 | 500000. | 442610. | -57400. | -11.5 | .12374 | .002 | 1 |
| CalStd10=10 | 10000. | 10372. | 372. | 3.72 | .00406 | .000 | 1 |
| CalStd14-100 | 1000000. | 787980. | -212000. | -21.2 | .20916 | .001 | 1 |
| CalStd12-100 | 100000. | 97337. | -2660. | -2.66 | .03118 | .001 | 1 |
| CalStd9=100 | 1000.0 | 839.98 | -160. | -16.0 | .00041 | .000 | 1 |

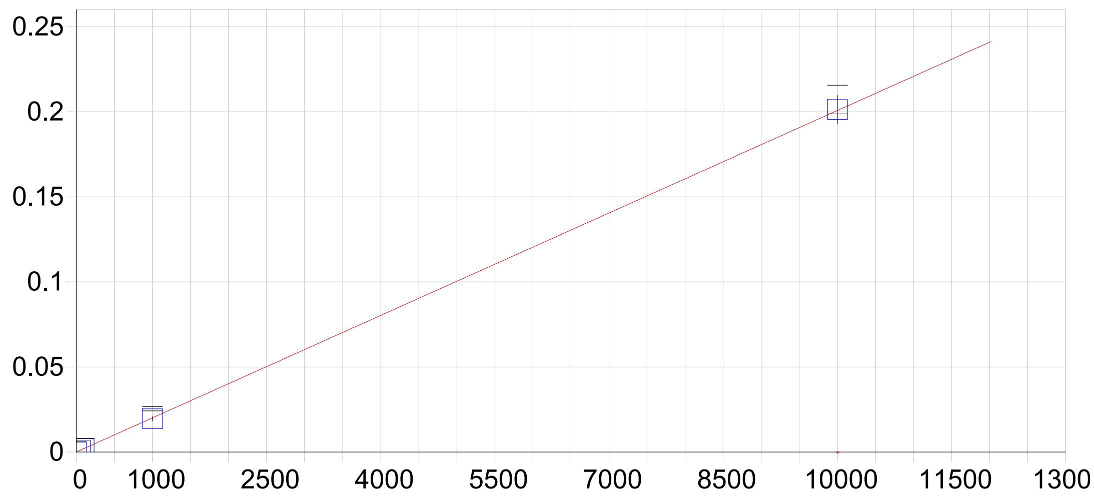



**Mg 279.079 {121}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Full Fit | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000027 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.020000 | | |
| Correlation: | 0.999999 | Status: | O . |
| Std Error o Est: | 0.000088 | | |
| Predicted MDL: | 34.448491 | | |
| Predicted MQL: | 114.828303 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 305.44 | 305. | .000 | .00000 | .000 | 1 |
| CalStd13=50 | 500000. | 465590. | -34400. | -6.88 | .04815 | .003 | 1 |
| CalStd10=10 | 10000. | 8961.1 | -1040. | -10.4 | .00083 | .000 | 1 |
| CalStd14-100 | 1000000. | 861010. | -139000. | -13.9 | .09017 | .004 | 1 |
| CalStd12-100 | 100000. | 99254. | -746. | -.746 | .00993 | .001 | 1 |
| CalStd9=100 | 1000.0 | 1287.8 | 288. | 28.8 | .00009 | .000 | 1 |

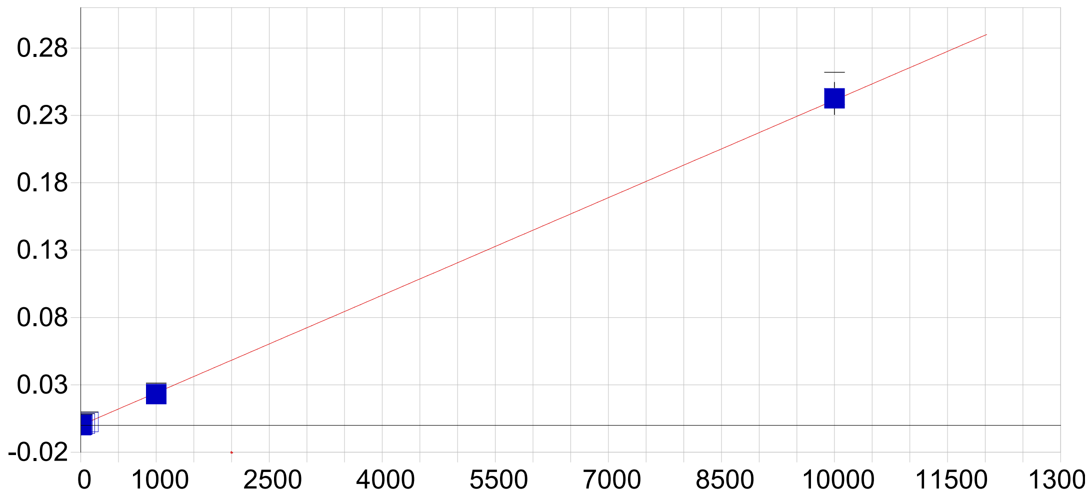



**Mg 280.270 {120}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000047 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000020 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999956 | Status: | O . |
| Std Error o Est: | 0.000006 | | |
| Predicted MDL: | 0.134729 | | |
| Predicted MQL: | 0.449095 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00058 | -.001 | .000 | .00005 | .000 | 1 |
| CalStd9=100 | 1000.0 | 970.99 | -29.0 | -2.90 | .01954 | .001 | 1 |
| CalStd10=10 | 10000. | 10027. | 27.0 | .270 | .20131 | .008 | 1 |
| CalStd8=100 | 100.00 | 100.30 | .295 | .295 | .00206 | .000 | 1 |
| CalStd7=50 | 50.000 | 51.746 | 1.75 | 3.49 | .00109 | .000 | 1 |

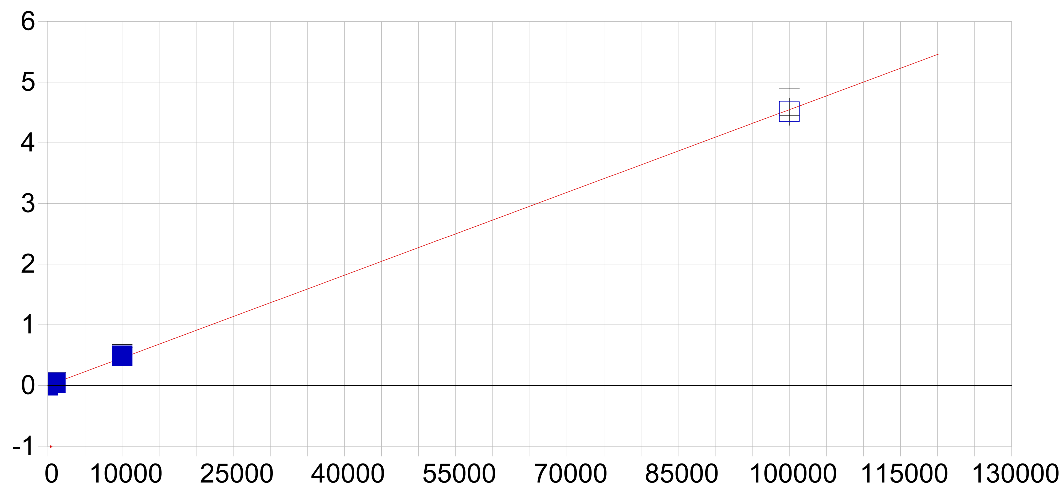



**Mn 257.610 {131}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000002 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000024 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999882 | Status: | O . |
| Std Error o Est: | 0.000003 | | |
| Predicted MDL: | 0.504231 | | |
| Predicted MQL: | 1.680769 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00071 | .001 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.265 | .265 | 2.65 | .00025 | .000 | 1 |
| CalStd7=50 | 50.000 | 48.471 | -1.53 | -3.06 | .00117 | .000 | 1 |
| CalStd6=20 | 20.000 | 20.468 | .468 | 2.34 | .00050 | .000 | 1 |
| CalStd8=100 | 100.00 | 96.652 | -3.35 | -3.35 | .00234 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.5716 | -.428 | -8.57 | .00011 | .000 | 1 |
| CalStd9=100 | 1000.0 | 953.41 | -46.6 | -4.66 | .02301 | .001 | 1 |
| CalStd10=10 | 10000. | 10051. | 51.2 | .512 | .24259 | .012 | 1 |

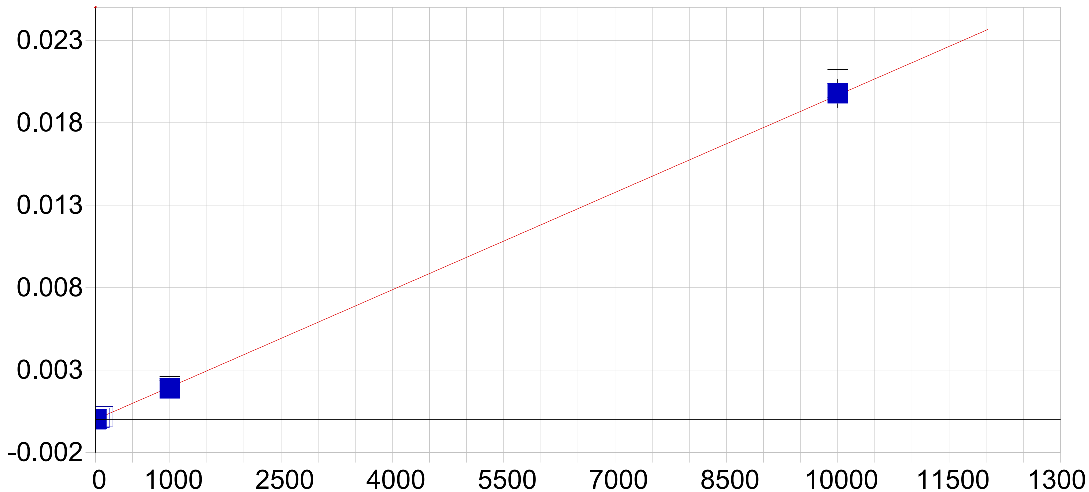



**Mn 259.373 {130}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000027 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000045 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999725 | Status: | OK . |
| Std Error of Est: | 0.000502 | | |
| Predicted MDL: | 0.498783 | | |
| Predicted MQL: | 1.662610 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.07664 | -.077 | .000 | .00002 | .000 | 1 |
| CalStd10=10 | 10000. | 10743. | 743. | 7.43 | .48899 | .025 | 1 |
| CalStd11-100 | 100000. | 99246. | -754. | -.754 | 4.5110 | .223 | 1 |
| CalStd9=100 | 1000.0 | 1009.9 | 9.88 | .988 | .04599 | .002 | 1 |

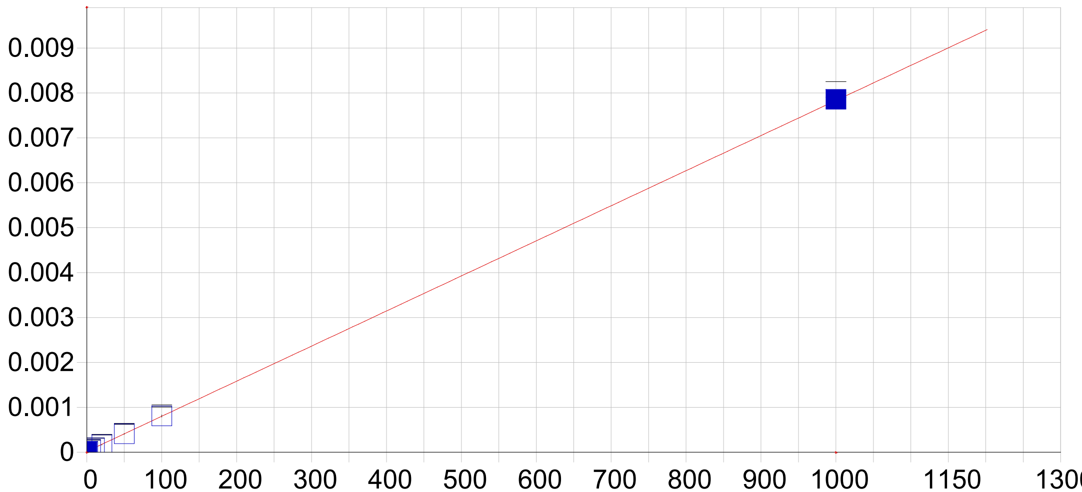



**Mn 293.930 {115}**

Date of Fit: 06/17/2015 13:02:43 Type of Fit: Linear Weighting: 1/Conc

A0 (Offset): -0.000002 Re-Slope: 1.000000
A1 (Gain): 0.000002 Y-int: 0.000000
A2 (Curvature): 0.000000
n (Exponent): 1.000000
Correlation: 0.999890 Status: OK.
Std Error of Est: 0.000000
Predicted MDL: 2.908771
Predicted MQL: 9.695904

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00102 | .001 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.8145 | -.185 | -1.85 | .00002 | .000 | 1 |
| CalStd7=50 | 50.000 | 49.511 | -.489 | -.978 | .00010 | .000 | 1 |
| CalStd6=20 | 20.000 | 20.060 | .060 | .300 | .00004 | .000 | 1 |
| CalStd8=100 | 100.00 | 97.249 | -2.75 | -2.75 | .00019 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.4488 | -.551 | -11.0 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 954.48 | -45.5 | -4.55 | .00188 | .000 | 1 |
| CalStd10=10 | 10000. | 10049. | 49.4 | .494 | .01978 | .001 | 1 |

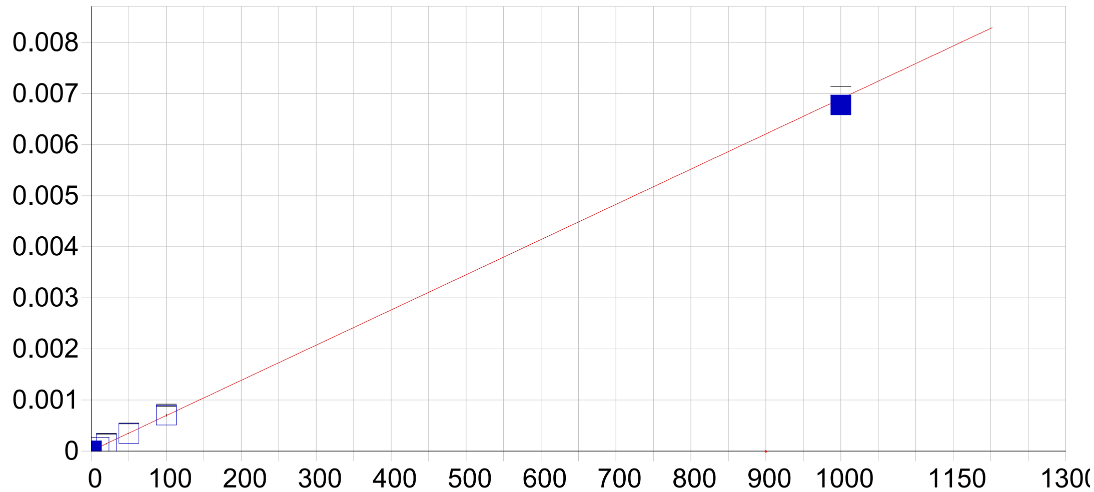



**Mo 203.844 {465}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000019 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000008 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999214 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 0.905251 | | |
| Predicted MQL: | 3.017502 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00152 | .002 | .000 | .00002 | .000 | 1 |
| CalStd7=50 | 50.000 | 49.823 | -.177 | -.354 | .00041 | .000 | 1 |
| CalStd3=1 | 1.0000 | -.30118 | -1.30 | -130. | .00002 | .000 | 1 |
| CalStd6=20 | 20.000 | 18.993 | -1.01 | -5.03 | .00017 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.3701 | -.630 | -6.30 | .00009 | .000 | 1 |
| CalStd8=100 | 100.00 | 100.71 | .708 | .708 | .00081 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.4219 | -.578 | -11.6 | .00005 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1003.0 | 2.98 | .298 | .00786 | .000 | 1 |

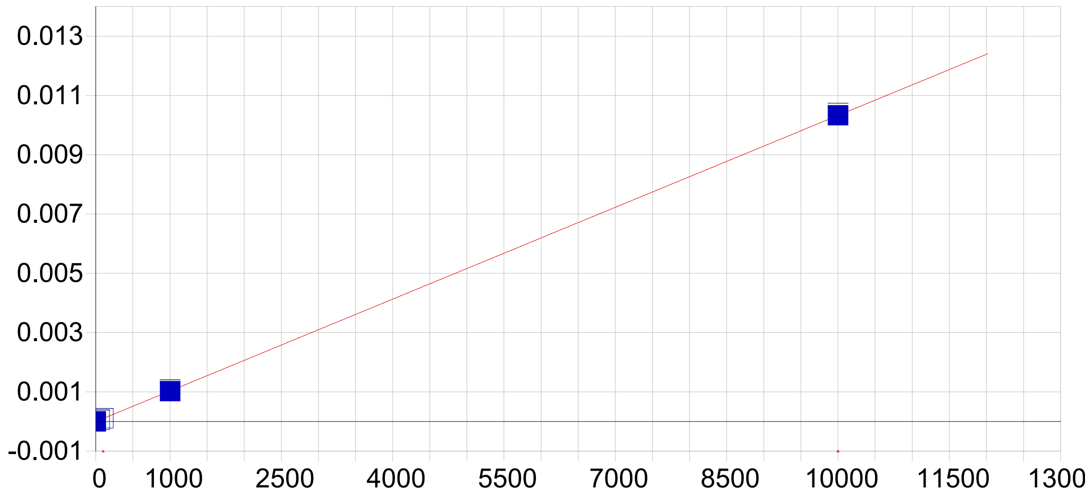



**Mo 202.030 {467}**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | | Type o Fit: | Linear | eighting: | 1/Var | |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000008 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000007 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999331 | Status: | O . |
| Std Error o Est: | 0.000001 | | |
| Predicted MDL: | 0.763291 | | |
| Predicted MQL: | 2.544302 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.63619 | -.636 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 48.801 | -1.20 | -2.40 | .00034 | .000 | 1 |
| CalStd6=20 | 20.000 | 19.528 | -.472 | -2.36 | .00014 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.012 | .012 | .125 | .00008 | .000 | 1 |
| CalStd8=100 | 100.00 | 100.73 | .727 | .727 | .00070 | .000 | 1 |
| CalStd9=100 | 1000.0 | 982.02 | -18.0 | -1.80 | .00677 | .000 | 1 |

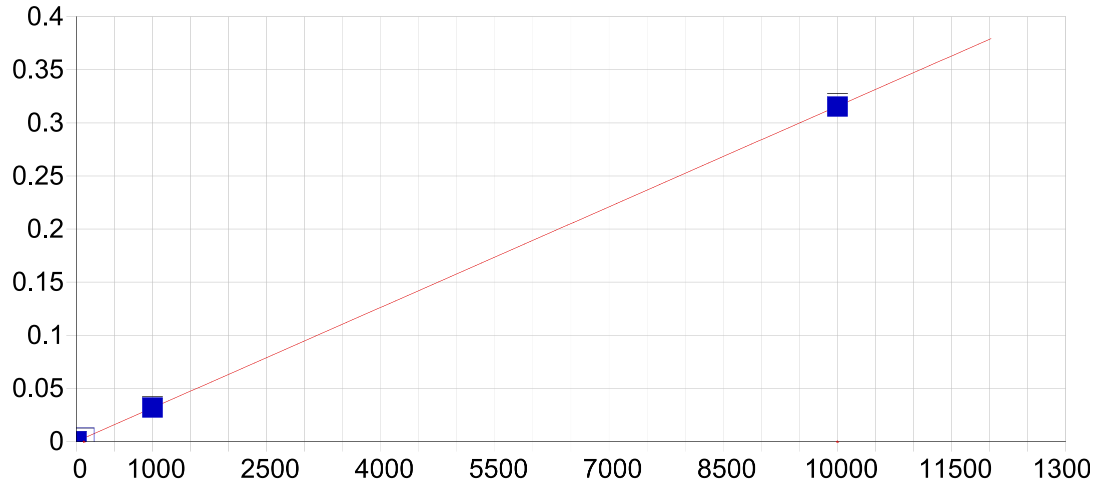



**Mo 204.598 {465}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O set): | -0.000003 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999999 | Status: | O . |
| Std Error o Est: | 0.000008 | | |
| Predicted MDL: | 1.214651 | | |
| Predicted MQL: | 4.048835 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 3.1739 | 3.17 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 987.92 | -12.1 | -1.21 | .00102 | .000 | 1 |
| CalStd10=10 | 10000. | 10001. | 1.15 | .011 | .01033 | .000 | 1 |
| CalStd7=50 | 50.000 | 53.627 | 3.63 | 7.25 | .00005 | .000 | 1 |
| CalStd8=100 | 100.00 | 104.13 | 4.13 | 4.13 | .00010 | .000 | 1 |

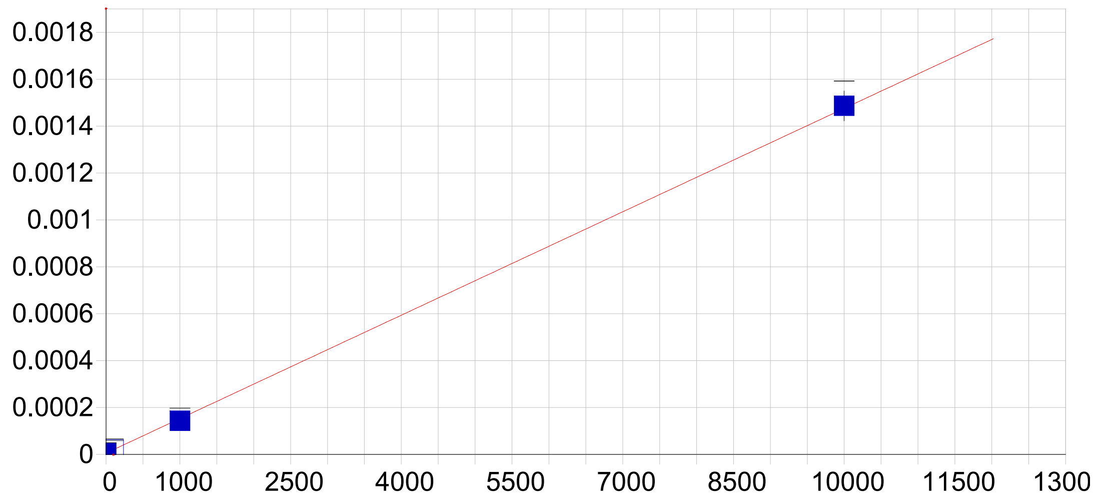



**Ni 221.647 {452}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000019 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000032 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999988 | Status: | OK . |
| Std Error of Est: | 0.000007 | | |
| Predicted MDL: | 0.391242 | | |
| Predicted MQL: | 1.304140 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00505 | -.005 | .000 | .00002 | .000 | 1 |
| CalStd10=10 | 10000. | 9987.9 | -12.1 | -.121 | .31523 | .003 | 1 |
| CalStd8=100 | 100.00 | 104.40 | 4.40 | 4.40 | .00331 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1007.7 | 7.68 | .768 | .03182 | .001 | 1 |

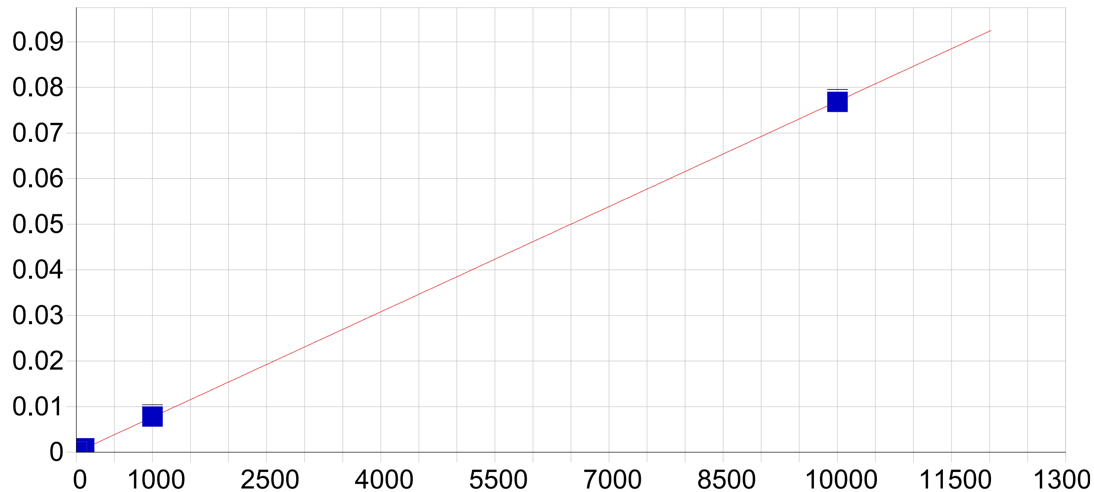



**Ni 231.604 {146}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000006 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999763 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 22.783102 | | |
| Predicted MQL: | 75.943675 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .01129 | .011 | .000 | .00001 | .000 | 1 |
| CalStd10=10 | 10000. | 10072. | 72.2 | .722 | .00149 | .000 | 1 |
| CalStd8=100 | 100.00 | 94.676 | -5.32 | -5.32 | .00002 | .000 | 1 |
| CalStd9=100 | 1000.0 | 933.16 | -66.8 | -6.68 | .00014 | .000 | 1 |

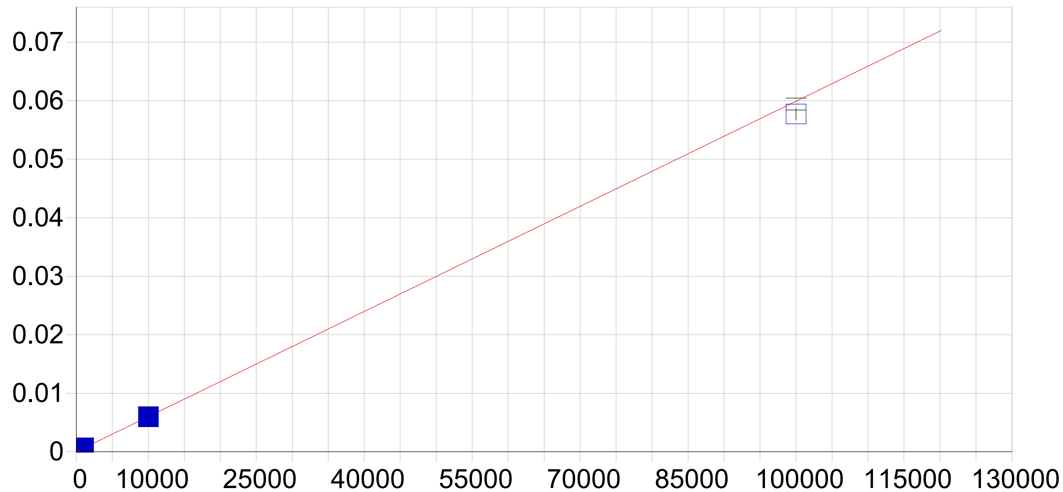



**Ni 231.604 {445}**

Date o Fit: 06/17/2015 13:02:43 Type o Fit: Linear  eighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000004 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000008 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999975 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 0.435427 | | |
| Predicted MQL: | 1.451424 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00021 | .000 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 52.223 | 2.22 | 4.45 | .00041 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.552 | .552 | 5.52 | .00009 | .000 | 1 |
| CalStd8=100 | 100.00 | 104.18 | 4.18 | 4.18 | .00081 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.3988 | .399 | 7.98 | .00005 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1013.5 | 13.5 | 1.35 | .00780 | .000 | 1 |
| CalStd3=1 | 1.0000 | .97920 | -.021 | -2.08 | .00001 | .000 | 1 |
| CalStd10=10 | 10000. | 9979.2 | -20.8 | -.208 | .07679 | .001 | 1 |

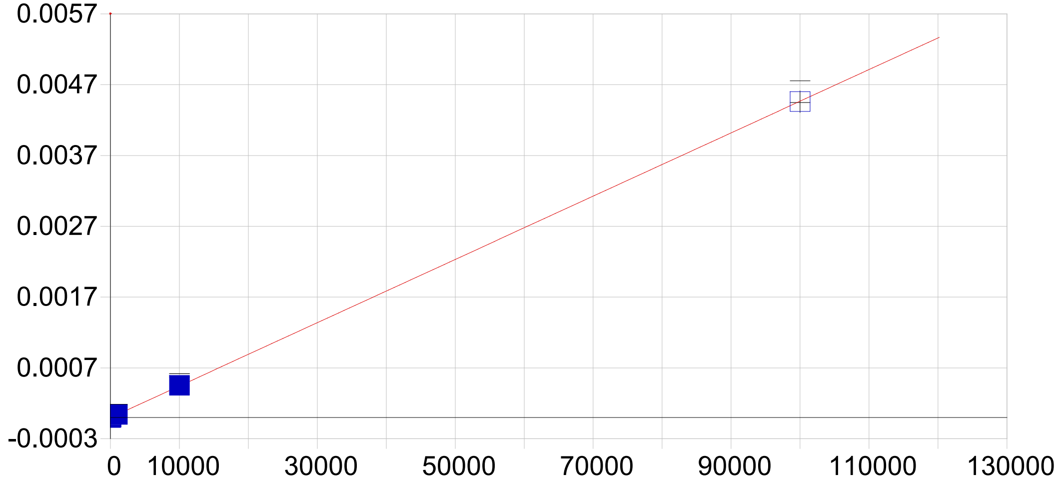



**Pb 216.999 {455}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Curvilinear |  eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000005 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Eponent): | 1.000000 | | |
| Correlation: | 0.999964 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 3.509442 | | |
| Predicted MQL: | 11.698139 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00373 | -.004 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1071.1 | 71.1 | 7.11 | .00065 | .000 | 1 |
| CalStd10=10 | 10000. | 9874.5 | -126. | -1.26 | .00593 | .000 | 1 |
| CalStd11-100 | 100000. | 96317. | -3680. | -3.68 | .05772 | .001 | 1 |
| CalStd8=100 | 100.00 | 105.10 | 5.10 | 5.10 | .00007 | .000 | 1 |
| CalStd4=5 | 5.0000 | 7.4458 | 2.45 | 48.9 | .00001 | .000 | 1 |
| CalStd5=10 | 10.000 | 11.426 | 1.43 | 14.3 | .00001 | .000 | 1 |

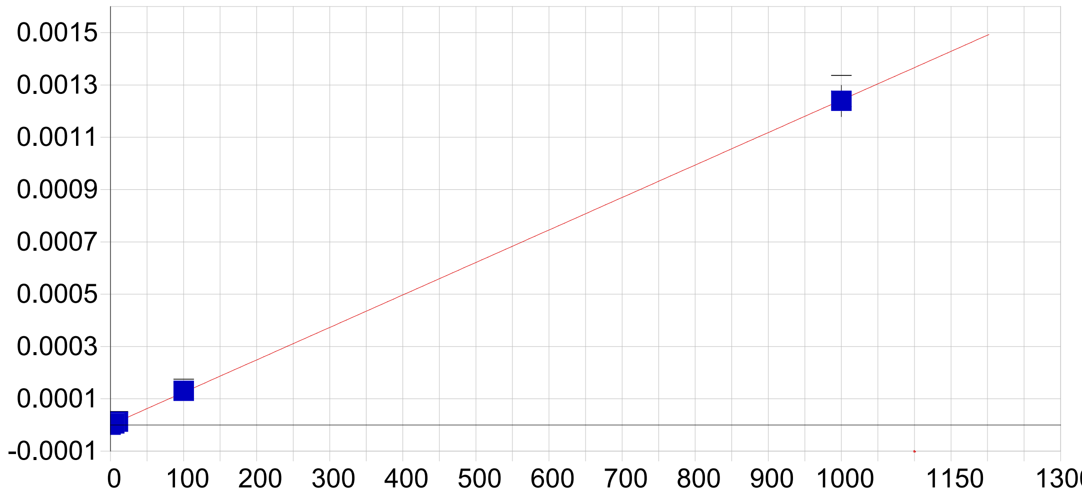



**Pb 220.353 {153}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000003 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999562 | Status: | OK . |
| Std Error of Est: | 0.000001 | | |
| Predicted MDL: | 54.740367 | | |
| Predicted MQL: | 182.467890 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -24.152 | -24.2 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 929.17 | -70.8 | -7.08 | .00004 | .000 | 1 |
| CalStd10=10 | 10000. | 10171. | 171. | 1.71 | .00045 | .000 | 1 |
| CalStd8=100 | 100.00 | 94.438 | -5.56 | -5.56 | .00000 | .000 | 1 |
| CalStd4=5 | 5.0000 | 13.724 | 8.72 | 174. | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 27.849 | 17.8 | 178. | .00000 | .000 | 1 |
| CalStd11-100 | 100000. | 99851. | -149. | -.149 | .00446 | .000 | 1 |

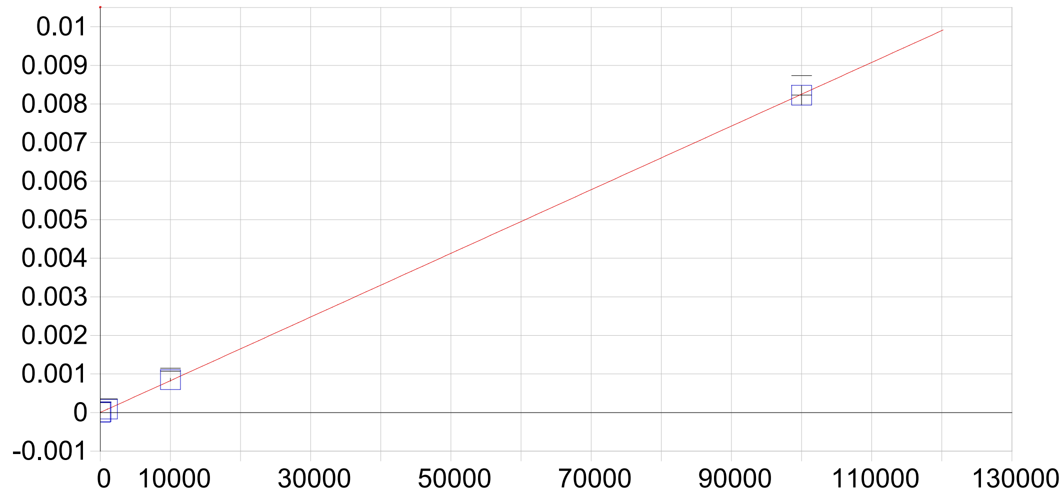



**Pb 220.353 {453}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000000 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999730 | Status: | OK. |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 1.964698 | | |
| Predicted MQL: | 6.548995 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00140 | .001 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.4224 | -.578 | -5.78 | .00001 | .000 | 1 |
| CalStd8=100 | 100.00 | 104.58 | 4.58 | 4.58 | .00013 | .000 | 1 |
| CalStd4=5 | 5.0000 | 3.6754 | -1.32 | -26.5 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 997.32 | -2.68 | -.268 | .00124 | .000 | 1 |

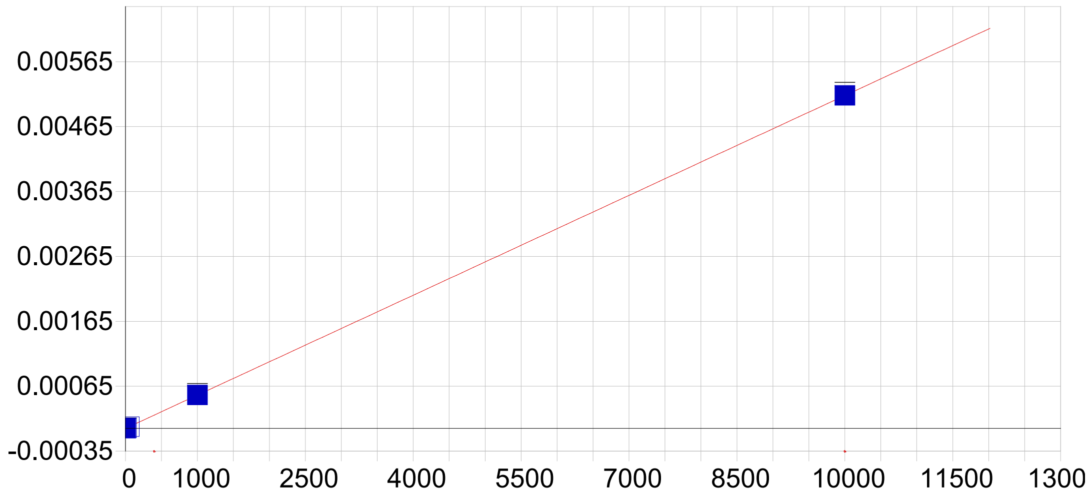



**Pb 283.306 {119}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000002 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999882 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 76.460531 | | |
| Predicted MQL: | 254.868437 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.04516 | -.045 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1015.8 | 15.8 | 1.58 | .00009 | .000 | 1 |
| CalStd10=10 | 10000. | 10281. | 281. | 2.81 | .00085 | .000 | 1 |
| CalStd11-100 | 100000. | 99662. | -338. | -.338 | .00822 | .000 | 1 |
| CalStd8=100 | 100.00 | 141.11 | 41.1 | 41.1 | .00001 | .000 | 1 |

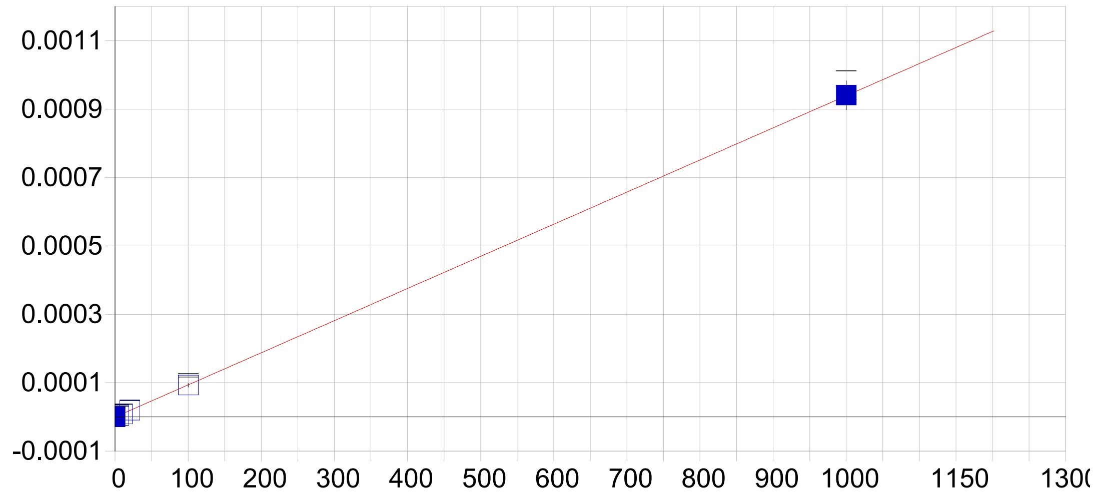



**Sb 206.833 {463}**

Date of Fit: 06/17/2015 13:02:43 Type of Fit: Linear Weighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000000 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999999 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 2.608652 | | |
| Predicted MQL: | 8.695507 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00003 | .000 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1000.4 | .380 | .038 | .00051 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.8019 | -.198 | -1.98 | .00001 | .000 | 1 |
| CalStd7=50 | 50.000 | 50.841 | .841 | 1.68 | .00003 | .000 | 1 |
| CalStd10=10 | 10000. | 9999.0 | -1.02 | -.010 | .00513 | .000 | 1 |

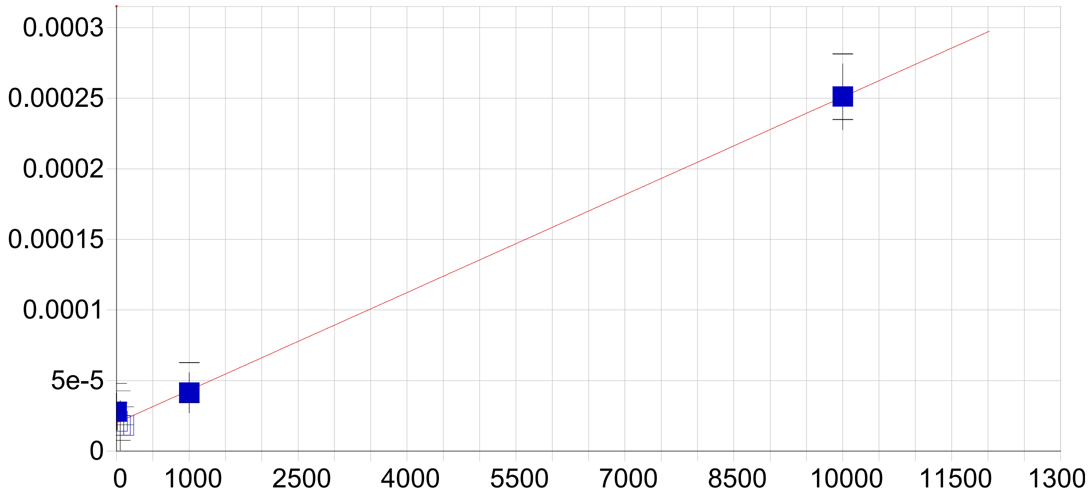



**Sb 217.581 {455}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000000 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Eponent): | 1.000000 | | |
| Correlation: | 0.999930 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 1.935014 | | |
| Predicted MQL: | 6.450048 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00064 | .001 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1001.5 | 1.50 | .150 | .00094 | .000 | 1 |
| CalStd6=20 | 20.000 | 20.846 | .846 | 4.23 | .00002 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.0862 | -.914 | -9.14 | .00001 | .000 | 1 |
| CalStd8=100 | 100.00 | 98.923 | -1.08 | -1.08 | .00009 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.6469 | -.353 | -7.06 | .00000 | .000 | 1 |

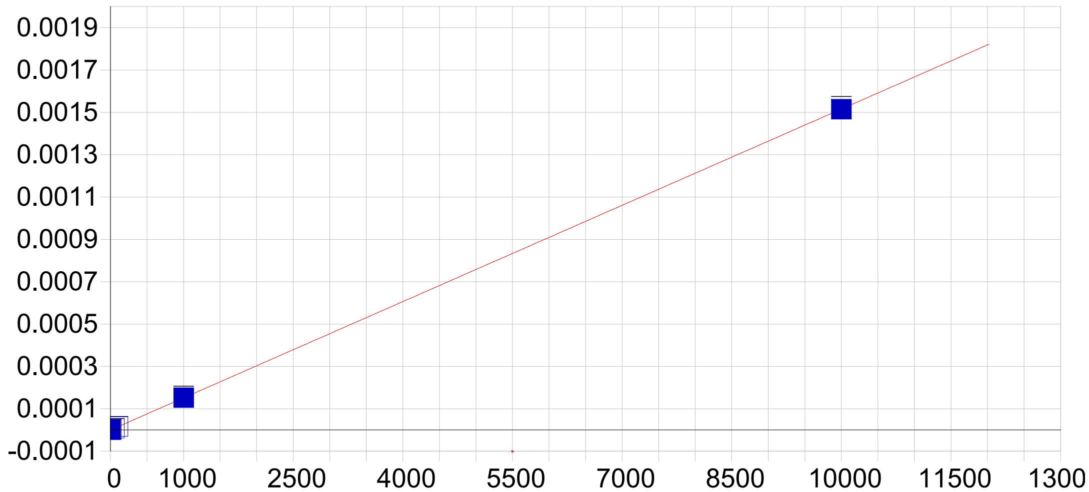



**Se 196.090 {172}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000020 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Eponent): | 1.000000 | | |
| Correlation: | 0.998914 | Status: | O . |
| Std Error o Est: | 0.000005 | | |
| Predicted MDL: | 593.342791 | | |
| Predicted MQL: | 1977.809304 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 342.79 | 343. | .000 | .00003 | .000 | 1 |
| CalStd7=50 | 50.000 | -77.446 | -127. | -255. | .00002 | .000 | 1 |
| CalStd9=100 | 1000.0 | 926.01 | -74.0 | -7.40 | .00004 | .000 | 1 |
| CalStd5=10 | 10.000 | 43.054 | 33.1 | 331. | .00002 | .000 | 1 |
| CalStd8=100 | 100.00 | -84.254 | -184. | -184. | .00002 | .000 | 1 |
| CalStd10=10 | 10000. | 10010. | 9.85 | .098 | .00025 | .000 | 1 |

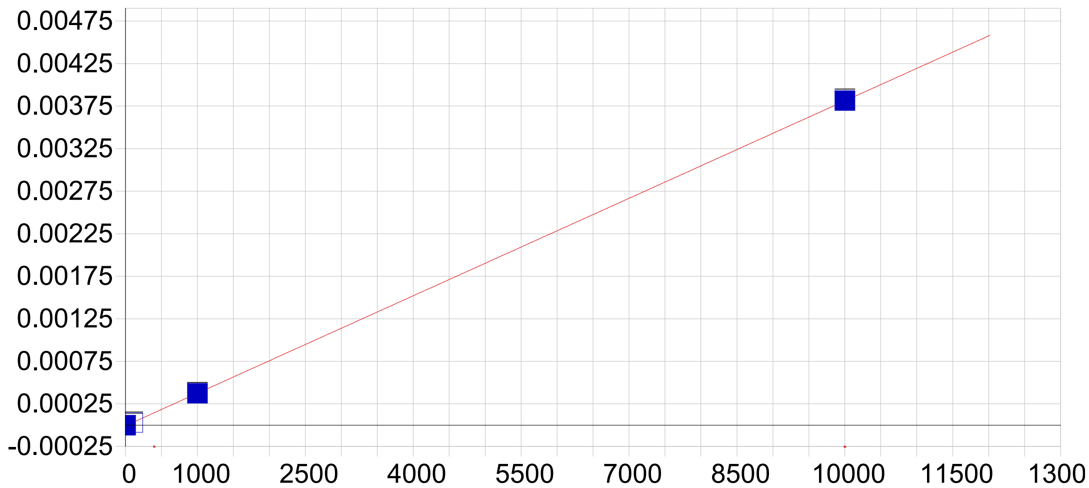



**Se 196.090 {472}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000000 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999955 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 7.033544 | | |
| Predicted MQL: | 23.445148 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00308 | -.003 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 49.064 | -.936 | -1.87 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1004.2 | 4.18 | .418 | .00015 | .000 | 1 |
| CalStd5=10 | 10.000 | 12.899 | 2.90 | 29.0 | .00000 | .000 | 1 |
| CalStd8=100 | 100.00 | 103.32 | 3.32 | 3.32 | .00002 | .000 | 1 |
| CalStd10=10 | 10000. | 9990.5 | -9.46 | -.095 | .00151 | .000 | 1 |

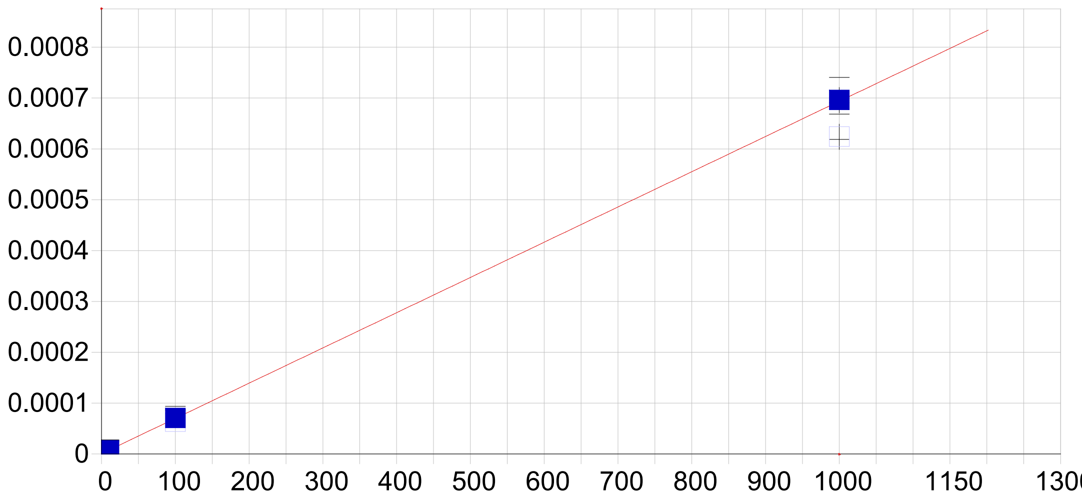



**Se 206.279 {463}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000007 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999999 | Status: | O . |
| Std Error o Est: | 0.000003 | | |
| Predicted MDL: | 19.675898 | | |
| Predicted MQL: | 65.586326 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 9.7074 | 9.71 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 994.94 | -5.06 | -.506 | .00037 | .000 | 1 |
| CalStd10=10 | 10000. | 10001. | .558 | .006 | .00381 | .000 | 1 |
| CalStd8=100 | 100.00 | 94.795 | -5.21 | -5.21 | .00003 | .000 | 1 |

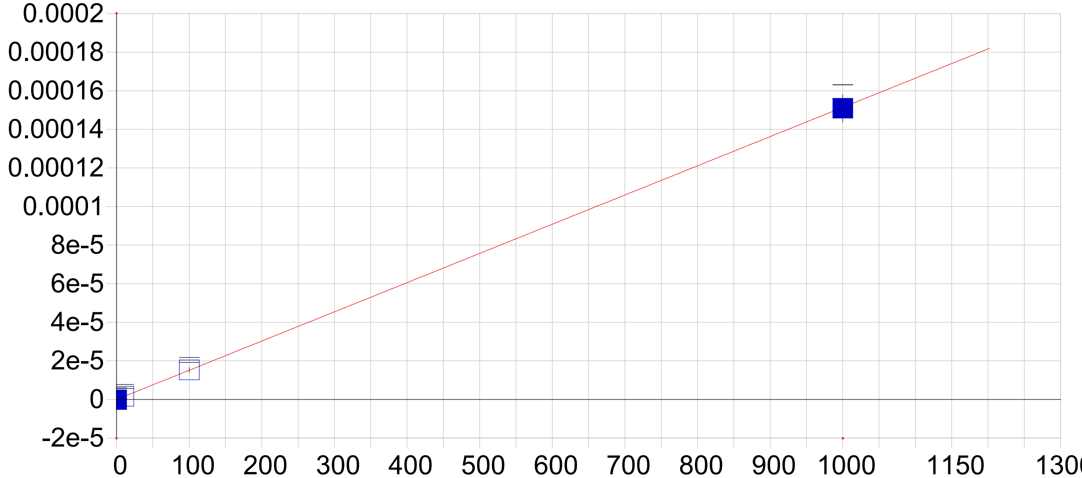



**Tl 190.856 {476}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000001 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999408 | Status: | OK . |
| Std Error of Est: | 0.000001 | | |
| Predicted MDL: | 2.167467 | | |
| Predicted MQL: | 7.224889 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .99515 | .995 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1003.3 | 3.26 | .326 | .00062 | .000 | 1 |
| CalStd8=100 | 100.00 | 100.77 | .769 | .769 | .00006 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.0027 | -.997 | -9.97 | .00001 | .000 | 1 |

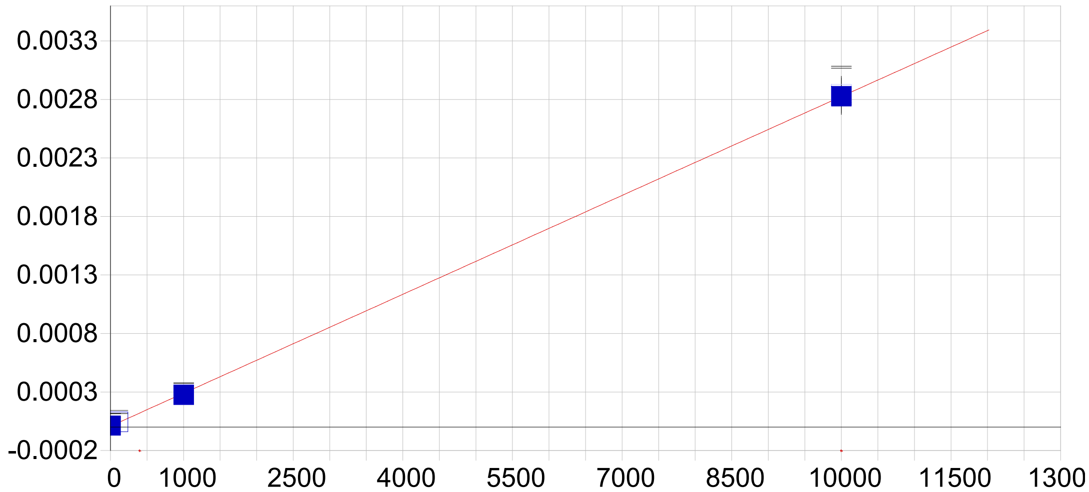



**Tl 190.856 {477}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000000 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999953 | Status: | OK. |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 7.712373 | | |
| Predicted MQL: | 25.707910 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -1.1400 | -1.14 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 996.51 | -3.49 | -.349 | .00015 | .000 | 1 |
| CalStd8=100 | 100.00 | 101.11 | 1.11 | 1.11 | .00002 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.336 | .336 | 3.36 | .00000 | .000 | 1 |

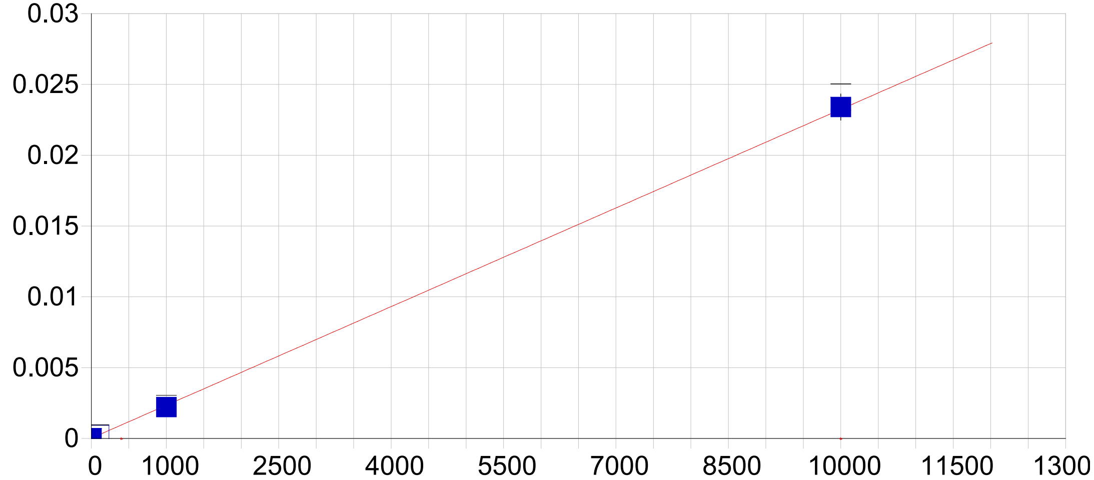



**Tl 276.787 {122}**

Date o Fit: 06/17/2015 13:02:43 Type o Fit: Linear  eighting: None

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000008 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999972 | Status: | O . |
| Std Error o Est: | 0.000013 | | |
| Predicted MDL: | 78.649117 | | |
| Predicted MQL: | 262.163723 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 18.174 | 18.2 | .000 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 947.31 | -52.7 | -5.27 | .00028 | .000 | 1 |
| CalStd10=10 | 10000. | 10005. | 4.98 | .050 | .00284 | .000 | 1 |
| CalStd8=100 | 100.00 | 129.54 | 29.5 | 29.5 | .00004 | .000 | 1 |

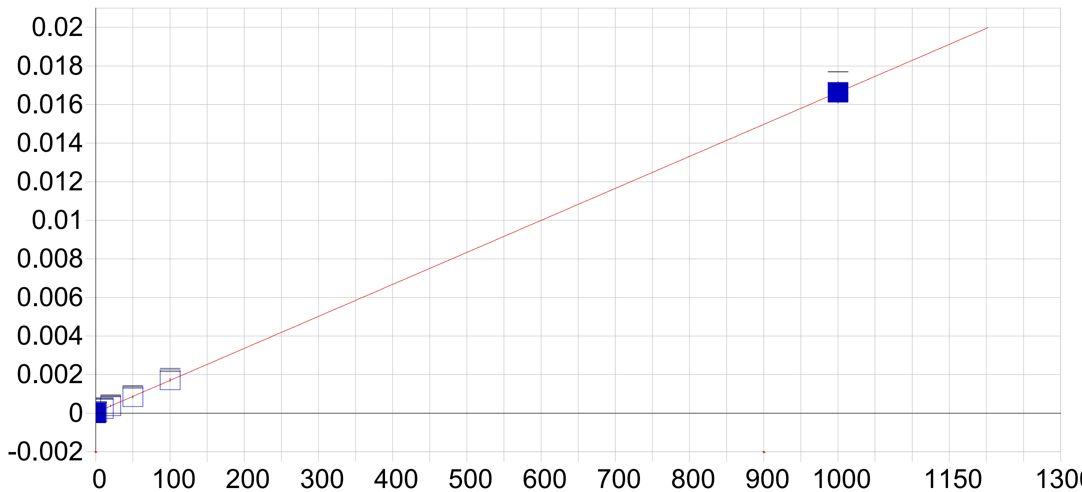



**V 290.882 {116}**

Date of Fit: 06/17/2015 13:02:43 Type of Fit: Linear Weighting: 1/Conc

A0 (Offset): 0.000020 Re-Slope: 1.000000
A1 (Gain): 0.000002 Y-int: 0.000000
A2 (Curvature): 0.000000
n (Exponent): 1.000000
Correlation: 0.999796 Status: OK.
Std Error of Est: 0.000002
Predicted MDL: 2.825016
Predicted MQL: 9.416721

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .01163 | .012 | .000 | .00002 | .000 | 1 |
| CalStd9=100 | 1000.0 | 939.20 | -60.8 | -6.08 | .00220 | .000 | 1 |
| CalStd10=10 | 10000. | 10067. | 67.0 | .670 | .02340 | .001 | 1 |
| CalStd8=100 | 100.00 | 93.777 | -6.22 | -6.22 | .00024 | .000 | 1 |

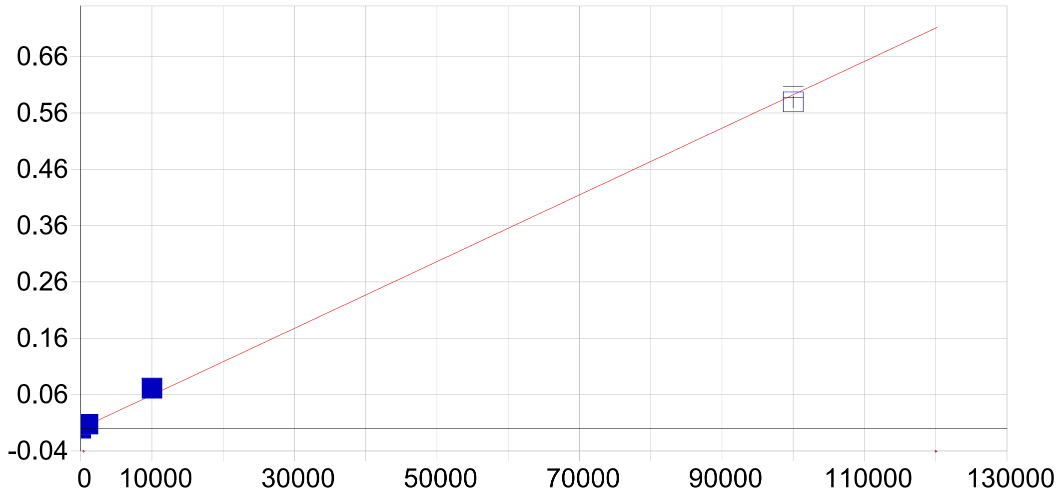



**V 292.402 {115}**

Date o Fit: 06/17/2015 13:02:43    Type o Fit: Linear     eighting: None

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000038 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000017 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999992 | Status: | O . |
| Std Error o Est: | 0.000027 | | |
| Predicted MDL: | 2.612460 | | |
| Predicted MQL: | 8.708200 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -2.0766 | -2.08 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 48.584 | -1.42 | -2.83 | .00084 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.88 | -.120 | -.012 | .01663 | .001 | 1 |
| CalStd6=20 | 20.000 | 20.584 | .584 | 2.92 | .00038 | .000 | 1 |
| CalStd5=10 | 10.000 | 11.839 | 1.84 | 18.4 | .00023 | .000 | 1 |
| CalStd8=100 | 100.00 | 101.61 | 1.61 | 1.61 | .00172 | .000 | 1 |
| CalStd3=1 | 1.0000 | .58219 | -.418 | -41.8 | .00005 | .000 | 1 |

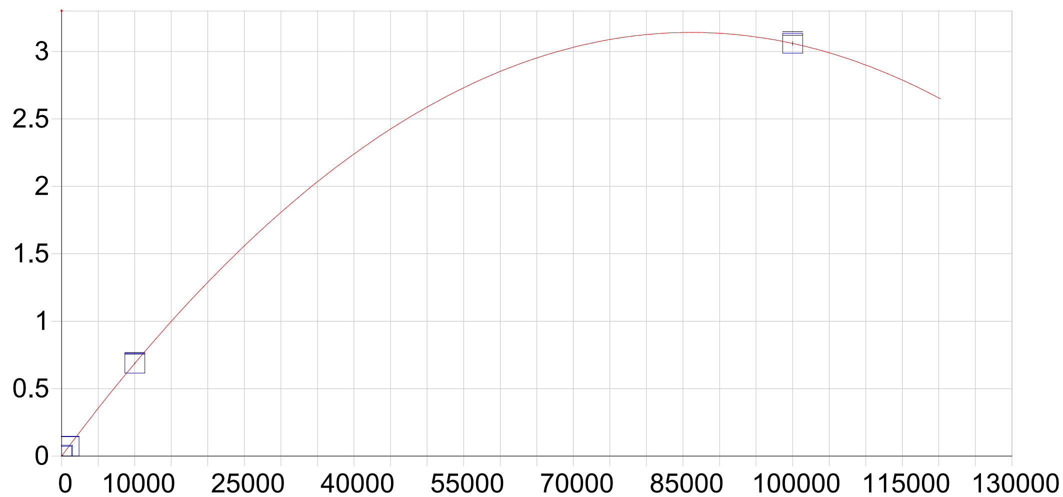



**Zn 206.200 {463}**

Date o Fit: 06/17/2015 13:02:43 Type o Fit: Linear  eighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000000 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000006 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Eponent): | 1.000000 | | |
| Correlation: | 0.997834 | Status: | O . |
| Std Error o Est: | 0.000184 | | |
| Predicted MDL: | 0.274109 | | |
| Predicted MQL: | 0.913695 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| CalStd10=10 | 10000. | 11968. | 1970. | 19.7 | .07088 | .001 | 1 |
| Blank | .00000 | -.39222 | -.392 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1217.3 | 217. | 21.7 | .00721 | .000 | 1 |
| CalStd11-100 | 100000. | 97815. | -2190. | -2.19 | .57932 | .010 | 1 |

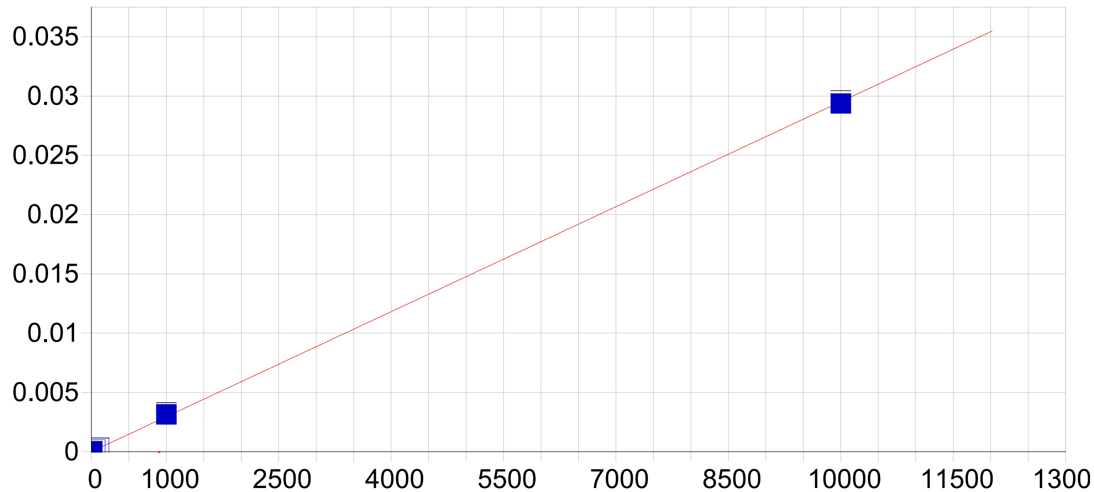



**Zn 213.856 {457}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Curvilinear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000034 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000073 | Y-int: | 0.000000 |
| A2 (Curvature): | -0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999998 | Status: | OK . |
| Std Error of Est: | 0.000012 | | |
| Predicted MDL: | 0.117659 | | |
| Predicted MQL: | 0.392196 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| CalStd10=10 | 10000. | 10009. | 9.30 | .093 | .68787 | .006 | 1 |
| Blank | .00000 | -.00052 | -.001 | .000 | .00003 | .000 | 1 |
| CalStd9=100 | 1000.0 | 991.09 | -8.91 | -.891 | .07193 | .002 | 1 |
| CalStd11-100 | 100000. | 72233. | -27800. | -27.8 | 3.0599 | .013 | 1 |
| CalStd8=100 | 100.00 | 101.32 | 1.32 | 1.32 | .00742 | .000 | 1 |




**Zn 213.856 {458}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000004 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999745 | Status: | O . |
| Std Error o Est: | 0.000002 | | |
| Predicted MDL: | 0.480672 | | |
| Predicted MQL: | 1.602241 | | |

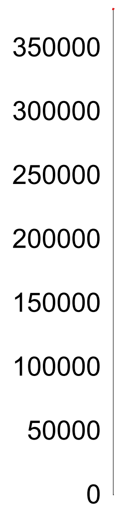
| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.12444 | -.124 | .000 | .00000 | .000 | 1 |
| CalStd8=100 | 100.00 | 109.91 | 9.91 | 9.91 | .00033 | .000 | 1 |
| CalStd7=50 | 50.000 | 54.507 | 4.51 | 9.01 | .00017 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.510 | .510 | 5.10 | .00004 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1062.4 | 62.4 | 6.24 | .00314 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.9328 | -.067 | -1.34 | .00002 | .000 | 1 |
| CalStd10=10 | 10000. | 9942.5 | -57.5 | -.575 | .02936 | .000 | 1 |


**Y 224.306 {450}***

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | | | |
|---|---|---|---|---|---|
| A0 (Offset): | 0.000000 | Re-Slope: | 1.000000 | | |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 | | |
| A2 (Curvature): | 0.000000 | | | | |
| n (Exponent): | 1.000000 | | | | |
| Correlation: | 0.000000 | Status: | Warning | Zero Gain | |
| Std Error of Est: | 0.000000 | | | | |
| Predicted MDL: | n/a | | | | |
| Predicted MQL: | n/a | | | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | 73677. | 905. | 1 |

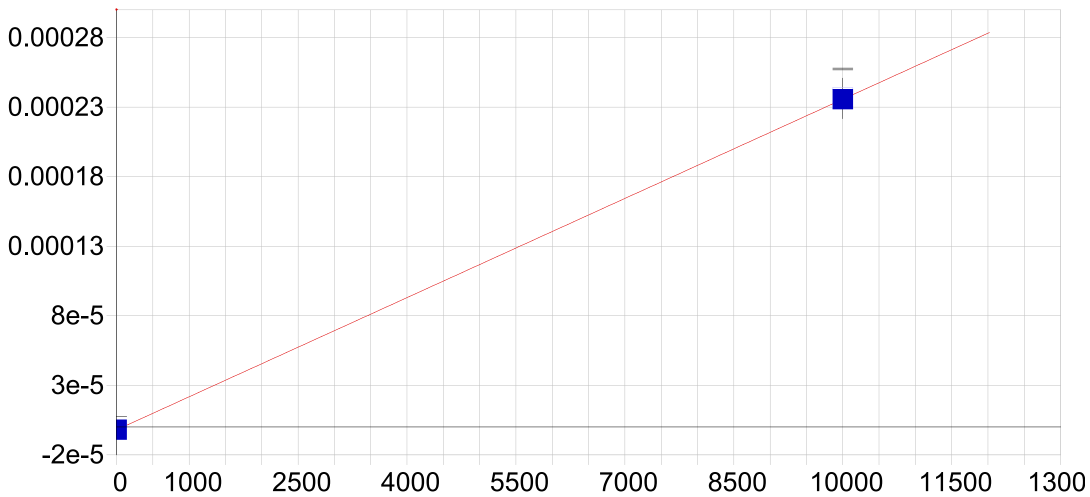



**Y 371.030 { 91}***

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000000 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.000000 | Status: | Warning Zero Gain |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | n/a | | |
| Predicted MQL: | n/a | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | 345250. | 14000. | 1 |

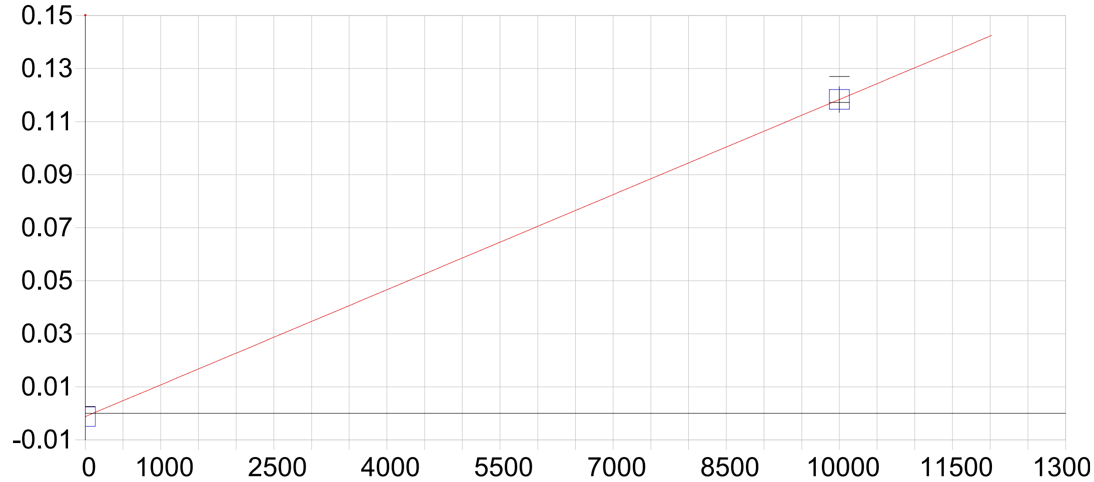



**Na 330.298 {102}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000002 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 508.161272 | | |
| Predicted MQL: | 1693.870908 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00000 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .00024 | .000 | 1 |

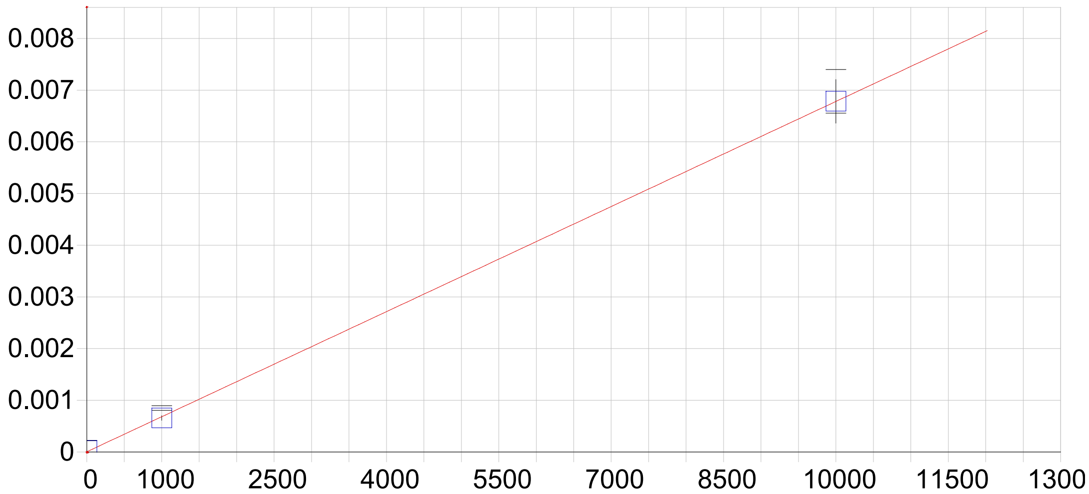



**Na 588.995 { 57}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.001209 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000012 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | OK. |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 3.963492 | | |
| Predicted MQL: | 13.211641 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | -.00121 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .11834 | .005 | 1 |

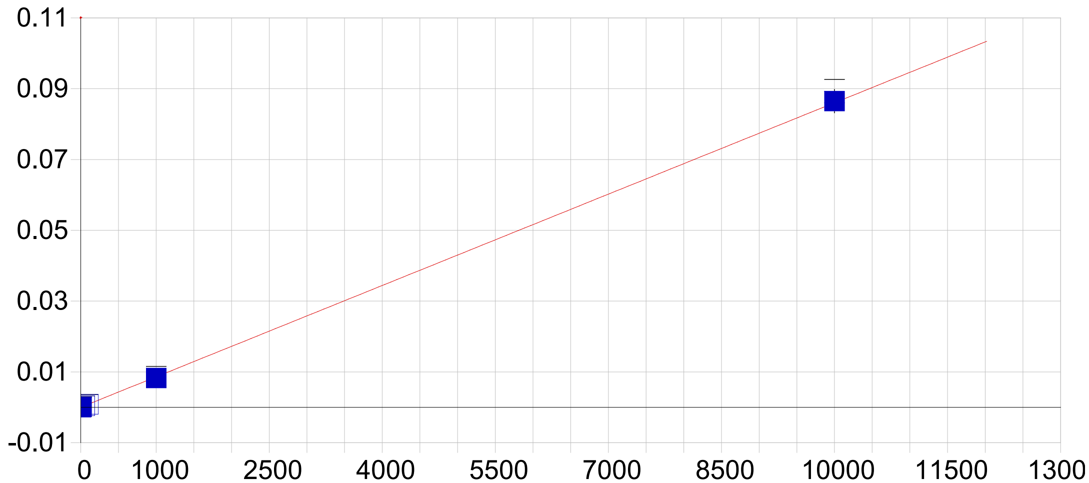



**Si 251.611 {134}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000005 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999979 | Status: | OK . |
| Std Error of Est: | 0.000034 | | |
| Predicted MDL: | 6.540594 | | |
| Predicted MQL: | 21.801981 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 33.733 | 33.7 | .000 | .00003 | .000 | 1 |
| CalStd10=10 | 10000. | 10004. | 3.75 | .037 | .00678 | .000 | 1 |
| CalStd9=100 | 1000.0 | 962.52 | -37.5 | -3.75 | .00066 | .000 | 1 |

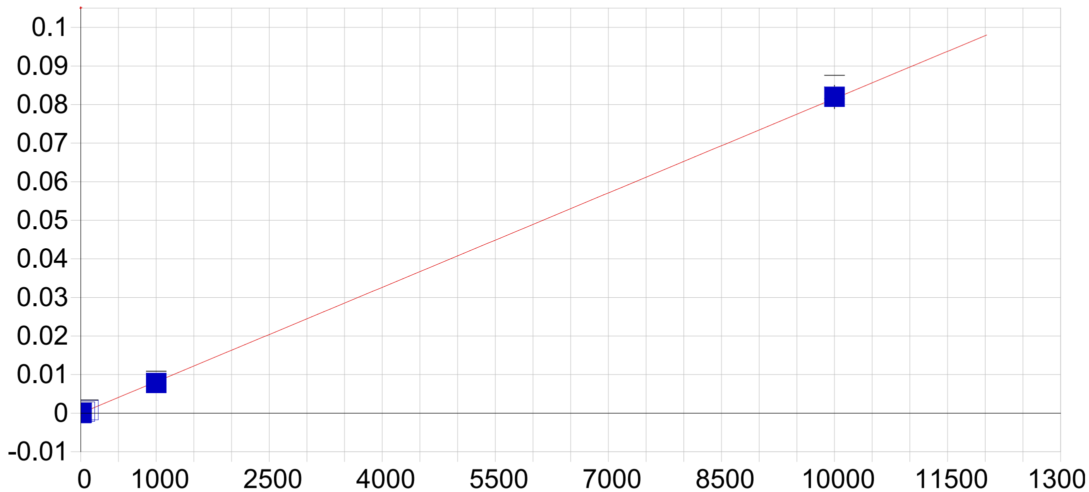



**Ti 334.941 {101}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000001 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000009 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999883 | Status: | OK . |
| Std Error of Est: | 0.000001 | | |
| Predicted MDL: | 0.895862 | | |
| Predicted MQL: | 2.986207 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00065 | .001 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.317 | .317 | 3.17 | .00009 | .000 | 1 |
| CalStd8=100 | 100.00 | 95.629 | -4.37 | -4.37 | .00082 | .000 | 1 |
| CalStd9=100 | 1000.0 | 954.36 | -45.6 | -4.56 | .00821 | .001 | 1 |
| CalStd10=10 | 10000. | 10052. | 51.6 | .516 | .08647 | .003 | 1 |
| CalStd7=50 | 50.000 | 48.328 | -1.67 | -3.34 | .00042 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.7773 | -.223 | -4.45 | .00004 | .000 | 1 |

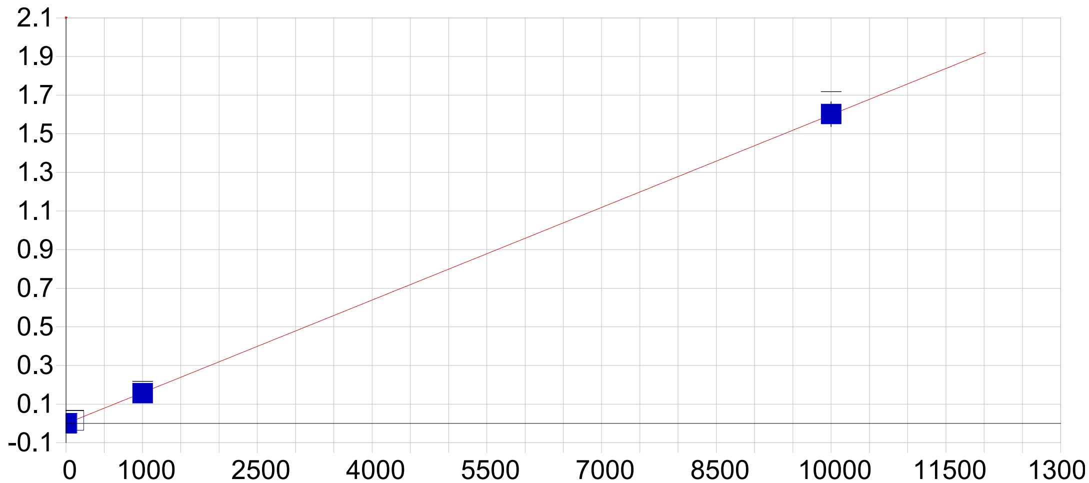



**Ti 337.280 {100}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O set): | -0.000010 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000008 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999884 | Status: | O . |
| Std Error o Est: | 0.000001 | | |
| Predicted MDL: | 1.260177 | | |
| Predicted MQL: | 4.200591 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00055 | -.001 | .000 | -.00001 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.104 | .104 | 1.04 | .00007 | .000 | 1 |
| CalStd8=100 | 100.00 | 96.621 | -3.38 | -3.38 | .00078 | .000 | 1 |
| CalStd9=100 | 1000.0 | 955.80 | -44.2 | -4.42 | .00779 | .001 | 1 |
| CalStd10=10 | 10000. | 10048. | 48.3 | .483 | .08196 | .003 | 1 |
| CalStd7=50 | 50.000 | 48.168 | -1.83 | -3.66 | .00038 | .000 | 1 |
| CalStd4=5 | 5.0000 | 6.0497 | 1.05 | 21.0 | .00004 | .000 | 1 |

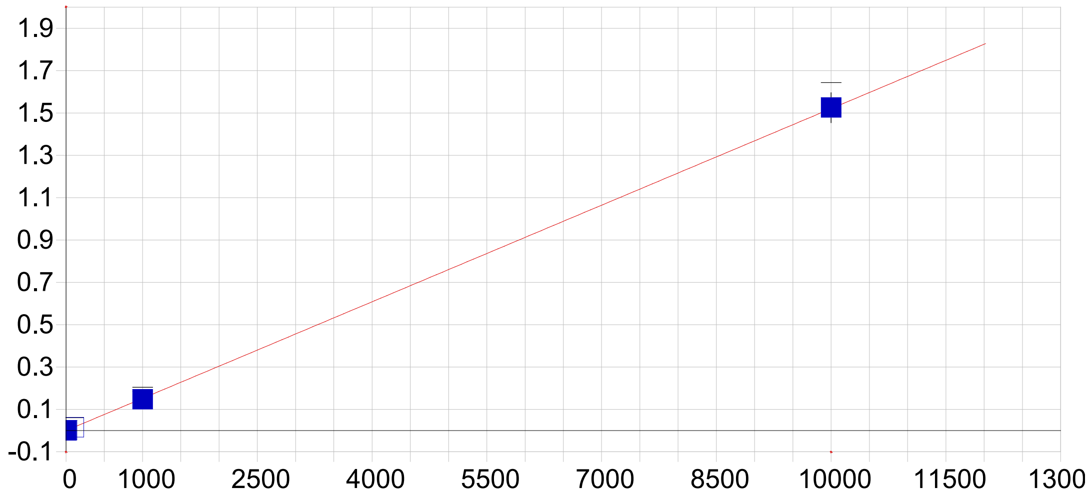



**Sr 407.771 { 83}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000957 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000160 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999975 | Status: | O . |
| Std Error o Est: | 0.000005 | | |
| Predicted MDL: | 0.090000 | | |
| Predicted MQL: | 0.299999 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00003 | .000 | .000 | -.00096 | .000 | 1 |
| CalStd3=1 | 1.0000 | .96016 | -.040 | -3.98 | -.00080 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.1911 | .191 | 3.82 | -.00013 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.550 | .550 | 5.50 | .00073 | .000 | 1 |
| CalStd8=100 | 100.00 | 99.599 | -.401 | -.401 | .01497 | .001 | 1 |
| CalStd9=100 | 1000.0 | 978.11 | -21.9 | -2.19 | .15546 | .010 | 1 |
| CalStd10=10 | 10000. | 10022. | 21.6 | .216 | 1.6017 | .065 | 1 |

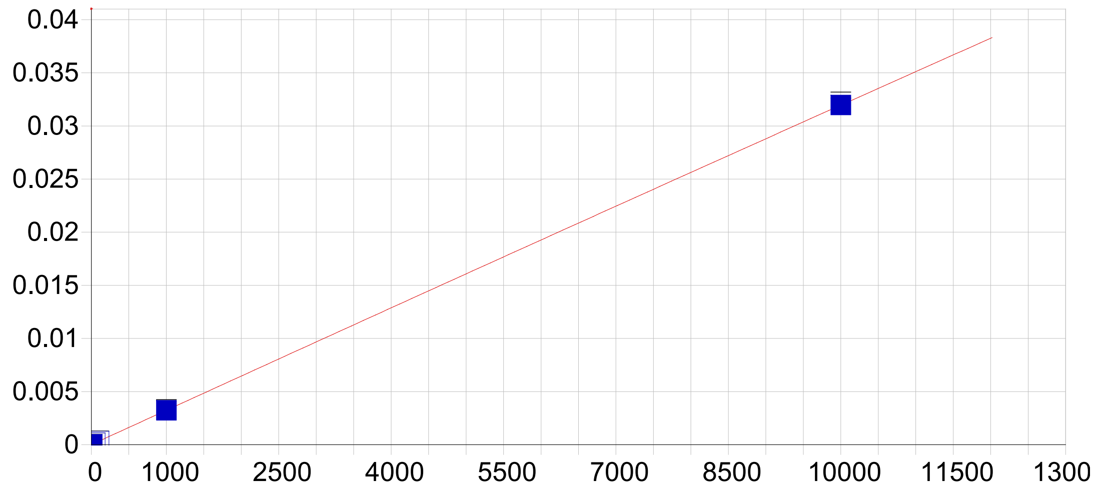



**Sr 421.552 { 80}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O set): | -0.000029 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000152 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999958 | Status: | O . |
| Std Error o Est: | 0.000005 | | |
| Predicted MDL: | 0.091609 | | |
| Predicted MQL: | 0.305363 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00008 | .000 | .000 | -.00003 | .000 | 1 |
| CalStd3=1 | 1.0000 | 1.0591 | .059 | 5.91 | .00013 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.0631 | .063 | 1.26 | .00074 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.444 | .444 | 4.44 | .00156 | .000 | 1 |
| CalStd8=100 | 100.00 | 98.613 | -1.39 | -1.39 | .01497 | .001 | 1 |
| CalStd9=100 | 1000.0 | 971.62 | -28.4 | -2.84 | .14773 | .010 | 1 |
| CalStd10=10 | 10000. | 10029. | 29.2 | .292 | 1.5252 | .071 | 1 |

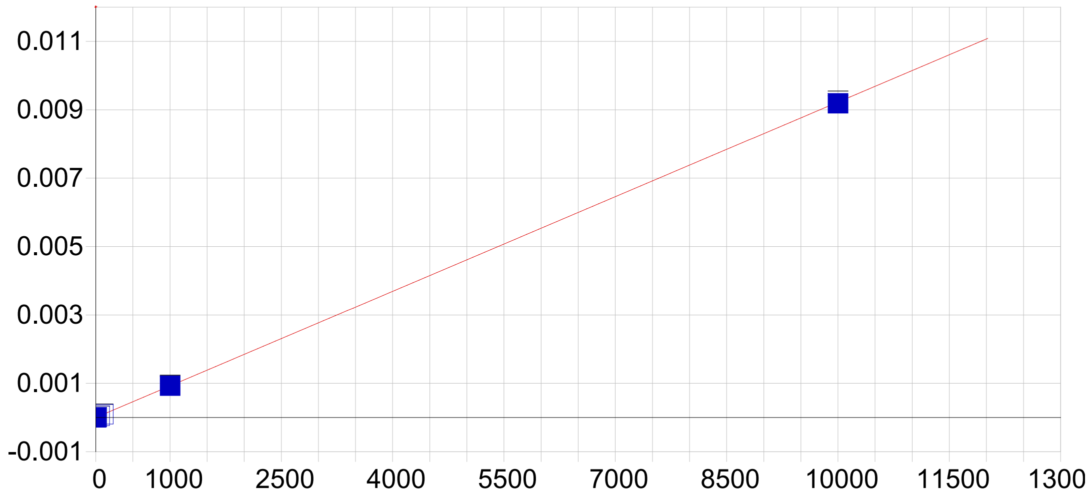



**Sn 189.989 {477}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Curvilinear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000006 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | -0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999993 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 1.250135 | | |
| Predicted MQL: | 4.167116 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00025 | .000 | .000 | .00001 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .409 | .004 | .03196 | .000 | 1 |
| CalStd9=100 | 1000.0 | 995.72 | -4.28 | -.428 | .00322 | .000 | 1 |
| CalStd8=100 | 100.00 | 101.60 | 1.60 | 1.60 | .00033 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.031 | .031 | .313 | .00004 | .000 | 1 |
| CalStd7=50 | 50.000 | 52.282 | 2.28 | 4.56 | .00017 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.9502 | -.050 | -.996 | .00002 | .000 | 1 |

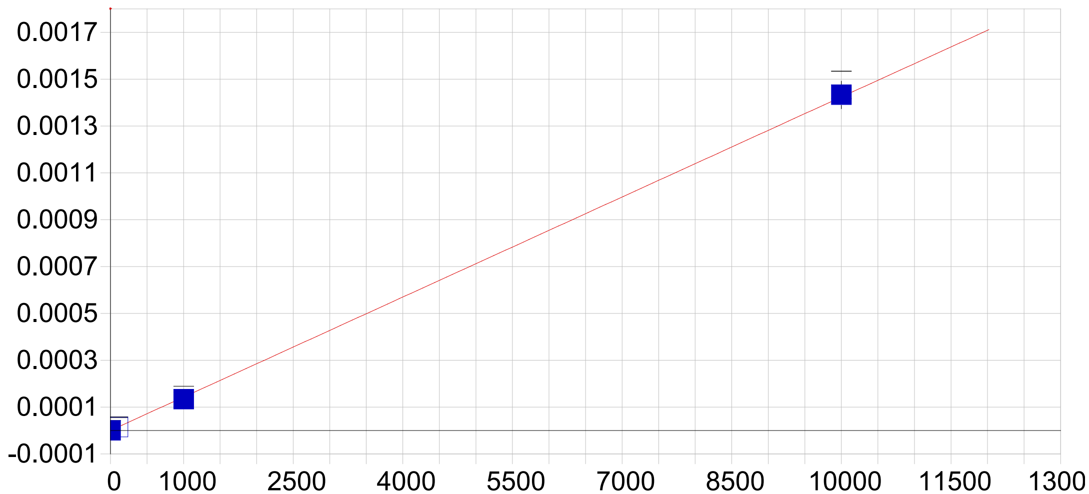



**Sn 189.989 {478}**

Date of Fit: 06/17/2015 13:02:43 Type of Fit: Curvilinear Weighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000001 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999968 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 4.100314 | | |
| Predicted MQL: | 13.667714 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00199 | .002 | .000 | .00000 | .000 | 1 |
| CalStd10=10 | 10000. | 9955.5 | -44.5 | -.445 | .00918 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1001.9 | 1.86 | .186 | .00093 | .000 | 1 |
| CalStd8=100 | 100.00 | 101.91 | 1.91 | 1.91 | .00010 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.5742 | -.426 | -4.26 | .00001 | .000 | 1 |
| CalStd7=50 | 50.000 | 48.144 | -1.86 | -3.71 | .00005 | .000 | 1 |
| CalStd4=5 | 5.0000 | 3.3050 | -1.70 | -33.9 | .00000 | .000 | 1 |

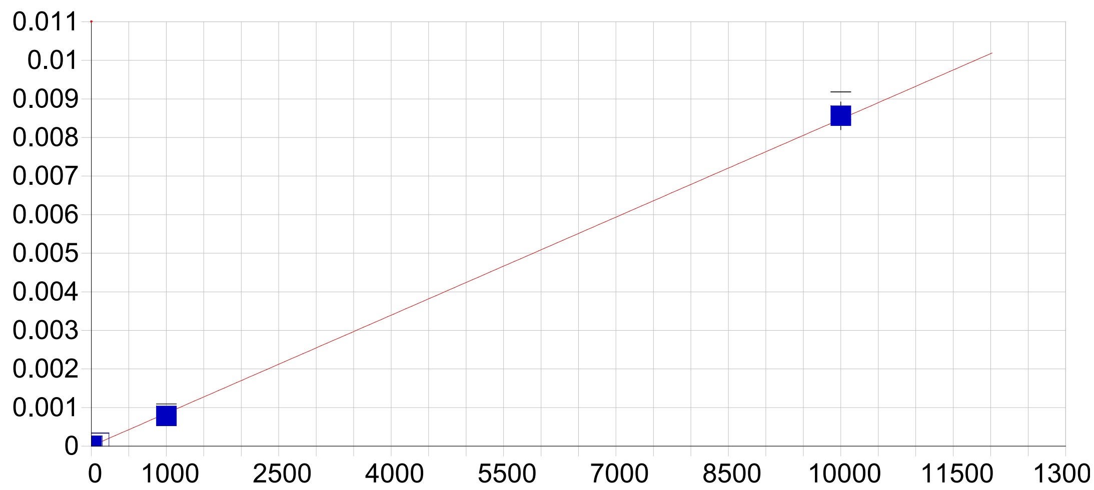



**Sn 283.999 {119}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000000 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999790 | Status: | OK. |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 31.956271 | | |
| Predicted MQL: | 106.520903 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00727 | .007 | .000 | .00000 | .000 | 1 |
| CalStd10=10 | 10000. | 10066. | 66.2 | .662 | .00143 | .000 | 1 |
| CalStd9=100 | 1000.0 | 935.31 | -64.7 | -6.47 | .00013 | .000 | 1 |
| CalStd8=100 | 100.00 | 98.534 | -1.47 | -1.47 | .00001 | .000 | 1 |

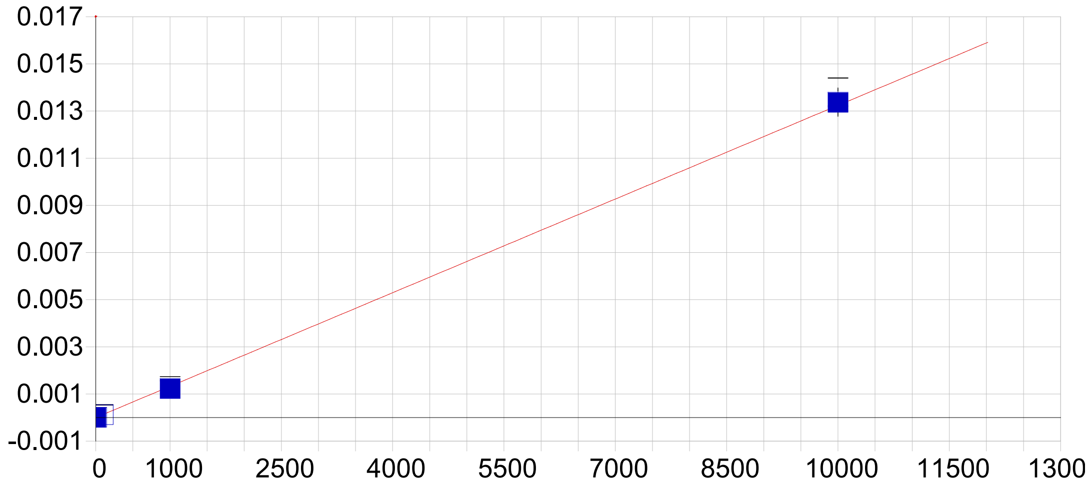



**B 249.678 {135}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000004 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999521 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 5.000896 | | |
| Predicted MQL: | 16.669653 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00575 | .006 | .000 | .00000 | .000 | 1 |
| CalStd8=100 | 100.00 | 91.644 | -8.36 | -8.36 | .00008 | .000 | 1 |
| CalStd5=10 | 10.000 | 5.8416 | -4.16 | -41.6 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 914.80 | -85.2 | -8.52 | .00078 | .000 | 1 |
| CalStd10=10 | 10000. | 10098. | 97.7 | .977 | .00856 | .000 | 1 |

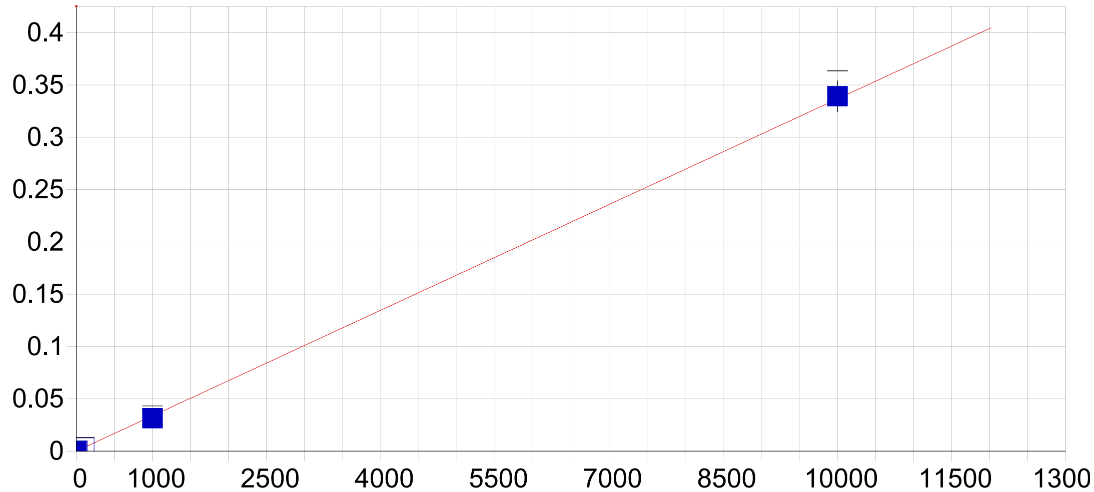



**B 249.773 {135}**

Date o□ Fit: 06/17/2015 13:02:43    Type o□ Fit: Linear    □ eighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (O□□set): | -0.000001 | Re-Slope: | 1.000000 |
| A1 (□ ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E□ ponent): | 1.000000 | | |
| Correlation: | 0.999600 | Status: | O□ . |
| Std Error o□ Est: | 0.000001 | | |
| Predicted MDL: | 3.320012 | | |
| Predicted MQL: | 11.066707 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00428 | .004 | .000 | .00000 | .000 | 1 |
| CalStd8=100 | 100.00 | 87.524 | -12.5 | -12.5 | .00011 | .000 | 1 |
| CalStd5=10 | 10.000 | 7.6443 | -2.36 | -23.6 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 922.68 | -77.3 | -7.73 | .00122 | .000 | 1 |
| CalStd10=10 | 10000. | 10092. | 92.1 | .921 | .01339 | .001 | 1 |

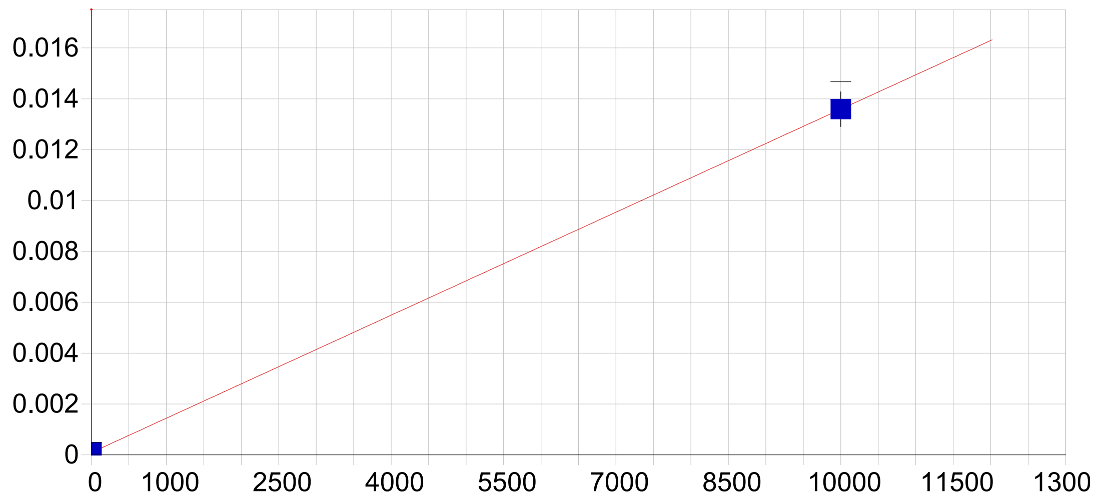



**Li 670.784 { 50}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000067 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000034 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999744 | Status: | O . |
| Std Error o Est: | 0.000010 | | |
| Predicted MDL: | 0.963748 | | |
| Predicted MQL: | 3.212493 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00156 | .002 | .000 | .00007 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.6612 | -.339 | -3.39 | .00039 | .000 | 1 |
| CalStd8=100 | 100.00 | 93.973 | -6.03 | -6.03 | .00323 | .000 | 1 |
| CalStd9=100 | 1000.0 | 931.09 | -68.9 | -6.89 | .03141 | .002 | 1 |
| CalStd10=10 | 10000. | 10075. | 75.3 | .753 | .33921 | .015 | 1 |

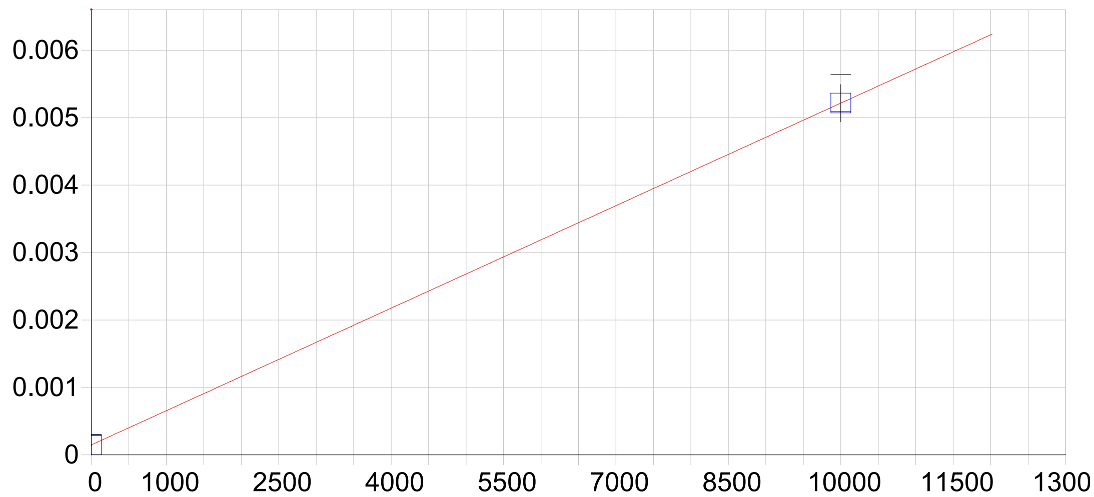



**K 766.490 { 44}**

Date of Fit: 06/17/2015 13:02:43 Type of Fit: Linear Weighting: 1/Conc

A0 (Offset): 0.000090 Re-Slope: 1.000000
A1 (Gain): 0.000001 Y-int: 0.000000
A2 (Curvature): 0.000000
n (Exponent): 1.000000
Correlation: 1.000000 Status: OK .
Std Error of Est: 0.000000
Predicted MDL: 19.097745
Predicted MQL: 63.659150

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00009 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .01359 | .001 | 1 |

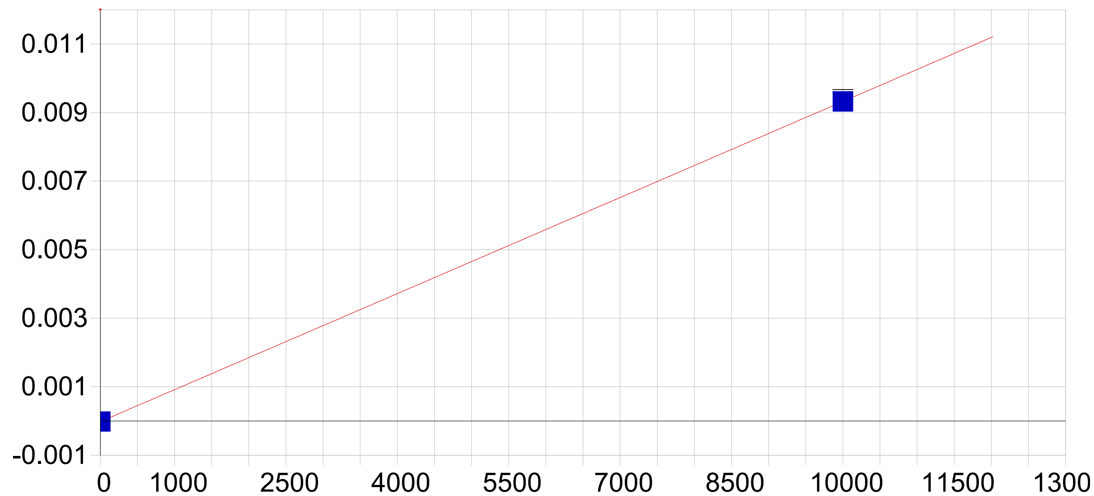



**K 769.896 { 44}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000148 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 45.361524 | | |
| Predicted MQL: | 151.205079 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00015 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .00522 | .000 | 1 |

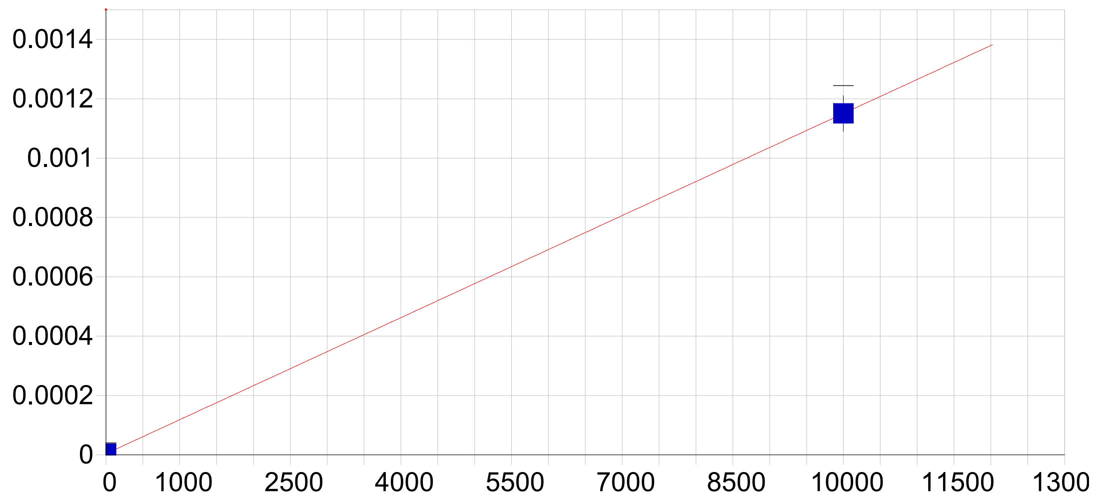



**P 177.495 {489}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000020 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 4.080704 | | |
| Predicted MQL: | 13.602345 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | -.00002 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .00933 | .000 | 1 |

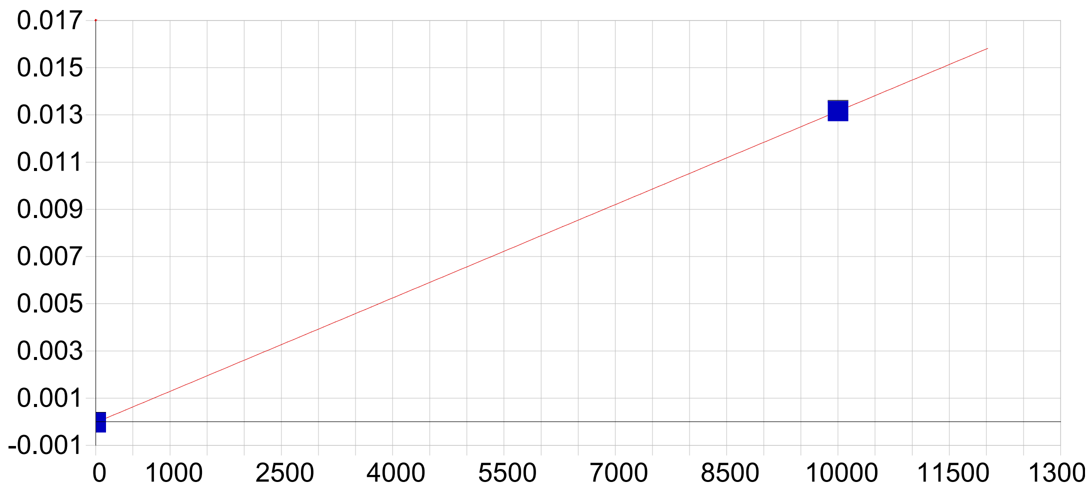



**P 213.618 {158}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/17/2015 13:02:43 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000004 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 101.823120 | | |
| Predicted MQL: | 339.410401 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00000 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .00115 | .000 | 1 |

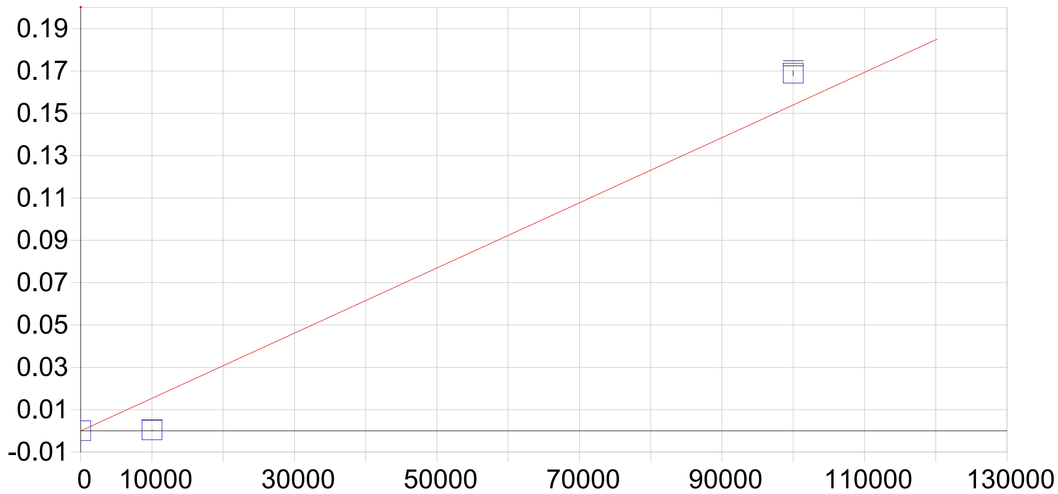



**P 213.618 {457}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000032 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 5.454151 | | |
| Predicted MQL: | 18.180502 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | -.00003 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .01316 | .000 | 1 |

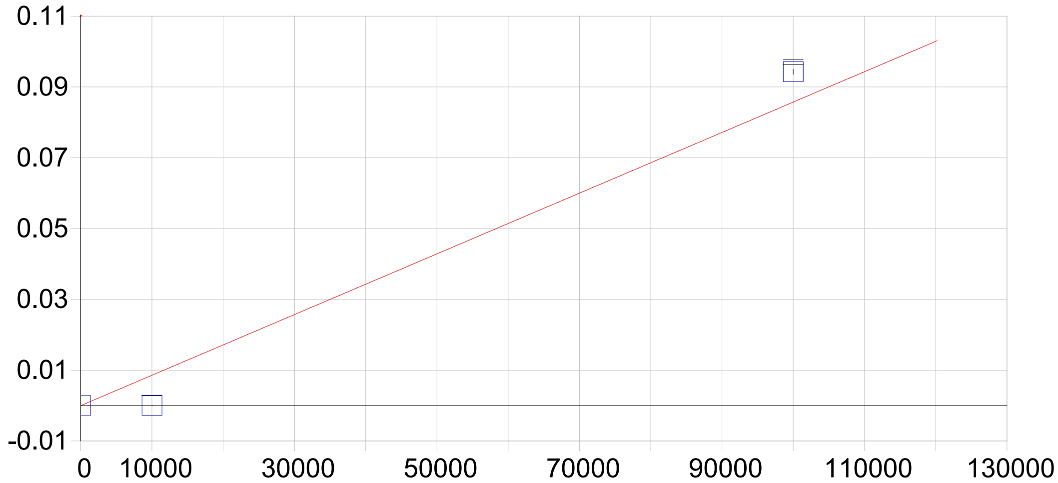



**S 180.731 {486}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000026 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000002 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.955789 | Status: | OK . |
| Std Error of Est: | 0.000860 | | |
| Predicted MDL: | 3.170962 | | |
| Predicted MQL: | 10.569872 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 8.7512 | 8.75 | .000 | -.00001 | .000 | 1 |
| CalStd12-100 | 100000. | 109720. | 9720. | 9.72 | .16888 | .001 | 1 |
| CalStd10=10 | 10000. | 276.41 | -9720. | -97.2 | .00040 | .000 | 1 |

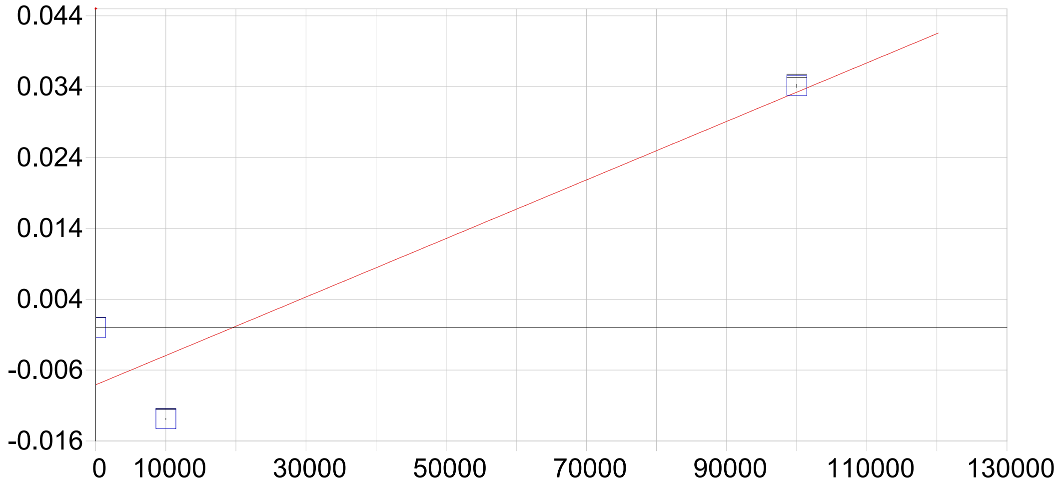



**S 182.034 {485}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000011 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.953638 | Status: | OK . |
| Std Error of Est: | 0.000491 | | |
| Predicted MDL: | 5.400133 | | |
| Predicted MQL: | 18.000444 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 8.9768 | 8.98 | .000 | .00000 | .000 | 1 |
| CalStd12-100 | 100000. | 109970. | 9970. | 9.97 | .09428 | .001 | 1 |
| CalStd10=10 | 10000. | 25.770 | -9970. | -99.7 | .00001 | .000 | 1 |

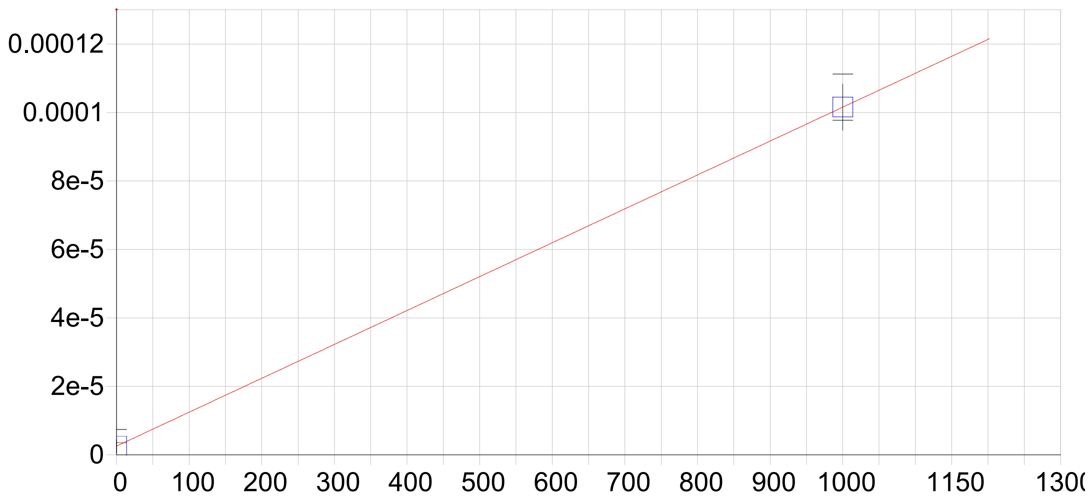



**S 182.624 {484}**

Date of Fit: 06/17/2015 13:02:43 Type of Fit: Linear Weighting: None

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.008069 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.936025 | Status: | OK . |
| Std Error of Est: | 0.012096 | | |
| Predicted MDL: | 11.657839 | | |
| Predicted MQL: | 38.859464 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 19537. | 19500. | .000 | .00000 | .000 | 1 |
| CalStd12-100 | 100000. | 102170. | 2170. | 2.17 | .03413 | .000 | 1 |
| CalStd10=10 | 10000. | -11708. | -21700. | -217. | -.01290 | .000 | 1 |

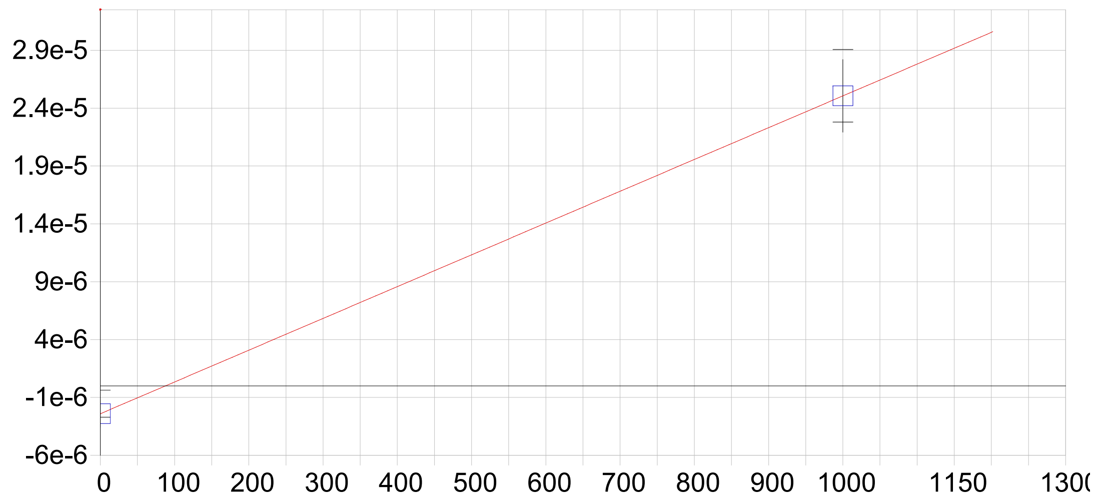



**W 239.709 {140}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/17/2015 13:02:43 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000003 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 34.502259 | | |
| Predicted MQL: | 115.007531 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1000.0 | .000 | .000 | .00010 | .000 | 1 |




**W 245.148 {137}**

Date of Fit: 06/17/2015 13:02:43 Type of Fit: Linear Weighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000002 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | OK. |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 136.640754 | | |
| Predicted MQL: | 455.469179 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1000.0 | .000 | .000 | .00003 | .000 | 1 |

Sample Name: Blank Acquired: 06/16/2015 13:50:53 Type: Cal
Method: DOD Calibration Updated 060614(v643) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al3961 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Be2348 | Ca3158 | Ca3933 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.001** | **.000** | **.000** | **.000** | **.000** | **20.3** | **-.004** | **.000** | **.000** | **.000** | **.005** |
| Stddev | .000 | .000 | .00 | .000 | .000 | .00 | 6.0 | .000 | .000 | .000 | .000 | .001 |
| %RSD | 323. | 2.50 | 53.8 | 172. | 273. | 7370. | 29.8 | 5.78 | 262. | 93.1 | 5.91 | 18.0 |

| Elem | Cd2265 | Cd2288 | Co2286 | Co2388 | Cr2677 | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Fe2599 | Mg2025 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .00 | .00 | .00 | .000 | .00 | .000 | .000 | .000 | .000 | .00 |
| %RSD | 84.2 | 13.0 | 42.0 | 101. | 340. | 63.6 | 36.1 | 3.03 | 38.5 | 115. | 19.3 | 13.4 |

| Elem | Mg2802 | Mn2576 | Mn2593 | Mo2020 | Mo2045 | Ni2316 | Ni2316 | Pb2169 | Pb2203 | Sb2068 | Sb2175 | Se1960 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .00 | .00 |
| %RSD | 9.98 | 238. | 118. | 58.7 | 95.4 | 39.0 | 75.9 | 27.2 | 353. | 359. | 430. | 344. |

| Elem | Se2062 | Tl1908 | Tl2767 | V_2908 | V_2924 | Zn2062 | Zn2138 |
|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .00 | .000 | .000 | .000 | .000 | .00 | .000 |
| %RSD | 111. | 78.3 | 134. | 19.9 | 1060. | 15.4 | 42.7 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **73677.** | **345250.** |
| Stddev | 905. | 14029. |
| %RSD | 1.2288 | 4.0634 |

Sample Name: CalStd1=0.25 Acquired: 06/16/2015 13:55:17 Type: Cal
Method: DOD Calibration Updated 060614(v643) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Be3130 |
|---|---|
| Units | Cts/S |
| Avg | **.000** |
| Stddev | .000 |
| %RSD | 30.7 |

| Int. Std. | Y_2243 |
|---|---|
| Units | Cts/S |
| Avg | **73868.** |
| Stddev | 113. |
| %RSD | .15256 |

Sample Name: CalStd2=0.5 Acquired: 06/16/2015 13:59:41 Type: Cal
Method: DOD Calibration Updated 060614(v643) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ba4554 | Be3130 | Cd2265 | Cd2288 |
|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **44.3** | **.000** | **.000** | **.000** |
| Stddev | 2.4 | .000 | .000 | .000 |
| %RSD | 5.49 | 4.98 | 21.8 | 5.33 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **73286.** | **343400.** |
| Stddev | 354. | 13572. |
| %RSD | .48328 | 3.9522 |

Sample Name: CalStd3=1 Acquired: 06/16/2015 14:04:03 Type: Cal
Method: DOD Calibration Updated 060614(v643) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Ba4554 | Be3130 | Cd2265 | Cd2288 | Co2286 | Cr2677 | Cu2247 | Ni2316 | V_2924 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **64.4** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | 4.3 | .000 | .000 | .000 | .000 | .00 | .00 | .000 | .000 |
| %RSD | 53.1 | 6.71 | 12.0 | 12.1 | 6.22 | 6.68 | 607. | 35.6 | 14.1 | 77.8 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **73883.** | **343110.** |
| Stddev | 235. | 12501. |
| %RSD | .31847 | 3.6434 |

Sample Name: CalStd4=5 Acquired: 06/16/2015 14:08:26 Type: Cal
Method: DOD Calibration Updated 060614(v643) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Mn2576 | Ni2316 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **245.** | **-.002** | **.001** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .00 | 10. | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 22.9 | 98.3 | 106. | 4.13 | 22.3 | 3.49 | 6.77 | 7.25 | 23.1 | 31.9 | 11.0 | 3.77 |

| Elem | Pb2169 | Pb2203 | Sb2175 | Zn2138 |
|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 |
| %RSD | 15.3 | 39.1 | 51.2 | 4.18 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **73902.** | **345860.** |
| Stddev | 156. | 11269. |
| %RSD | .21103 | 3.2582 |

Sample Name: CalStd5=10    Acquired: 06/16/2015 14:12:48    Type: Cal
Method: DOD Calibration Updated 060614(v643)    Mode: IR    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Cd2265 | Cd2288 | Co2286 | Cr2677 | Cu2247 | Mn2576 | Mo2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **498.** | **.002** | **.000** | **.001** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | 14. | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 14.9 | 10.3 | 38.9 | 2.88 | 2.85 | 5.93 | 1.45 | 6.45 | 13.8 | 7.03 | 7.05 | .326 |

| Elem | Ni2316 | Pb2169 | Pb2203 | Sb2068 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 6.74 | .775 | 17.8 | 16.5 | 6.32 | 49.8 | 15.7 | 14.8 | 8.98 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **73784.** | **349750.** |
| Stddev | 396. | 16803. |
| %RSD | .53687 | 4.8043 |

Sample Name: CalStd6=20 Acquired: 06/16/2015 14:17:10 Type: Cal
Method: DOD Calibration Updated 060614(v643) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ba4554 | Cr2677 | Cu2247 | Fe2599 | Mn2576 | Mo2020 | Sb2175 | V_2924 |
|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **927.** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | 43. | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 4.60 | 13.6 | 5.71 | 4.54 | 7.14 | 4.07 | 5.56 | 11.6 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **73965.** | **341920.** |
| Stddev | 271. | 11673. |
| %RSD | .36696 | 3.4138 |

Sample Name: CalStd7=50 Acquired: 06/16/2015 14:21:28 Type: Cal
Method: DOD Calibration Updated 060614(v643) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Al1670 | As1937 | Ba4554 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cr2835 | Cu2247 | Fe2599 | Mg2802 | Mn2576 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **2230.** | **.075** | **.001** | **.000** | **.000** | **.000** | **.000** | **.000** | **.001** | **.001** |
| Stddev | .000 | .000 | 78. | .003 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 8.35 | 10.8 | 3.51 | 3.39 | 5.88 | 5.50 | 3.55 | 5.51 | 5.51 | 14.6 | 6.93 | 3.41 |

| Elem | Mo2020 | Mo2045 | Ni2316 | Sb2068 | Se1960 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.001** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 1.99 | 4.74 | 5.72 | 8.99 | 15.7 | 7.14 | 5.00 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **74087.** | **346410.** |
| Stddev | 365. | 12186. |
| %RSD | .49325 | 3.5180 |

Sample Name: CalStd8=100 Acquired: 06/16/2015 14:25:47 Type: Cal
Method: DOD Calibration Updated 060614(v643) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Be2348 | Ca3933 | Cd2265 | Cd2288 | Co2286 | Co2388 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.001** | **.000** | **.000** | **4410.** | **.047** | **.023** | **.000** | **.138** | **.001** | **.011** | **.001** | **.000** |
| Stddev | .000 | .000 | .000 | 172. | .002 | .001 | .000 | .005 | .000 | .000 | .000 | .000 |
| %RSD | 7.13 | 2.76 | 12.2 | 3.90 | 4.40 | 4.46 | 7.11 | 3.68 | 5.62 | 2.26 | 5.82 | 8.79 |

| Elem | Cr2677 | Cr2835 | Cu2247 | Cu3247 | Fe2599 | Mg2802 | Mn2576 | Mo2020 | Mo2045 | Ni2316 | Ni2316 | Pb2169 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.001** | **.000** | **.002** | **.002** | **.001** | **.000** | **.000** | **.001** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 6.69 | 6.41 | 5.69 | 5.87 | 8.41 | 6.79 | 4.47 | 2.90 | 4.59 | 17.9 | 6.03 | 4.63 |

| Elem | Pb2203 | Sb2175 | Se1960 | Se2062 | Tl1908 | Tl2767 | V_2908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.002** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 4.77 | 5.77 | 5.35 | 34.5 | 5.83 | 31.7 | 8.50 | 4.87 | 5.58 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **74043.** | **344320.** |
| Stddev | 306. | 13799. |
| %RSD | .41375 | 4.0076 |

Sample Name: CalStd9=1000 Acquired: 06/16/2015 14:30:00 Type: Cal
Method: DOD Calibration Updated 060614(v643) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Al3092 | Al3961 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Be2348 | Ca3158 | Ca3933 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.004** | **.009** | **.000** | **.000** | **.000** | **43400.** | **.495** | **.227** | **.003** | **.004** | **1.21** |
| Stddev | .000 | .000 | .000 | .000 | .000 | 1870. | .021 | .009 | .000 | .000 | .05 |
| %RSD | 2.20 | 3.87 | 4.82 | 4.30 | 5.42 | 4.30 | 4.15 | 3.97 | 6.26 | 4.35 | 4.35 |

| Elem | Cd2265 | Cd2288 | Co2286 | Co2388 | Cr2677 | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Fe2599 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.010** | **.102** | **.010** | **.001** | **.002** | **.002** | **.003** | **.003** | **.000** | **.000** | **.001** |
| Stddev | .001 | .002 | .001 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 4.92 | 2.05 | 5.17 | 6.00 | 6.19 | 6.12 | 5.12 | 6.56 | 5.64 | 6.41 | 6.27 |

| Elem | Mg2025 | Mg2802 | Mn2576 | Mn2593 | Mo2020 | Mo2045 | Ni2316 | Ni2316 | Pb2169 | Pb2203 | Sb2068 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.020** | **.023** | **.046** | **.007** | **.001** | **.000** | **.008** | **.001** | **.001** | **.001** |
| Stddev | .000 | .001 | .001 | .002 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 4.68 | 6.34 | 3.71 | 3.87 | 2.54 | 5.02 | 8.31 | 5.20 | 4.83 | 4.82 | 4.61 |

| Elem | Sb2175 | Se1960 | Se2062 | Tl1908 | Tl2767 | V_2908 | V_2924 | Zn2062 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.001** | **.000** | **.000** | **.001** | **.000** | **.002** | **.017** | **.007** | **.003** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .001 | .000 | .000 |
| %RSD | 4.47 | 4.83 | 2.73 | 4.00 | 5.33 | 6.22 | 3.32 | 5.06 | 4.77 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **74217.** | **344700.** |
| Stddev | 73. | 10455. |
| %RSD | .09789 | 3.0331 |

Sample Name: CalStd10=10000 Acquired: 06/16/2015 14:33:51 Type: Cal
Method: DOD Calibration Updated 060614(v643) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Al3092 | Al3961 | As1890 | Ba4934 | Ca3158 | Co2388 | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Fe2599 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.036** | **.101** | **.000** | **5.23** | **.041** | **.008** | **.024** | **.027** | **.030** | **.001** | **.003** | **.014** |
| Stddev | .002 | .005 | .000 | .30 | .002 | .000 | .001 | .000 | .001 | .000 | .000 | .001 |
| %RSD | 4.56 | 4.69 | 1.25 | 5.68 | 5.58 | 4.43 | 3.91 | .757 | 4.31 | 4.09 | 3.91 | 3.96 |

| Elem | Mg2025 | Mg2802 | Mn2576 | Mn2593 | Mo2045 | Ni2316 | Ni2316 | Pb2169 | Sb2068 | Se1960 | Se2062 | Tl2767 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.004** | **.201** | **.243** | **.489** | **.010** | **.001** | **.077** | **.006** | **.005** | **.002** | **.004** | **.003** |
| Stddev | .000 | .008 | .012 | .025 | .000 | .000 | .001 | .000 | .000 | .000 | .000 | .000 |
| %RSD | .939 | 4.21 | 4.93 | 5.15 | .721 | 4.26 | .713 | .972 | .944 | .892 | .503 | 5.46 |

| Elem | V_2908 | Zn2062 | Zn2138 |
|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S |
| Avg | **.023** | **.071** | **.029** |
| Stddev | .001 | .001 | .000 |
| %RSD | 3.96 | .729 | .862 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **71050.** | **335480.** |
| Stddev | 105. | 4236. |
| %RSD | .14832 | 1.2628 |

Sample Name: CalStd11-100k Acquired: 06/16/2015 14:38:16 Type: Cal
Method: DOD Calibration Updated 060614(v643) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Cr2835 | Cu3247 | Mn2593 | Pb2169 | Zn2062 |
|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.230** | **.294** | **4.51** | **.058** | **.579** |
| Stddev | .006 | .007 | .22 | .001 | .010 |
| %RSD | 2.46 | 2.48 | 4.95 | 1.77 | 1.76 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **71561.** | **336900.** |
| Stddev | 213. | 5970. |
| %RSD | .29734 | 1.7719 |

Sample Name: CalStd12-100000 Acquired: 06/16/2015 14:42:37 Type: Cal
Method: DOD Calibration Updated 060614(v643) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Al3092 | Al3961 | Ca3158 | Fe2343 | Fe2395 | Mg2025 |
|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.353** | **.999** | **.404** | **.011** | **.029** | **.031** |
| Stddev | .014 | .042 | .017 | .001 | .002 | .001 |
| %RSD | 3.99 | 4.24 | 4.23 | 6.25 | 6.21 | 3.94 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **69731.** | **329320.** |
| Stddev | 285. | 10708. |
| %RSD | .40835 | 3.2516 |

Sample Name: CalStd13=500000 Acquired: 06/16/2015 14:47:28 Type: Cal
Method: DOD Calibration Updated 060614(v643) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Al3961 | Ca3158 | Fe2343 | Mg2025 |
|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **5.01** | **2.03** | **.050** | **.124** |
| Stddev | .38 | .10 | .003 | .002 |
| %RSD | 7.66 | 4.96 | 5.57 | 1.85 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **63599.** | **323490.** |
| Stddev | 212. | 4749. |
| %RSD | .33318 | 1.4679 |

Sample Name: CalStd14-1000k    Acquired: 06/16/2015 14:52:10    Type: Cal
Method: DOD Calibration Updated 060614(v643)    Mode: IR    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | Al3961 | Ca3158 | Fe2343 | Mg2025 |
|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **10.1** | **3.81** | **.090** | **.209** |
| Stddev | .4 | .11 | .003 | .001 |
| %RSD | 4.05 | 2.85 | 3.76 | .492 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **59217.** | **316540.** |
| Stddev | 195. | 1594. |
| %RSD | .32989 | .50355 |

Sample Name: icv    Acquired: 06/16/2015 15:01:31    Type: QC
Method: DOD Calibration Updated 060614(v643)    Mode: CONC    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al3961 | As1890 | Ba4934 | Be3130 | Ca3158 | Cd2265 | Co2286 | Co2388 | Cr2677 | Cu2247 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **50.6** | **11900.** | **12000.** | **2080.** | **2080.** | **51.6** | **9620.** | **50.5** | **502.** | **493.** | **207.** | **259.** |
| Stddev | 5.5 | 463. | 435. | 64. | 91. | 2.1 | 411. | 1.4 | 13. | 24. | 10. | 7. |
| %RSD | 10.9 | 3.89 | 3.64 | 3.07 | 4.36 | 4.16 | 4.27 | 2.74 | 2.63 | 4.83 | 5.06 | 2.64 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Fe2343 | Fe2395 | Mg2025 | Mn2576 | Mn2593 | Mo2020 | Mo2045 | Ni2316 | Ni2316 | Pb2169 | Pb2203 | Sb2068 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **5120.** | **5080.** | **9440.** | **493.** | **517.** | **502.** | **504.** | **497.** | **523.** | **521.** | **510.** | **506.** |
| Stddev | 208. | 214. | 264. | 19. | 21. | 9. | 13. | 26. | 14. | 13. | 13. | 11. |
| %RSD | 4.06 | 4.21 | 2.80 | 3.93 | 3.99 | 1.75 | 2.65 | 5.24 | 2.73 | 2.56 | 2.46 | 2.12 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Sb2175 | Se1960 | Se2062 | Tl2767 | V_2908 | V_2924 | Zn2062 | Zn2138 |
|---|---|---|---|---|---|---|---|---|
| Avg | **502.** | **2060.** | **2060.** | **1910.** | **492.** | **527.** | **625.** | **551.** |
| Stddev | 13. | 39. | 32. | 87. | 21. | 23. | 18. | 15. |
| %RSD | 2.50 | 1.87 | 1.55 | 4.56 | 4.25 | 4.38 | 2.87 | 2.71 |
| Check ? | None | None | None | None | None | None | None | None |
| Value | | | | | | | | |
| Range | | | | | | | | |

Sample Name: icv Acquired: 06/16/2015 15:01:31 Type: QC
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **73132.** | **341870.** |
| Stddev | 108. | 3813. |
| %RSD | .14740 | 1.1155 |

Sample Name: ICVLL Acquired: 06/16/2015 15:05:44 Type: QC
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3158 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **67.6** | **1160.** | **1190.** | **65.8** | **32.1** | **13.4** | **1440.** | **1630.** | **14.7** | **30.5** | **31.4** | **30.8** |
| Stddev | 3.6 | 28. | 60. | 7.3 | .9 | .3 | 47. | 47. | .7 | 1.5 | 2.8 | 1.5 |
| %RSD | 5.28 | 2.41 | 5.04 | 11.1 | 2.67 | 2.44 | 3.27 | 2.86 | 4.97 | 4.77 | 9.01 | 4.85 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Fe2343 | Fe2395 | Fe2599 | Mg2802 | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **935.** | **938.** | **932.** | **1530.** | **31.0** | **32.5** | **31.5** | **29.0** | **62.2** | **68.4** | **55.4** | **31.0** |
| Stddev | 48. | 65. | 52. | 91. | 1.3 | .4 | 1.8 | 1.3 | 1.8 | 3.1 | 1.9 | 2.2 |
| %RSD | 5.16 | 6.94 | 5.61 | 5.95 | 4.32 | 1.36 | 5.61 | 4.31 | 2.91 | 4.59 | 3.34 | 6.97 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Zn2138 |
|---|---|
| Avg | **33.8** |
| Stddev | 1.6 |
| %RSD | 4.75 |
| Check ? | Chk Pass |
| Value | |
| Range | |

Sample Name: ICVLL Acquired: 06/16/2015 15:05:44 Type: QC
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **73633.** | **346110.** |
| Stddev | 201. | 12056. |
| %RSD | .27246 | 3.4834 |

Sample Name: icb      Acquired: 06/16/2015 15:14:19      Type: QC
Method: DOD Calibration Updated 060614(v643)      Mode: CONC      Corr. Factor: 1.000000
User: NAH      ICAP6500:      Prep Batch:      Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **-1.11** | **1.16** | **2.53** | **-.553** | **-.055** | **-5.46** | **-.980** | **.024** | **-1.73** | **-.267** | **6.77** | **1.01** |
| Stddev | 3.12 | 1.92 | 6.67 | .094 | .064 | .61 | .022 | .048 | 1.60 | .240 | 1.81 | .11 |
| %RSD | 282. | 165. | 264. | 16.9 | 117. | 11.2 | 2.27 | 204. | 92.4 | 90.0 | 26.8 | 10.8 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Avg | **.097** | **-.439** | **.344** | **.101** | **-1.49** | **-5.92** | **-.912** | **-1.13** | **-.198** |
| Stddev | .286 | .480 | .239 | .943 | 2.26 | 7.58 | 2.07 | 3.25 | .220 |
| %RSD | 295. | 109. | 69.5 | 933. | 151. | 128. | 227. | 288. | 111. |
| Check ? | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | |
| Range | | | | | | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **74205.** | **345150.** |
| Stddev | 101. | 8810. |
| %RSD | .13669 | 2.5526 |

Sample Name: icsa Acquired: 06/16/2015 15:22:58 Type: QC
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3961 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2343 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **.722** | **536000.** | **-.006** | **.002** | **-.177** | **490000.** | **.012** | **-.362** | **.004** | **.095** | **454000.** |
| Stddev | 2.95 | 27500. | 33.1 | .197 | .079 | 24800. | 4.59 | .351 | 1.75 | 2.36 | 18300. |
| %RSD | 409. | 5.13 | 582000. | 12500. | 44.9 | 5.05 | 38800. | 96.9 | 46700. | 2490. | 4.03 |
| Check ? | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None |
| High Limit | | | | | | | | | | | |
| Low Limit | | | | | | | | | | | |

| Elem | Mg2025 | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **468000.** | **.292** | **-.002** | **.039** | **-.363** | **-.059** | **-.233** | **-.704** | **.486** | **.058** |
| Stddev | 3450. | .880 | .438 | 1.58 | 4.69 | 2.54 | 14.8 | 5.19 | 4.36 | 1.59 |
| %RSD | .736 | 301. | 24400. | 4040. | 1290. | 4340. | 6330. | 737. | 897. | 2760. |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| High Limit | | | | | | | | | | |
| Low Limit | | | | | | | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **62617.** | **316820.** |
| Stddev | 144. | 3409. |
| %RSD | .22966 | 1.0759 |

Sample Name: icsab Acquired: 06/16/2015 15:27:39 Type: QC
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3961 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Be2348 | Ca3158 | Cd2265 | Cd2288 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **557.** | **528000.** | **514.** | **487.** | **518.** | **587.** | **569.** | **524.** | **485000.** | **422.** | **530.** |
| Stddev | 29. | 36300. | 37. | 14. | 27. | 30. | 29. | 27. | 26100. | 3. | 4. |
| %RSD | 5.20 | 6.87 | 7.13 | 2.77 | 5.14 | 5.18 | 5.07 | 5.14 | 5.38 | .628 | .832 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | |
| Range | | | | | | | | | | | |

| Elem | Co2286 | Co2388 | Cr2677 | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Mg2025 | Mn2576 | Mn2593 | Mo2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **425.** | **448.** | **507.** | **565.** | **429.** | **444.** | **445000.** | **460000.** | **531.** | **521.** | **498.** |
| Stddev | 3. | 22. | 24. | 29. | 2. | 18. | 19800. | 1850. | 25. | 41. | 5. |
| %RSD | .623 | 4.82 | 4.63 | 5.16 | .572 | 4.12 | 4.44 | .401 | 4.78 | 7.84 | .919 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | |
| Range | | | | | | | | | | | |

| Elem | Mo2045 | Ni2316 | Ni2316 | Pb2169 | Pb2203 | Sb2068 | Sb2175 | Se1960 | Se2062 | Tl1908 | Tl2767 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **442.** | **438.** | **415.** | **524.** | **519.** | **472.** | **474.** | **469.** | **494.** | **404.** | **558.** |
| Stddev | 3. | 23. | 4. | 36. | 4. | 4. | 4. | 11. | 37. | 4. | 169. |
| %RSD | .727 | 5.32 | .893 | 6.79 | .693 | .773 | .777 | 2.34 | 7.57 | .985 | 30.4 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | |
| Range | | | | | | | | | | | |

Sample Name: icsab    Acquired: 06/16/2015 15:27:39    Type: QC
Method: DOD Calibration Updated 060614(v643)    Mode: CONC    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | V_2908 | V_2924 | Zn2062 | Zn2138 |
|---|---|---|---|---|
| Avg | **458.** | **584.** | **538.** | **527.** |
| Stddev | 22. | 24. | 4. | 2. |
| %RSD | 4.88 | 4.16 | .670 | .376 |
| | | | | |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | |
| Range | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **63373.** | **319550.** |
| Stddev | 193. | 1291. |
| %RSD | .30408 | .40410 |

Sample Name: ccv1    Acquired: 06/16/2015 23:59:20    Type: QC
Method: DOD Calibration Updated 060614(v643)    Mode: CONC    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al3961 | As1890 | Ba4934 | Be3130 | Be2348 | Ca3158 | Cd2265 | Cd2288 | Co2388 | Cr2835 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **507.** | **4910.** | **5150.** | **4670.** | **5460.** | **526.** | **477.** | **4560.** | **458.** | **502.** | **4700.** | **4780.** |
| Stddev | 19. | 157. | 161. | 5. | 259. | 18. | 19. | 150. | 2. | 3. | 168. | 153. |
| %RSD | 3.77 | 3.20 | 3.12 | .099 | 4.74 | 3.42 | 3.96 | 3.30 | .537 | .543 | 3.58 | 3.21 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Mg2025 | Mg2802 | Mn2593 | Mo2045 | Ni2316 | Ni2316 | Pb2169 | Sb2068 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **4690.** | **4890.** | **4660.** | **4550.** | **4690.** | **4770.** | **5200.** | **4700.** | **4480.** | **4650.** | **4790.** | **4720.** |
| Stddev | 37. | 178. | 144. | 164. | 48. | 155. | 174. | 42. | 202. | 32. | 50. | 41. |
| %RSD | .779 | 3.64 | 3.09 | 3.61 | 1.02 | 3.26 | 3.35 | .902 | 4.51 | .695 | 1.03 | .861 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None | None | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Sb2175 | Se1960 | Se2062 | Tl2767 | V_2908 | Zn2062 |
|---|---|---|---|---|---|---|
| Avg | **4720.** | **4710.** | **4920.** | **4960.** | **4750.** | **5300.** |
| Stddev | 35. | 32. | 30. | 192. | 167. | 45. |
| %RSD | .732 | .689 | .599 | 3.86 | 3.51 | .848 |
| Check ? | None | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | |
| Range | | | | | | |

Sample Name: ccv1 Acquired: 06/16/2015 23:59:20 Type: QC
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **71256.** | **348710.** |
| Stddev | 141. | 1958. |
| %RSD | .19781 | .56150 |

Sample Name: ccv2 Acquired: 06/17/2015 00:03:48 Type: QC
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Ca3933 | Cd2265 | Co2286 | Co2388 | Cr2677 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **49.4** | **524.** | **481.** | **470.** | **534.** | **531.** | **50.4** | **535.** | **45.1** | **466.** | **466.** | **476.** |
| Stddev | 4.5 | 26. | 20. | 25. | 12. | 13. | 1.4 | 12. | 2.1 | 22. | 23. | 22. |
| %RSD | 9.17 | 4.95 | 4.21 | 5.34 | 2.29 | 2.47 | 2.71 | 2.22 | 4.68 | 4.68 | 4.89 | 4.53 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Cr2835 | Cu2247 | Cu3247 | Fe2599 | Mg2802 | Mn2576 | Mn2593 | Mo2020 | Mo2045 | Ni2316 | Pb2203 | Sb2068 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **472.** | **478.** | **490.** | **461.** | **474.** | **481.** | **510.** | **476.** | **479.** | **475.** | **473.** | **476.** |
| Stddev | 23. | 21. | 23. | 27. | 24. | 13. | 13. | 7. | 20. | 22. | 20. | 20. |
| %RSD | 4.79 | 4.29 | 4.74 | 5.79 | 4.99 | 2.63 | 2.54 | 1.48 | 4.19 | 4.70 | 4.16 | 4.15 |
| Check ? | None | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Sb2175 | Se1960 | Se2062 | Tl1908 | Tl2767 | V_2908 | V_2924 | Zn2062 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Avg | **476.** | **486.** | **528.** | **449.** | **474.** | **464.** | **511.** | **540.** | **498.** |
| Stddev | 20. | 22. | 11. | 19. | 61. | 22. | 9. | 26. | 22. |
| %RSD | 4.19 | 4.52 | 2.08 | 4.13 | 12.8 | 4.83 | 1.74 | 4.72 | 4.44 |
| Check ? | Chk Pass | Chk Pass | None | Chk Pass | None | None | Chk Pass | None | Chk Pass |
| Value | | | | | | | | | |
| Range | | | | | | | | | |

Sample Name: ccv2 Acquired: 06/17/2015 00:03:48 Type: QC
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **72780.** | **353220.** |
| Stddev | 112. | 10909. |
| %RSD | .15422 | 3.0884 |

Sample Name: ccb  Acquired: 06/17/2015 00:07:46  Type: QC
Method: DOD Calibration Updated 060614(v643)  Mode: CONC  Corr. Factor: 1.000000
User: NAH  ICAP6500:  Prep Batch:  Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **-.724** | **-1.09** | **.600** | **-.595** | **.010** | **-5.68** | **-1.06** | **.293** | **-.817** | **-.203** | **2.79** | **.621** |
| Stddev | 1.84 | 1.34 | 4.15 | .095 | .055 | .94 | .14 | .025 | 2.69 | .459 | 2.74 | .125 |
| %RSD | 253. | 124. | 692. | 15.9 | 564. | 16.5 | 12.7 | 8.36 | 329. | 226. | 98.2 | 20.1 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Avg | **.315** | **1.63** | **-.162** | **-.686** | **-.202** | **4.05** | **-.760** | **.024** | **-.820** |
| Stddev | .404 | .70 | .496 | .376 | 1.56 | .95 | 2.11 | 1.70 | .669 |
| %RSD | 128. | 42.9 | 307. | 54.8 | 772. | 23.3 | 278. | 7120. | 81.7 |
| Check ? | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | |
| Range | | | | | | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **73622.** | **360070.** |
| Stddev | 62. | 16170. |
| %RSD | .08429 | 4.4908 |

Sample Name: lcss52891 Acquired: 06/17/2015 00:51:19 Type: Unk
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | As1890 | Ba4934 | Be3130 | Ca3933 | Cd2265 | Cd2288 | Co2286 | Co2388 | Cr2677 | Cu2247 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **80.7** | **3170.** | **3390.** | **3700.** | **88.1** | **35.5** | **85.4** | **106.** | **849.** | **833.** | **345.** | **616.** |
| Stddev | 4.6 | 82. | 34. | 109. | 2.8 | 1.1 | .6 | 1. | 9. | 24. | 7. | 118. |
| %RSD | 5.65 | 2.59 | 1.02 | 2.96 | 3.14 | 3.01 | .752 | 1.03 | 1.08 | 2.91 | 2.14 | 19.2 |

| Elem | Cu3247 | Fe2343 | Fe2395 | Mg2802 | Mn2576 | Mn2593 | Mo2020 | Ni2316 | Ni2316 | Pb2169 | Pb2203 | Sb2068 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **1650.** | **5920.** | **5810.** | **26.5** | **814.** | **865.** | **.840** | **820.** | **898.** | **1130.** | **1070.** | **852.** |
| Stddev | 401. | 582. | 555. | .7 | 28. | 29. | .862 | 46. | 8. | 158. | 149. | 9. |
| %RSD | 24.3 | 9.84 | 9.55 | 2.49 | 3.42 | 3.35 | 103. | 5.54 | .858 | 14.0 | 13.9 | 1.07 |

| Elem | Sb2175 | Se1960 | Se2062 | Tl2767 | V_2908 | Zn2062 | Zn2138 |
|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **854.** | **3290.** | **3170.** | **3260.** | **930.** | **1020.** | **882.** |
| Stddev | 6. | 36. | 38. | 137. | 11. | 14. | 11. |
| %RSD | .680 | 1.08 | 1.19 | 4.20 | 1.21 | 1.35 | 1.30 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **77062.** | **351890.** |
| Stddev | 253. | 4843. |
| %RSD | .32847 | 1.3763 |

Sample Name: ccv1 Acquired: 06/17/2015 00:55:10 Type: QC
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al3961 | As1890 | Ba4934 | Be3130 | Be2348 | Ca3158 | Cd2265 | Cd2288 | Co2388 | Cr2835 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **511.** | **4960.** | **5260.** | **4700.** | **5460.** | **533.** | **491.** | **4670.** | **465.** | **507.** | **4870.** | **4920.** |
| Stddev | 14. | 163. | 150. | 21. | 203. | 16. | 16. | 128. | 4. | 3. | 161. | 150. |
| %RSD | 2.83 | 3.29 | 2.85 | .449 | 3.71 | 2.94 | 3.34 | 2.75 | .912 | .517 | 3.30 | 3.05 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Mg2025 | Mg2802 | Mn2593 | Mo2045 | Ni2316 | Ni2316 | Pb2169 | Sb2068 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **4790.** | **5030.** | **4850.** | **4740.** | **4770.** | **4910.** | **5300.** | **4790.** | **4640.** | **4740.** | **4870.** | **4800.** |
| Stddev | 45. | 180. | 156. | 139. | 59. | 154. | 152. | 52. | 150. | 50. | 57. | 51. |
| %RSD | .947 | 3.58 | 3.21 | 2.93 | 1.24 | 3.13 | 2.86 | 1.08 | 3.24 | 1.05 | 1.17 | 1.07 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None | None | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Sb2175 | Se1960 | Se2062 | Tl2767 | V_2908 | Zn2062 |
|---|---|---|---|---|---|---|
| Avg | **4790.** | **4760.** | **4900.** | **4980.** | **4880.** | **5440.** |
| Stddev | 54. | 47. | 15. | 128. | 164. | 50. |
| %RSD | 1.12 | .982 | .297 | 2.56 | 3.36 | .915 |
| Check ? | None | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | |
| Range | | | | | | |

Sample Name: ccv1 Acquired: 06/17/2015 00:55:10 Type: QC
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **71598.** | **345830.** |
| Stddev | 156. | 2668. |
| %RSD | .21844 | .77151 |

Sample Name: ccv2 Acquired: 06/17/2015 00:59:41 Type: QC
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Ca3933 | Cd2265 | Co2286 | Co2388 | Cr2677 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **49.4** | **528.** | **482.** | **465.** | **523.** | **524.** | **49.5** | **524.** | **45.8** | **469.** | **456.** | **468.** |
| Stddev | 4.0 | 31. | 21. | 28. | 18. | 21. | 1.8 | 21. | 2.3 | 27. | 25. | 30. |
| %RSD | 8.15 | 5.79 | 4.43 | 6.01 | 3.39 | 3.99 | 3.57 | 3.91 | 4.97 | 5.68 | 5.37 | 6.44 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Cr2835 | Cu2247 | Cu3247 | Fe2599 | Mg2802 | Mn2576 | Mn2593 | Mo2020 | Mo2045 | | Ni2316 | Pb2169 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **463.** | **482.** | **481.** | **468.** | **466.** | **472.** | **499.** | **481.** | **485.** | | **481.** | **506.** |
| Stddev | 32. | 27. | 35. | 31. | 31. | 16. | 18. | 9. | 26. | | 27. | 26. |
| %RSD | 6.93 | 5.66 | 7.27 | 6.56 | 6.67 | 3.48 | 3.69 | 1.84 | 5.31 | | 5.62 | 5.20 |
| Check ? | None | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | | Chk Pass | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Pb2203 | Sb2068 | Sb2175 | Se1960 | Se2062 | Tl1908 | Tl2767 | V_2908 | V_2924 | Zn2062 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **477.** | **478.** | **482.** | **484.** | **510.** | **450.** | **476.** | **454.** | **506.** | **544.** | **495.** |
| Stddev | 24. | 25. | 26. | 22. | 13. | 22. | 39. | 30. | 21. | 31. | 30. |
| %RSD | 4.94 | 5.25 | 5.41 | 4.62 | 2.48 | 4.91 | 8.11 | 6.64 | 4.07 | 5.69 | 6.02 |
| Check ? | Chk Pass | None | Chk Pass | Chk Pass | None | Chk Pass | None | None | Chk Pass | None | Chk Pass |
| Value | | | | | | | | | | | |
| Range | | | | | | | | | | | |

Sample Name: ccv2 Acquired: 06/17/2015 00:59:41 Type: QC
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **72507.** | **351390.** |
| Stddev | 373. | 14406. |
| %RSD | .51380 | 4.0997 |

Sample Name: ccb Acquired: 06/17/2015 01:03:39 Type: QC
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **1.55** | **-1.98** | **1.11** | **-.762** | **.014** | **-6.34** | **-.960** | **.251** | **-2.23** | **-.624** | **14.4** | **.285** |
| Stddev | 2.59 | .23 | 3.78 | .108 | .062 | .29 | .033 | .311 | .09 | .073 | 2.6 | .008 |
| %RSD | 167. | 11.9 | 341. | 14.2 | 448. | 4.57 | 3.45 | 124. | 4.02 | 11.7 | 17.8 | 2.66 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Avg | **.123** | **2.92** | **-.328** | **.875** | **.709** | **9.45** | **.107** | **-1.71** | **.180** |
| Stddev | .329 | .08 | .107 | 1.85 | .402 | 8.90 | .364 | 3.18 | .484 |
| %RSD | 268. | 2.82 | 32.7 | 212. | 56.6 | 94.1 | 341. | 186. | 270. |
| Check ? | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | |
| Range | | | | | | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **72703.** | **340850.** |
| Stddev | 171. | 2283. |
| %RSD | .23564 | .66965 |

Sample Name: mbs52891 Acquired: 06/17/2015 01:08:02 Type: Unk
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **.588** | **15.7** | **3.04** | **-.274** | **.065** | **8.54** | **-.890** | **.021** | **-.573** | **.896** | **126.** | **26.6** |
| Stddev | 2.79 | 2.3 | 7.04 | .075 | .034 | 1.53 | .091 | .094 | .766 | .573 | 25. | 2.5 |
| %RSD | 474. | 14.9 | 231. | 27.4 | 51.8 | 18.0 | 10.2 | 443. | 134. | 63.9 | 20.0 | 9.43 |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **.496** | **2.93** | **.121** | **.138** | **-.064** | **5.43** | **-1.40** | **-.373** | **1.41** |
| Stddev | .335 | .49 | .377 | .754 | 1.77 | 5.91 | 1.41 | 1.80 | .28 |
| %RSD | 67.6 | 16.6 | 312. | 547. | 2770. | 109. | 101. | 484. | 20.2 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **77145.** | **358360.** |
| Stddev | 367. | 16768. |
| %RSD | .47565 | 4.6792 |

Sample Name: 595908 Acquired: 06/17/2015 01:12:22 Type: Unk
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3961 | As1937 | Ba4554 | Ba4934 | Be3130 | Ca3158 | Cd2265 | Co2388 | Cr2677 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-8.14** | **567000.** | **-13.6** | **453.** | **521.** | **-.571** | **320000.** | **76.9** | **828.** | **589.** |
| Stddev | 1.13 | 39900. | 37.3 | 13. | 16. | .301 | 12300. | 4.3 | 38. | 21. |
| %RSD | 13.9 | 7.04 | 274. | 2.95 | 3.13 | 52.7 | 3.84 | 5.66 | 4.59 | 3.47 |

| Elem | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Mg2025 | Mn2593 | Mo2020 | Ni2316 | Ni2316 | Pb2203 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | mg/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **885.** | **1330.** | **1570.** | **1260000.** | **768000.** | **11100.** | **-2.84** | **1580.** | **1400.** | **124.** |
| Stddev | 38. | 12. | 52. | 38900. | 7380. | 392. | 2.10 | 75. | 14. | 1. |
| %RSD | 4.31 | .920 | 3.34 | 3.07 | .961 | 3.52 | 74.0 | 4.75 | 1.02 | 1.06 |

| Elem | Sb2175 | Tl1908 | V_2908 | Zn2062 |
|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L |
| Avg | **-1.87** | **490.** | **1300.** | **1190.** |
| Stddev | 4.83 | 18. | 44. | 13. |
| %RSD | 258. | 3.61 | 3.41 | 1.08 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **62772.** | **331950.** |
| Stddev | 196. | 1611. |
| %RSD | .31300 | .48525 |

Sample Name: I595908    Acquired: 06/17/2015 01:16:44    Type: Unk
Method: DOD Calibration Updated 060614(v643)    Mode: CONC    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3961 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2343 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-2.76** | **122000.** | **12.8** | **102.** | **-.156** | **70600.** | **3.48** | **327.** | **137.** | **367.** | **329000.** |
| Stddev | 2.37 | 4030. | 4.5 | 3. | .114 | 2580. | 1.22 | 8. | 7. | 8. | 10700. |
| %RSD | 86.0 | 3.30 | 35.3 | 3.42 | 73.3 | 3.65 | 35.0 | 2.47 | 5.18 | 2.16 | 3.26 |

| Elem | Mg2025 | Mn2593 | Mo2020 | Ni2316 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | mg/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **199000.** | **2420.** | **-1.70** | **394.** | **380.** | **32.1** | **1.39** | **-30.6** | **111.** | **368.** | **283.** |
| Stddev | 4380. | 85. | 1.94 | 35. | 7. | 2.2 | 1.98 | 2.8 | 4. | 12. | 8. |
| %RSD | 2.20 | 3.49 | 115. | 8.93 | 1.79 | 6.87 | 142. | 9.32 | 3.24 | 3.31 | 2.84 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **68500.** | **340870.** |
| Stddev | 394. | 4107. |
| %RSD | .57502 | 1.2048 |

Sample Name: dup595908 Acquired: 06/17/2015 01:20:49 Type: Unk
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3961 | As1937 | Ba4554 | Ba4934 | Be3130 | Ca3158 | Cd2265 | Co2388 | Cr2677 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-4.80** | **520000.** | **-8.40** | **372.** | **420.** | **1.34** | **282000.** | **68.6** | **750.** | **525.** |
| Stddev | 3.06 | 35100. | 25.1 | 13. | 17. | .22 | 13600. | 6.1 | 20. | 29. |
| %RSD | 63.7 | 6.74 | 299. | 3.55 | 4.02 | 16.7 | 4.83 | 8.85 | 2.62 | 5.51 |

| Elem | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Mg2025 | Mn2593 | Mo2020 | Ni2316 | Ni2316 | Pb2203 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | mg/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **762.** | **1220.** | **1400.** | **1170000.** | **717000.** | **9940.** | **-4.70** | **1430.** | **1310.** | **105.** |
| Stddev | 50. | 22. | 68. | 55400. | 17300. | 449. | 1.06 | 89. | 27. | 5. |
| %RSD | 6.55 | 1.83 | 4.84 | 4.75 | 2.41 | 4.52 | 22.5 | 6.23 | 2.08 | 4.35 |

| Elem | Sb2175 | Se1960 | Tl1908 | V_2908 | Zn2062 |
|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-4.22** | **-95.9** | **357.** | **1070.** | **1070.** |
| Stddev | .38 | 7.3 | 14. | 62. | 23. |
| %RSD | 9.02 | 7.66 | 3.91 | 5.75 | 2.16 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **62812.** | **335390.** |
| Stddev | 220. | 4470. |
| %RSD | .34996 | 1.3328 |

Sample Name: mss595908 Acquired: 06/17/2015 01:25:06 Type: Unk
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3961 | As1890 | Ba4934 | Be3130 | Ca3158 | Cd2265 | Cd2288 | Co2388 | Cr2677 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **84.3** | **550000.** | **2910.** | **4770.** | **97.9** | **305000.** | **131.** | **105.** | **1530.** | **837.** |
| Stddev | 7.0 | 39200. | 52. | 273. | 5.6 | 14700. | 7. | . | 91. | 46. |
| %RSD | 8.27 | 7.13 | 1.77 | 5.72 | 5.70 | 4.83 | 5.50 | .396 | 5.96 | 5.55 |

| Elem | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Mg2025 | Mn2593 | Mo2020 | Ni2316 | Ni2316 | Pb2169 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | mg/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **1090.** | **1560.** | **1910.** | **1190000.** | **737000.** | **11000.** | **-2.28** | **2220.** | **1960.** | **937.** |
| Stddev | 74. | 23. | 119. | 57000. | 13200. | 532. | .87 | 118. | 36. | 17. |
| %RSD | 6.74 | 1.50 | 6.23 | 4.80 | 1.79 | 4.84 | 38.3 | 5.30 | 1.81 | 1.76 |

| Elem | Pb2203 | Sb2175 | Se1960 | Se2062 | Tl2767 | V_2908 | Zn2062 |
|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **661.** | **319.** | **2570.** | **3260.** | **3220.** | **1910.** | **1810.** |
| Stddev | 9. | 10. | 38. | 33. | 224. | 113. | 34. |
| %RSD | 1.42 | 3.20 | 1.46 | 1.00 | 6.96 | 5.93 | 1.88 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **62543.** | **333570.** |
| Stddev | 136. | 2615. |
| %RSD | .21746 | .78390 |

Sample Name: msds595908 Acquired: 06/17/2015 01:29:25 Type: Unk
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3961 | As1890 | Ba4934 | Be3130 | Ca3158 | Cd2265 | Cd2288 | Co2388 | Cr2677 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **86.5** | **565000.** | **2910.** | **4910.** | **99.8** | **302000.** | **131.** | **107.** | **1500.** | **839.** |
| Stddev | 5.6 | 35900. | 88. | 204. | 3.6 | 11700. | 4. | 1. | 48. | 35. |
| %RSD | 6.46 | 6.36 | 3.03 | 4.17 | 3.65 | 3.86 | 3.14 | .957 | 3.21 | 4.22 |

| Elem | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Mg2025 | Mn2593 | Mo2020 | Ni2316 | Ni2316 | Pb2169 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | mg/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **1110.** | **1480.** | **1810.** | **1190000.** | **729000.** | **11300.** | **-2.25** | **2190.** | **1930.** | **931.** |
| Stddev | 44. | 32. | 87. | 42400. | 15800. | 455. | 2.00 | 104. | 46. | 16. |
| %RSD | 3.96 | 2.14 | 4.84 | 3.57 | 2.17 | 4.02 | 88.8 | 4.75 | 2.38 | 1.66 |

| Elem | Pb2203 | Sb2175 | Se1960 | Se2062 | Tl2767 | V_2908 | Zn2062 |
|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **651.** | **346.** | **2550.** | **3340.** | **3300.** | **1880.** | **1780.** |
| Stddev | 16. | 7. | 48. | 73. | 229. | 89. | 39. |
| %RSD | 2.41 | 2.08 | 1.90 | 2.19 | 6.94 | 4.70 | 2.20 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **61723.** | **337370.** |
| Stddev | 137. | 3854. |
| %RSD | .22167 | 1.1424 |

Sample Name: pdss595908    Acquired: 06/17/2015 01:33:38    Type: Unk
Method: DOD Calibration Updated 060614(v643)    Mode: CONC    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3961 | As1890 | Ba4934 | Be3130 | Ca3158 | Cd2265 | Cd2288 | Co2388 | Cr2677 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **87.5** | **524000.** | **3100.** | **4850.** | **99.9** | **281000.** | **131.** | **109.** | **1510.** | **844.** |
| Stddev | 1.4 | 33300. | 49. | 163. | 3.5 | 9890. | 2. | . | 56. | 39. |
| %RSD | 1.58 | 6.35 | 1.59 | 3.35 | 3.48 | 3.53 | 1.70 | .312 | 3.69 | 4.67 |

| Elem | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Mg2025 | Mn2593 | Mo2020 | Ni2316 | Ni2316 | Pb2169 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | mg/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **1100.** | **1530.** | **1830.** | **1170000.** | **718000.** | **10800.** | **-2.67** | **2180.** | **1940.** | **947.** |
| Stddev | 57. | 35. | 83. | 48500. | 15200. | 350. | 1.67 | 94. | 47. | 4. |
| %RSD | 5.21 | 2.29 | 4.54 | 4.15 | 2.12 | 3.23 | 62.4 | 4.34 | 2.42 | .458 |

| Elem | Pb2203 | Sb2068 | Sb2175 | Se1960 | Se2062 | Tl2767 | V_2908 | Zn2062 |
|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **677.** | **743.** | **783.** | **2820.** | **3500.** | **3340.** | **1900.** | **1820.** |
| Stddev | 13. | 18. | 20. | 52. | 50. | 335. | 100. | 47. |
| %RSD | 1.95 | 2.45 | 2.53 | 1.86 | 1.43 | 10.1 | 5.26 | 2.57 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **62798.** | **333480.** |
| Stddev | 395. | 3116. |
| %RSD | .62888 | .93450 |

Sample Name: 595910 Acquired: 06/17/2015 01:37:56 Type: Unk
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3961 | As1937 | Ba4934 | Be3130 | Ca3158 | Cd2265 | Co2388 | Cr2677 | Cr2835 | Cu2247 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-1.37** | **353000.** | **-27.6** | **2220.** | **-3.09** | **282000.** | **36.7** | **493.** | **633.** | **733.** | **2280.** |
| Stddev | 1.98 | 11900. | 29.5 | 114. | .11 | 12300. | 3.6 | 16. | 27. | 25. | 38. |
| %RSD | 145. | 3.38 | 107. | 5.12 | 3.54 | 4.38 | 9.78 | 3.21 | 4.26 | 3.46 | 1.65 |

| Elem | Cu3247 | Fe2343 | Mg2025 | Mn2593 | Mo2020 | Ni2316 | Ni2316 | Pb2169 | Sb2175 | Se1960 | Tl1908 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | mg/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **2860.** | **646000.** | **529000.** | **13400.** | **3.27** | **1010.** | **931.** | **7130.** | **2.20** | **-23.4** | **408.** |
| Stddev | 156. | 27700. | 8590. | 593. | 2.01 | 46. | 17. | 86. | 4.78 | 14.7 | 20. |
| %RSD | 5.45 | 4.29 | 1.62 | 4.43 | 61.5 | 4.56 | 1.82 | 1.20 | 217. | 62.8 | 4.90 |

| Elem | V_2908 | Zn2062 |
|---|---|---|
| Units | ug/L | ug/L |
| Avg | **1220.** | **6070.** |
| Stddev | 56. | 119. |
| %RSD | 4.61 | 1.96 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **64319.** | **340980.** |
| Stddev | 378. | 1234. |
| %RSD | .58803 | .36192 |

Sample Name: 595912 Acquired: 06/17/2015 01:42:11 Type: Unk
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3961 | As1937 | Ba4554 | Ba4934 | Be3130 | Ca3158 | Cd2265 | Co2388 | Cr2677 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-6.79** | **649000.** | **-28.6** | **768.** | **922.** | **-5.45** | **354000.** | **97.5** | **876.** | **766.** |
| Stddev | 2.93 | 43600. | 38.4 | 29. | 37. | .26 | 14400. | 4.4 | 24. | 23. |
| %RSD | 43.2 | 6.73 | 134. | 3.81 | 4.04 | 4.85 | 4.06 | 4.47 | 2.72 | 3.06 |

| Elem | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Mg2025 | Mn2593 | Mo2020 | Ni2316 | Ni2316 | Pb2169 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | mg/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **1080.** | **2720.** | **3570.** | **1330000.** | **902000.** | **16800.** | **.856** | **1860.** | **1630.** | **934.** |
| Stddev | 47. | 26. | 150. | 41000. | 10300. | 668. | 1.17 | 65. | 17. | 23. |
| %RSD | 4.32 | .963 | 4.21 | 3.08 | 1.14 | 3.98 | 137. | 3.51 | 1.07 | 2.41 |

| Elem | Pb2203 | Sb2175 | Tl1908 | V_2908 | Zn2062 |
|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **617.** | **-1.80** | **720.** | **2170.** | **2890.** |
| Stddev | 7. | 2.07 | 27. | 93. | 28. |
| %RSD | 1.14 | 115. | 3.71 | 4.30 | .989 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **60908.** | **330910.** |
| Stddev | 160. | 2394. |
| %RSD | .26302 | .72331 |

Sample Name: 595914 Acquired: 06/17/2015 01:46:30 Type: Unk
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3961 | As1937 | Ba4554 | Ba4934 | Be3130 | Ca3158 | Cd2265 | Co2388 | Cr2677 | Cr2835 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-4.30** | **508000.** | **-27.0** | **831.** | **969.** | **-6.60** | **325000.** | **45.7** | **768.** | **687.** | **827.** |
| Stddev | 5.63 | 31700. | 32.6 | 32. | 41. | .36 | 15600. | 3.3 | 23. | 24. | 34. |
| %RSD | 131. | 6.24 | 121. | 3.88 | 4.23 | 5.42 | 4.80 | 7.29 | 3.02 | 3.52 | 4.07 |

| Elem | Cu2247 | Cu3247 | Fe2343 | Mg2025 | Mn2593 | Mo2020 | Ni2316 | Ni2316 | Pb2203 | Sb2175 | Se1960 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | mg/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **731.** | **810.** | **795000.** | **711000.** | **21200.** | **3.43** | **1480.** | **1330.** | **116.** | **1.45** | **-42.3** |
| Stddev | 4. | 28. | 25600. | 4370. | 1000. | 1.65 | 77. | 11. | 4. | 1.95 | 5.4 |
| %RSD | .533 | 3.48 | 3.22 | .614 | 4.73 | 47.9 | 5.18 | .855 | 3.12 | 134. | 12.8 |

| Elem | Tl1908 | V_2908 | Zn2062 |
|---|---|---|---|
| Units | ug/L | ug/L | ug/L |
| Avg | **800.** | **1420.** | **2450.** |
| Stddev | 32. | 53. | 11. |
| %RSD | 4.00 | 3.74 | .441 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **62881.** | **336780.** |
| Stddev | 419. | 895. |
| %RSD | .66590 | .26581 |

Sample Name: ccv1 Acquired: 06/17/2015 01:50:53 Type: QC
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al3961 | As1890 | Ba4934 | Be3130 | Be2348 | Ca3158 | Cd2265 | Cd2288 | Co2388 | Cr2835 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **500.** | **4930.** | **5190.** | **4780.** | **5440.** | **527.** | **495.** | **4600.** | **484.** | **509.** | **4840.** | **4930.** |
| Stddev | 15. | 153. | 170. | 86. | 287. | 19. | 24. | 152. | 12. | 3. | 267. | 251. |
| %RSD | 2.99 | 3.10 | 3.27 | 1.81 | 5.28 | 3.54 | 4.79 | 3.30 | 2.39 | .525 | 5.52 | 5.09 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Mg2025 | Mg2802 | Mn2593 | Mo2045 | Ni2316 | Ni2316 | Pb2169 | Sb2068 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **4900.** | **5030.** | **4980.** | **4850.** | **4850.** | **4920.** | **5190.** | **4900.** | **4650.** | **4890.** | **5000.** | **4870.** |
| Stddev | 122. | 297. | 192. | 184. | 130. | 242. | 179. | 121. | 228. | 125. | 118. | 113. |
| %RSD | 2.48 | 5.92 | 3.86 | 3.79 | 2.68 | 4.92 | 3.44 | 2.47 | 4.90 | 2.56 | 2.36 | 2.33 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None | None | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Sb2175 | Se1960 | Se2062 | Tl2767 | V_2908 | Zn2062 |
|---|---|---|---|---|---|---|
| Avg | **4900.** | **4820.** | **4890.** | **4920.** | **4900.** | F **5550.** |
| Stddev | 116. | 112. | 31. | 202. | 267. | 141. |
| %RSD | 2.37 | 2.32 | .630 | 4.10 | 5.45 | 2.54 |
| Check ? | None | None | Chk Pass | Chk Pass | Chk Pass | Chk Fail |
| Value | | | | | | 5000. |
| Range | | | | | | 10.4% |

Sample Name: ccv1  Acquired: 06/17/2015 01:50:53  Type: QC
Method: DOD Calibration Updated 060614(v643)  Mode: CONC  Corr. Factor: 1.000000
User: NAH  ICAP6500:  Prep Batch:  Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **72752.** | **345750.** |
| Stddev | 287. | 7932. |
| %RSD | .39490 | 2.2941 |

Sample Name: ccv2 Acquired: 06/17/2015 01:55:20 Type: QC
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Ca3933 | Cd2265 | Co2286 | Co2388 | Cr2677 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **50.6** | **541.** | **487.** | **472.** | **526.** | **523.** | **49.8** | **526.** | **46.5** | **473.** | **462.** | **465.** |
| Stddev | 4.3 | 23. | 21. | 20. | 18. | 19. | 1.8 | 19. | 1.9 | 19. | 22. | 22. |
| %RSD | 8.46 | 4.20 | 4.39 | 4.24 | 3.38 | 3.62 | 3.70 | 3.62 | 4.11 | 4.02 | 4.80 | 4.81 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Cr2835 | Cu2247 | Cu3247 | Fe2599 | Mg2802 | Mn2576 | Mn2593 | Mo2020 | Mo2045 | Ni2316 | Ni2316 | Pb2169 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **467.** | **487.** | **478.** | **467.** | **470.** | **470.** | **499.** | **482.** | **489.** | **448.** | **487.** | **510.** |
| Stddev | 27. | 20. | 25. | 19. | 24. | 19. | 18. | 9. | 19. | 20. | 20. | 21. |
| %RSD | 5.70 | 4.19 | 5.20 | 4.15 | 5.13 | 4.10 | 3.56 | 1.81 | 3.87 | 4.50 | 4.06 | 4.07 |
| Check ? | None | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Pb2203 | Sb2068 | Sb2175 | Se1960 | Se2062 | Tl1908 | Tl2767 | V_2908 | V_2924 | Zn2062 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **480.** | **484.** | **485.** | **493.** | **522.** | **450.** | **496.** | **457.** | **507.** | **548.** | **491.** |
| Stddev | 18. | 18. | 19. | 14. | 26. | 13. | 64. | 26. | 15. | 22. | 21. |
| %RSD | 3.67 | 3.61 | 3.94 | 2.90 | 4.88 | 2.84 | 13.0 | 5.69 | 3.05 | 4.03 | 4.25 |
| Check ? | Chk Pass | None | Chk Pass | Chk Pass | None | Chk Pass | None | None | Chk Pass | None | Chk Pass |
| Value | | | | | | | | | | | |
| Range | | | | | | | | | | | |

Sample Name: ccv2 Acquired: 06/17/2015 01:55:20 Type: QC
Method: DOD Calibration Updated 060614(v643) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **73148.** | **353040.** |
| Stddev | 468. | 10717. |
| %RSD | .63992 | 3.0355 |

Sample Name: ccb  Acquired: 06/17/2015 01:59:19  Type: QC
Method: DOD Calibration Updated 060614(v643)  Mode: CONC  Corr. Factor: 1.000000
User: NAH  ICAP6500:  Prep Batch:  Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **1.79** | **-.529** | **.567** | **-.466** | **.025** | **-4.82** | **-1.10** | **.291** | **-2.33** | **-.550** | **8.84** | **2.46** |
| Stddev | 1.96 | 1.11 | 2.90 | .041 | .068 | .81 | .11 | .062 | 1.07 | .431 | 2.58 | .66 |
| %RSD | 110. | 209. | 511. | 8.90 | 267. | 16.8 | 10.0 | 21.4 | 45.9 | 78.2 | 29.2 | 26.8 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Avg | **.385** | **2.27** | **-.243** | **-.223** | **.937** | **7.46** | **-.824** | **-1.25** | **-.417** |
| Stddev | .590 | .72 | .156 | .789 | 1.54 | 4.90 | .341 | 1.55 | .557 |
| %RSD | 153. | 31.9 | 64.4 | 353. | 164. | 65.7 | 41.3 | 124. | 134. |
| Check ? | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | |
| Range | | | | | | | | | |

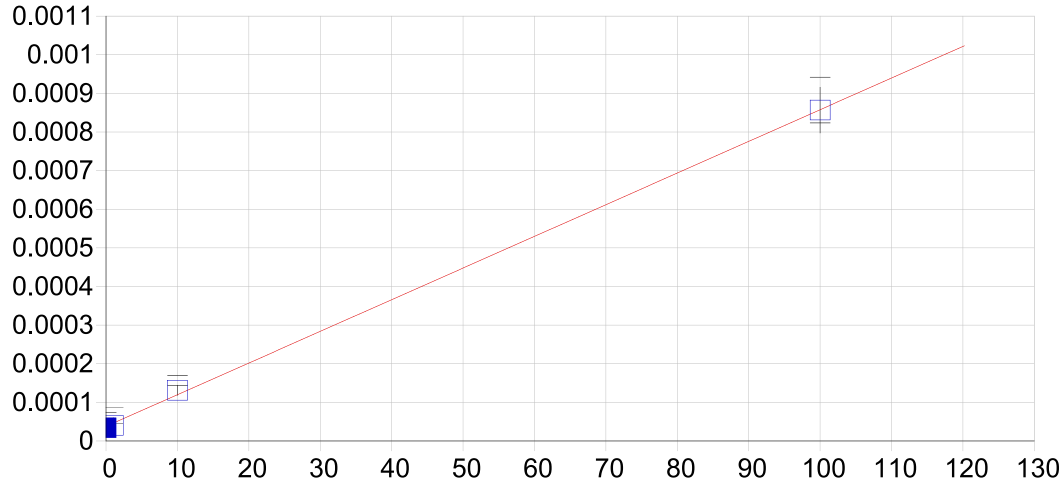
| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **72766.** | **355100.** |
| Stddev | 324. | 15009. |
| %RSD | .44541 | 4.2266 |

| Element, Wavelength and Order | Date of Fit | Date of Cal. | Type of Fit | Weighting | A0 | A1 | A2 | n (Exponent) | Correlation | Std Error of Est | Predicted MDL | Predicted MQL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ag 328.068 {103} | 06/18/2015 12:46:09 | 06/17/2015 13:56:49 | Linear | None | 0.000038 | 0.000008 | 0.000000 | 1.000000 | 0.999818 | 0.000009 | 3.006245 | 10.020816 |
| Ag 338.289 {100} | 06/18/2015 12:46:09 | 06/17/2015 14:00:35 | Linear | None | 0.000009 | 0.000001 | 0.000000 | 1.000000 | 0.999255 | 0.000022 | 10.493131 | 34.977104 |
| Al 308.215 {109} | 06/18/2015 12:46:09 | 06/17/2015 14:23:06 | Linear | 1/Conc | 0.000045 | 0.000000 | 0.000000 | 1.000000 | 0.999940 | 0.000006 | 19.793755 | 65.979184 |
| Al 309.271 {109} | 06/18/2015 12:46:09 | 06/17/2015 14:13:26 | Linear | 1/Conc | 0.001031 | 0.000003 | 0.000000 | 1.000000 | 0.999953 | 0.000016 | 12.905999 | 43.019998 |
| Al 396.152 { 85} | 06/18/2015 12:46:09 | 06/17/2015 14:23:06 | Linear | 1/Var | -0.000023 | 0.000008 | 0.000000 | 1.000000 | 0.998888 | 0.000148 | 7.878314 | 26.261048 |
| Al 167.079 {502} | 06/18/2015 12:46:09 | 06/17/2015 14:00:35 | Linear | None | 0.000002 | 0.000000 | 0.000000 | 1.000000 | 0.999983 | 0.000001 | 1.589316 | 5.297721 |
| As 193.759 {474} | 06/18/2015 12:46:09 | 06/17/2015 14:00:35 | Linear | 1/Var | 0.000000 | 0.000001 | 0.000000 | 1.000000 | 0.999798 | 0.000002 | 6.527768 | 21.759225 |
| As 189.042 {479} | 06/18/2015 12:46:09 | 06/17/2015 14:04:55 | Linear | None | -0.000000 | 0.000000 | 0.000000 | 1.000000 | 0.999999 | 0.000000 | 20.590398 | 68.634659 |
| Ba 455.403 { 74} | 06/18/2015 12:46:09 | 06/17/2015 14:00:35 | Linear | None | 0.000108 | 0.000116 | 0.000000 | 1.000000 | 0.999996 | 0.000117 | 0.169570 | 0.565234 |
| Ba 493.409 { 68} | 06/18/2015 12:46:09 | 06/17/2015 14:04:55 | Linear | 1/Var | -0.005215 | 0.000519 | 0.000000 | 1.000000 | 0.999661 | 0.000264 | 0.523476 | 1.744919 |
| Be 313.042 {108} | 06/18/2015 12:46:09 | 06/17/2015 14:00:36 | Linear | 1/Conc | 0.000002 | 0.000222 | 0.000000 | 1.000000 | 0.999871 | 0.000002 | 0.088853 | 0.296175 |
| Be 234.861 {144} | 06/18/2015 12:46:09 | 06/17/2015 14:00:36 | Linear | 1/Conc | -0.000002 | 0.000003 | 0.000000 | 1.000000 | 0.999900 | 0.000001 | 0.980620 | 3.268735 |
| Ca 315.887 {107} | 06/18/2015 12:46:09 | 06/17/2015 14:23:07 | Curvilin | 1/Conc | 0.000317 | 0.000003 | 0.000000 | 1.000000 | 0.999890 | 0.000089 | 8.041294 | 26.804314 |
| Ca 317.933 {106} | 06/18/2015 12:46:09 | 06/17/2015 14:23:07 | Linear | 1/Var | 0.003373 | 0.000001 | 0.000000 | 1.000000 | 0.995988 | 0.000342 | 4.076126 | 13.587085 |
| Ca 393.366 { 86} | 06/18/2015 12:46:09 | 06/17/2015 14:00:36 | Linear | None | 0.015084 | 0.001169 | 0.000000 | 1.000000 | 0.999924 | 0.008395 | 0.043403 | 0.144677 |
| Ca 396.847 { 85} | 06/18/2015 12:46:09 | 06/17/2015 14:04:55 | Linear | None | 0.000687 | 0.000127 | 0.000000 | 1.000000 | 0.999998 | 0.001393 | 0.072995 | 0.243318 |
| Cd 214.438 {457} | 06/18/2015 12:46:09 | 06/17/2015 14:00:36 | Linear | None | 0.000163 | 0.000106 | 0.000000 | 1.000000 | 0.999977 | 0.000273 | 0.072962 | 0.243208 |
| Cd 226.502 {149} | 06/18/2015 12:46:09 | 06/17/2015 14:00:36 | Linear | None | 0.000008 | 0.000003 | 0.000000 | 1.000000 | 0.999916 | 0.000020 | 4.648351 | 15.494502 |
| Cd 226.502 {449} | 06/18/2015 12:46:09 | 06/17/2015 14:00:36 | Linear | None | 0.000079 | 0.000055 | 0.000000 | 1.000000 | 0.999975 | 0.000144 | 0.155629 | 0.518763 |
| Cd 228.802 {447} | 06/18/2015 12:46:09 | 06/17/2015 14:00:36 | Linear | None | 0.000185 | 0.000101 | 0.000000 | 1.000000 | 0.999978 | 0.000302 | 0.119347 | 0.397823 |
| Co 228.616 {147} | 06/18/2015 12:46:09 | 06/17/2015 14:00:36 | Linear | None | 0.000004 | 0.000003 | 0.000000 | 1.000000 | 0.999994 | 0.000005 | 4.640105 | 15.467016 |
| Co 228.616 {447} | 06/18/2015 12:46:09 | 06/17/2015 14:00:36 | Linear | 1/Conc | -0.000017 | 0.000058 | 0.000000 | 1.000000 | 0.999890 | 0.000001 | 0.186253 | 0.620844 |
| Co 238.892 {141} | 06/18/2015 12:46:09 | 06/17/2015 14:04:55 | Linear | 1/Var | 0.000005 | 0.000001 | 0.000000 | 1.000000 | 0.999688 | 0.000003 | 5.103061 | 17.010204 |
| Cr 267.716 {126} | 06/18/2015 12:46:09 | 06/17/2015 14:00:36 | Linear | None | 0.000000 | 0.000002 | 0.000000 | 1.000000 | 0.999991 | 0.000003 | 2.528205 | 8.427350 |
| Cr 283.563 {119} | 06/18/2015 12:46:09 | 06/17/2015 14:09:06 | Linear | 1/Conc | 0.000012 | 0.000002 | 0.000000 | 1.000000 | 0.999714 | 0.000005 | 2.425741 | 8.085803 |
| Cu 224.700 {450} | 06/18/2015 12:46:09 | 06/17/2015 14:04:55 | Linear | 1/Conc | -0.000008 | 0.000003 | 0.000000 | 1.000000 | 0.999928 | 0.000000 | 0.435102 | 1.450339 |
| Cu 324.754 {104} | 06/18/2015 12:46:09 | 06/17/2015 14:09:07 | Linear | None | 0.002422 | 0.000003 | 0.000000 | 1.000000 | 0.999987 | 0.000688 | 2.742590 | 9.141967 |
| Cu 327.396 {103} | 06/18/2015 12:46:09 | 06/17/2015 14:09:07 | Linear | 1/Conc | -0.000368 | 0.000001 | 0.000000 | 1.000000 | 0.999894 | 0.000001 | 11.363624 | 37.878746 |
| Fe 234.349 {144} | 06/18/2015 12:46:09 | 06/17/2015 14:23:07 | Full Fit | 1/Var | 0.000002 | 0.000000 | 0.000000 | 0.990000 | 0.999838 | 0.000003 | 14.609984 | 48.699948 |
| Fe 239.562 {141} | 06/18/2015 12:46:09 | 06/17/2015 14:13:26 | Curvilin | 1/Conc | 0.000003 | 0.000000 | 0.000000 | 1.000000 | 0.999985 | 0.000001 | 7.112729 | 23.709096 |
| Fe 259.940 {130} | 06/18/2015 12:46:09 | 06/17/2015 14:04:56 | Linear | None | -0.000003 | 0.000001 | 0.000000 | 1.000000 | 0.999986 | 0.000035 | 2.856975 | 9.523250 |
| Mg 202.582 {466} | 06/18/2015 12:46:09 | 06/17/2015 14:23:07 | Full Fit | 1/Conc | -0.000006 | 0.000001 | 0.000000 | 0.910000 | 0.999925 | 0.000006 | 1.519810 | 5.066034 |
| Mg 279.079 {121} | 06/18/2015 12:46:09 | 06/17/2015 14:23:07 | Full Fit | None | -0.000009 | 0.000000 | 0.000000 | 1.040000 | 1.000000 | 0.000034 | 46.693549 | 155.645162 |
| Mg 280.270 {120} | 06/18/2015 12:46:09 | 06/17/2015 14:04:56 | Linear | 1/Conc | 0.000049 | 0.000020 | 0.000000 | 1.000000 | 0.999964 | 0.000005 | 0.132530 | 0.441768 |
| Mn 257.610 {131} | 06/18/2015 12:46:09 | 06/17/2015 14:04:56 | Linear | 1/Conc | -0.000002 | 0.000023 | 0.000000 | 1.000000 | 0.999795 | 0.000004 | 0.510757 | 1.702524 |
| Mn 259.373 {130} | 06/18/2015 12:46:09 | 06/17/2015 14:09:07 | Linear | 1/Conc | 0.000002 | 0.000040 | 0.000000 | 1.000000 | 0.999732 | 0.000435 | 0.539595 | 1.798648 |
| Mn 293.930 {115} | 06/18/2015 12:46:09 | 06/17/2015 14:04:56 | Linear | 1/Conc | 0.000002 | 0.000002 | 0.000000 | 1.000000 | 0.999864 | 0.000000 | 2.826324 | 9.421081 |
| Mo 203.844 {465} | 06/18/2015 12:46:09 | 06/17/2015 14:00:37 | Linear | 1/Conc | 0.000007 | 0.000008 | 0.000000 | 1.000000 | 0.999735 | 0.000000 | 0.872780 | 2.909268 |
| Mo 202.030 {467} | 06/18/2015 12:46:09 | 06/17/2015 14:00:37 | Linear | 1/Var | 0.000005 | 0.000007 | 0.000000 | 1.000000 | 0.999754 | 0.000003 | 0.774638 | 2.582127 |
| Mo 204.598 {465} | 06/18/2015 12:46:09 | 06/17/2015 14:04:56 | Linear | None | 0.000001 | 0.000001 | 0.000000 | 1.000000 | 1.000000 | 0.000003 | 1.170769 | 3.902563 |
| Ni 221.647 {452} | 06/18/2015 12:46:09 | 06/17/2015 14:04:56 | Linear | 1/Conc | -0.000001 | 0.000031 | 0.000000 | 1.000000 | 0.999987 | 0.000008 | 0.390683 | 1.302276 |
| Ni 231.604 {146} | 06/18/2015 12:46:09 | 06/17/2015 14:04:56 | Linear | None | 0.000005 | 0.000000 | 0.000000 | 1.000000 | 0.999969 | 0.000022 | 32.328428 | 107.761425 |
| Ni 231.604 {445} | 06/18/2015 12:46:09 | 06/17/2015 14:04:56 | Linear | 1/Conc | -0.000002 | 0.000037 | 0.000000 | 1.000000 | 0.999983 | 0.000001 | 0.414335 | 1.381116 |
| Pb 216.999 {455} | 06/18/2015 12:46:09 | 06/17/2015 14:09:07 | Curvilin | 1/Conc | 0.000006 | 0.000001 | 0.000000 | 1.000000 | 0.999955 | 0.000000 | 3.358194 | 11.193979 |

| Element, Wavelength and Order | Date of Fit | Date of Cal. | Type of Fit | Weighting | A0 | A1 | A2 | n (Exponent) | Correlation | Std Error of Est | Predicted MDL | Predicted MQL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pb 220.353 153 | 06/18/2015 12:46:09 | 06/17/2015 14:09:07 | Linear | 1/Var | -0.000001 | 0.000000 | 0.000000 | 1.000000 | 0.999481 | 0.000000 | 59.916520 | 199.721732 |
| Pb 220.353 453 | 06/18/2015 12:46:09 | 06/17/2015 14:00:37 | Linear | 1/Conc | 0.000001 | 0.000001 | 0.000000 | 1.000000 | 0.999898 | 0.000000 | 1.899750 | 6.332500 |
| Pb 283.306 119 | 06/18/2015 12:46:09 | 06/17/2015 14:09:07 | Linear | 1/Conc | 0.000005 | 0.000000 | 0.000000 | 1.000000 | 0.999837 | 0.000000 | 77.884110 | 259.613700 |
| Sb 206.833 463 | 06/18/2015 12:46:09 | 06/17/2015 14:04:56 | Linear | 1/Conc | -0.000001 | 0.000000 | 0.000000 | 1.000000 | 0.999996 | 0.000000 | 2.879264 | 9.597546 |
| Sb 217.581 455 | 06/18/2015 12:46:09 | 06/17/2015 14:00:38 | Linear | 1/Conc | -0.000000 | 0.000001 | 0.000000 | 1.000000 | 0.999848 | 0.000000 | 1.843464 | 6.144879 |
| Se 196.090 172 | 06/18/2015 12:46:09 | 06/17/2015 14:04:56 | Linear | None | 0.000025 | 0.000000 | 0.000000 | 1.000000 | 0.998366 | 0.000009 | 396.124353 | 1320.41451 |
| Se 196.090 472 | 06/18/2015 12:46:09 | 06/17/2015 14:04:56 | Linear | 1/Var | -0.000002 | 0.000001 | 0.000000 | 1.000000 | 0.999986 | 0.000002 | 6.955159 | 23.183865 |
| Se 206.279 463 | 06/18/2015 12:46:09 | 06/17/2015 14:04:56 | Linear | None | -0.000007 | 0.000000 | 0.000000 | 1.000000 | 0.999997 | 0.000005 | 19.643816 | 65.479388 |
| Tl 190.856 476 | 06/18/2015 12:46:09 | 06/17/2015 14:00:38 | Linear | 1/Var | 0.000004 | 0.000002 | 0.000000 | 1.000000 | 0.999951 | 0.000003 | 2.730416 | 9.101387 |
| Tl 190.856 477 | 06/18/2015 12:46:09 | 06/17/2015 14:00:38 | Linear | 1/Var | 0.000002 | 0.000001 | 0.000000 | 1.000000 | 0.999857 | 0.000002 | 7.849793 | 26.165977 |
| Tl 276.787 122 | 06/18/2015 12:46:09 | 06/17/2015 14:04:56 | Linear | None | 0.000000 | 0.000000 | 0.000000 | 1.000000 | 0.999958 | 0.000015 | 76.577090 | 255.256966 |
| V 290.882 116 | 06/18/2015 12:46:09 | 06/17/2015 14:04:57 | Linear | 1/Conc | 0.000016 | 0.000002 | 0.000000 | 1.000000 | 0.999847 | 0.000002 | 2.745354 | 9.151178 |
| V 292.402 115 | 06/18/2015 12:46:09 | 06/17/2015 14:00:38 | Linear | 1/Conc | 0.000001 | 0.000004 | 0.000000 | 1.000000 | 0.999928 | 0.000000 | 2.345889 | 7.819629 |
| Zn 206.200 463 | 06/18/2015 12:46:09 | 06/17/2015 14:09:07 | Full Fit | 1/Conc | 0.000000 | 0.000005 | -0.000000 | 1.000000 | 1.000000 | 0.000000 | 0.282711 | 0.942372 |
| Zn 213.856 457 | 06/18/2015 12:46:09 | 06/17/2015 14:09:07 | Curvilin | 1/Conc | 0.000027 | 0.000073 | -0.000000 | 1.000000 | 0.999994 | 0.000021 | 0.114672 | 0.382240 |
| Zn 213.856 458 | 06/18/2015 12:46:09 | 06/17/2015 14:04:57 | Linear | 1/Var | 0.000002 | 0.000007 | 0.000000 | 1.000000 | 0.999639 | 0.000005 | 0.218362 | 0.727874 |
| Y 224.306 450 | 06/18/2015 12:46:09 | 06/17/2015 13:22:03 | Linear | 1/Conc | 0.000000 | 0.000000 | 0.000000 | 1.000000 | 0.000000 | 0.000000 | -1.000000 | -1.000000 |
| Y 371.030 91 | 06/18/2015 12:46:09 | 06/17/2015 13:22:03 | Linear | 1/Conc | 0.000000 | 0.000000 | 0.000000 | 1.000000 | 0.000000 | 0.000000 | -1.000000 | -1.000000 |
| Na 330.298 102 | 06/18/2015 12:46:09 | 06/17/2015 14:04:57 | Linear | 1/Conc | 0.000002 | 0.000000 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 499.179170 | 1663.93056 |
| Na 588.995 57 | 06/18/2015 12:46:09 | 06/17/2015 14:04:57 | Linear | 1/Conc | -0.002397 | 0.000013 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 3.619868 | 12.066226 |
| Si 251.611 134 | 06/18/2015 12:46:09 | 06/17/2015 14:04:57 | Linear | None | -0.000002 | 0.000001 | 0.000000 | 1.000000 | 0.999969 | 0.000031 | 8.420008 | 28.066693 |
| Ti 334.941 101 | 06/18/2015 12:46:09 | 06/17/2015 14:04:57 | Linear | 1/Conc | 0.000000 | 0.000009 | 0.000000 | 1.000000 | 0.999856 | 0.000001 | 0.880851 | 2.936171 |
| Ti 337.280 100 | 06/18/2015 12:46:09 | 06/17/2015 14:04:57 | Linear | 1/Conc | -0.000010 | 0.000008 | 0.000000 | 1.000000 | 0.999875 | 0.000001 | 1.237312 | 4.124372 |
| Sr 407.771 83 | 06/18/2015 12:46:09 | 06/17/2015 14:04:57 | Linear | 1/Conc | -0.000890 | 0.000168 | 0.000000 | 1.000000 | 0.999960 | 0.000006 | 0.084305 | 0.281015 |
| Sr 421.552 80 | 06/18/2015 12:46:09 | 06/17/2015 14:04:57 | Linear | 1/Conc | -0.000018 | 0.000157 | 0.000000 | 1.000000 | 0.999968 | 0.000005 | 0.086084 | 0.286947 |
| Sn 189.989 477 | 06/18/2015 12:46:09 | 06/17/2015 14:04:57 | Curvilin | 1/Conc | 0.000006 | 0.000003 | -0.000000 | 1.000000 | 0.999971 | 0.000000 | 1.265929 | 4.219762 |
| Sn 189.989 478 | 06/18/2015 12:46:09 | 06/17/2015 14:04:57 | Curvilin | 1/Conc | -0.000001 | 0.000001 | 0.000000 | 1.000000 | 0.999984 | 0.000000 | 4.046327 | 13.487756 |
| Sn 283.999 119 | 06/18/2015 12:46:09 | 06/17/2015 14:04:57 | Linear | 1/Conc | -0.000002 | 0.000000 | 0.000000 | 1.000000 | 0.999705 | 0.000000 | 31.148820 | 103.829400 |
| B 249.678 135 | 06/18/2015 12:46:09 | 06/17/2015 14:04:57 | Linear | 1/Conc | 0.000000 | 0.000001 | 0.000000 | 1.000000 | 0.999650 | 0.000000 | 4.955407 | 16.518023 |
| B 249.773 135 | 06/18/2015 12:46:09 | 06/17/2015 14:04:57 | Linear | 1/Conc | -0.000004 | 0.000001 | 0.000000 | 1.000000 | 0.999720 | 0.000000 | 3.636354 | 12.121180 |
| Li 670.784 50 | 06/18/2015 12:46:09 | 06/17/2015 14:04:57 | Linear | 1/Conc | 0.000111 | 0.000036 | 0.000000 | 1.000000 | 0.999750 | 0.000011 | 0.894437 | 2.981455 |
| 766.490 44 | 06/18/2015 12:46:09 | 06/17/2015 14:04:57 | Linear | 1/Conc | 0.000051 | 0.000001 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 18.110026 | 60.366755 |
| 769.896 44 | 06/18/2015 12:46:09 | 06/17/2015 14:04:57 | Linear | 1/Conc | 0.000141 | 0.000001 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 42.491678 | 141.638926 |
| P 177.495 489 | 06/18/2015 12:46:09 | 06/17/2015 14:04:58 | Linear | 1/Conc | -0.000023 | 0.000001 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 3.927797 | 13.092655 |
| P 213.618 158 | 06/18/2015 12:46:09 | 06/17/2015 14:04:58 | Linear | 1/Conc | 0.000009 | 0.000000 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 110.032959 | 366.776532 |
| P 213.618 457 | 06/18/2015 12:46:09 | 06/17/2015 14:04:58 | Linear | 1/Conc | -0.000003 | 0.000001 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 5.437197 | 18.123989 |
| S 180.731 486 | 06/18/2015 12:46:09 | 06/17/2015 14:13:27 | Linear | 1/Conc | -0.000032 | 0.000001 | 0.000000 | 1.000000 | 0.955729 | 0.000829 | 3.255044 | 10.850148 |
| S 182.034 485 | 06/18/2015 12:46:09 | 06/17/2015 14:13:27 | Linear | 1/Conc | -0.000005 | 0.000001 | 0.000000 | 1.000000 | 0.953597 | 0.000520 | 5.130027 | 17.100090 |
| S 182.624 484 | 06/18/2015 12:46:09 | 06/17/2015 14:13:27 | Linear | None | -0.008868 | 0.000000 | 0.000000 | 1.000000 | 0.931745 | 0.013286 | 11.056224 | 36.854081 |
| 239.709 140 | 06/18/2015 12:46:09 | 06/17/2015 14:00:39 | Linear | 1/Conc | 0.000003 | 0.000000 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 32.243362 | 107.477875 |
| 245.148 137 | 06/18/2015 12:46:09 | 06/17/2015 14:00:39 | Linear | 1/Conc | -0.000000 | 0.000000 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 126.792416 | 422.641387 |

| Element, Wavelength and Order | Status | Reslope | | QC Norm | |
|---|---|---|---|---|---|
| | | Slope | Y-int | Slope factor | Offset |
| Ag 328.068 ▯103▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ag 338.289 ▯100▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Al 308.215 ▯109▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Al 309.271 ▯109▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Al 396.152 ▯ 85▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Al 167.079 ▯502▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| As 193.759 ▯474▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| As 189.042 ▯479▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ba 455.403 ▯ 74▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ba 493.409 ▯ 68▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Be 313.042 ▯108▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Be 234.861 ▯144▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ca 315.887 ▯107▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ca 317.933 ▯106▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ca 393.366 ▯ 86▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ca 396.847 ▯ 85▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cd 214.438 ▯457▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cd 226.502 ▯149▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cd 226.502 ▯449▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cd 228.802 ▯447▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Co 228.616 ▯147▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Co 228.616 ▯447▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Co 238.892 ▯141▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cr 267.716 ▯126▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cr 283.563 ▯119▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cu 224.700 ▯450▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cu 324.754 ▯104▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cu 327.396 ▯103▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Fe 234.349 ▯144▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Fe 239.562 ▯141▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Fe 259.940 ▯130▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mg 202.582 ▯466▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mg 279.079 ▯121▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mg 280.270 ▯120▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mn 257.610 ▯131▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mn 259.373 ▯130▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mn 293.930 ▯115▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mo 203.844 ▯465▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mo 202.030 ▯467▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mo 204.598 ▯465▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ni 221.647 ▯452▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ni 231.604 ▯146▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ni 231.604 ▯445▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Pb 216.999 ▯455▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |

| Element, Wavelength and Order | Status | Reslope | | QC Norm | |
|---|---|---|---|---|---|
| | | Slope | Y-int | Slope factor | Offset |
| Pb 220.353 □153□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Pb 220.353 □453□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Pb 283.306 □119□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sb 206.833 □463□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sb 217.581 □455□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Se 196.090 □172□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Se 196.090 □472□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Se 206.279 □463□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Tl 190.856 □476□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Tl 190.856 □477□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Tl 276.787 □122□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| V 290.882 □116□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| V 292.402 □115□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Zn 206.200 □463□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Zn 213.856 □457□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Zn 213.856 □458□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Y 224.306 □450□□ | □ arnin | 1.000000 | 0.000000 | 1 | 0 |
| Y 371.030 □ 91□□ | □ arnin | 1.000000 | 0.000000 | 1 | 0 |
| Na 330.298 □102□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Na 588.995 □ 57□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Si 251.611 □134□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Ti 334.941 □101□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Ti 337.280 □100□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sr 407.771 □ 83□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sr 421.552 □ 80□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sn 189.989 □477□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sn 189.989 □478□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sn 283.999 □119□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| B 249.678 □135□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| B 249.773 □135□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Li 670.784 □ 50□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| □ 766.490 □ 44□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| □ 769.896 □ 44□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| P 177.495 □489□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| P 213.618 □158□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| P 213.618 □457□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| S 180.731 □486□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| S 182.034 □485□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| S 182.624 □484□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| □ 239.709 □140□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| □ 245.148 □137□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |

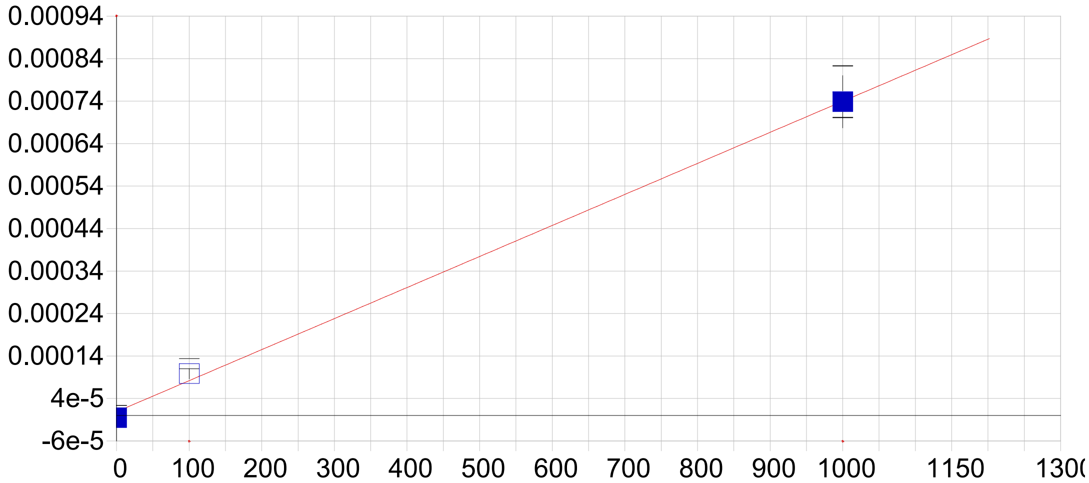



**Ag 328.068 {103}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000038 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000008 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999818 | Status: | OK. |
| Std Error of Est: | 0.000009 | | |
| Predicted MDL: | 3.006245 | | |
| Predicted MQL: | 10.020816 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.45945 | -.459 | .000 | .00003 | .000 | 1 |
| CalStd5=10 | 10.000 | 11.330 | 1.33 | 13.3 | .00013 | .000 | 1 |
| CalStd8=100 | 100.00 | 99.874 | -.126 | -.126 | .00086 | .000 | 1 |
| CalStd3=1 | 1.0000 | .25492 | -.745 | -74.5 | .00004 | .000 | 1 |

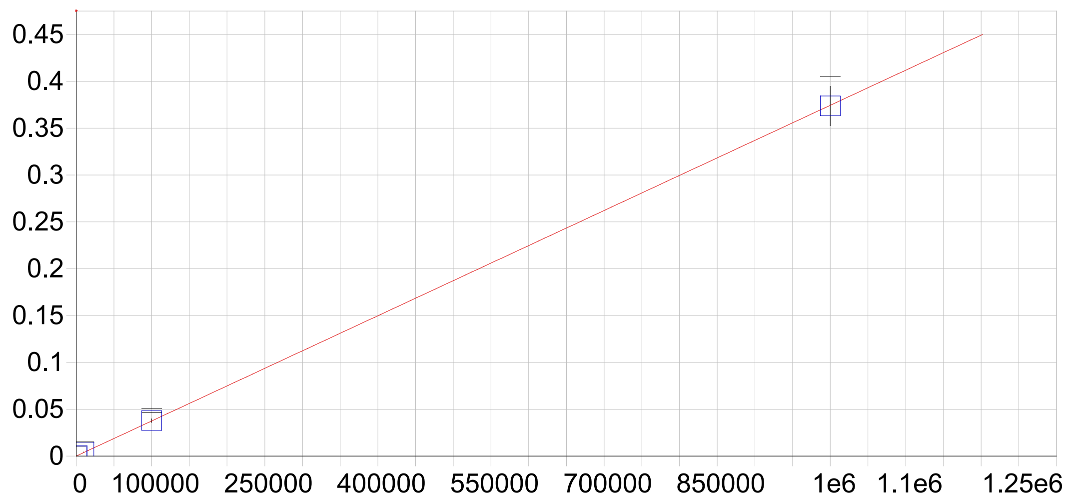



**Ag 338.289 {100}**

Date o Fit: 06/18/2015 12:46:09 Type o Fit: Linear  eighting: None

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000009 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999255 | Status: | O . |
| Std Error o Est: | 0.000022 | | |
| Predicted MDL: | 10.493131 | | |
| Predicted MQL: | 34.977104 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -20.102 | -20.1 | .000 | -.00001 | .000 | 1 |
| CalStd8=100 | 100.00 | 122.33 | 22.3 | 22.3 | .00010 | .000 | 1 |
| CalStd9=100 | 1000.0 | 997.77 | -2.23 | -.223 | .00074 | .000 | 1 |

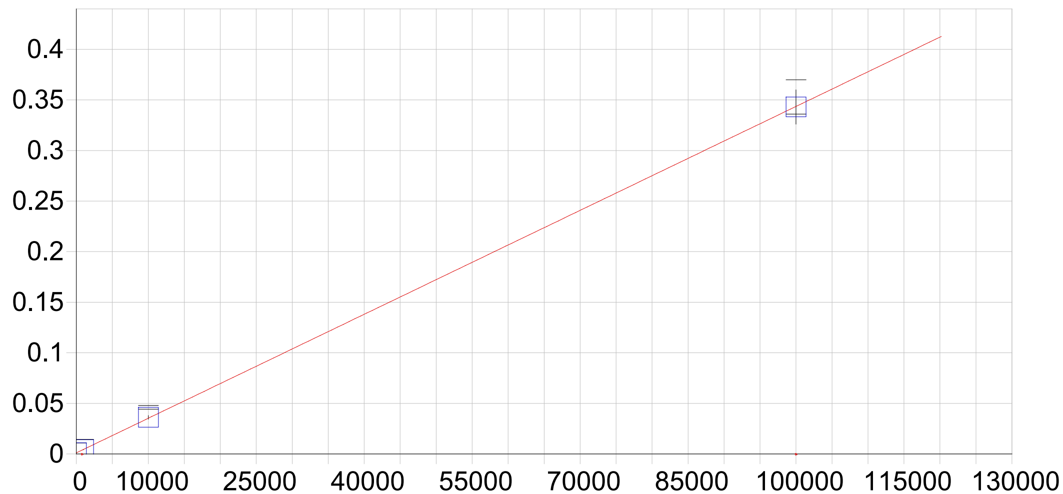



**Al 308.215 {109}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000045 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999940 | Status: | OK . |
| Std Error of Est: | 0.000006 | | |
| Predicted MDL: | 19.793755 | | |
| Predicted MQL: | 65.979184 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.13168 | -.132 | .000 | .00004 | .000 | 1 |
| CalStd10=10 | 10000. | 11101. | 1100. | 11.0 | .00420 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1014.6 | 14.6 | 1.46 | .00042 | .000 | 1 |
| CalStd12-100 | 100000. | 100910. | 909. | .909 | .03782 | .002 | 1 |
| CalStd14-100 | 1000000. | 997980. | -2020. | -.202 | .37368 | .021 | 1 |

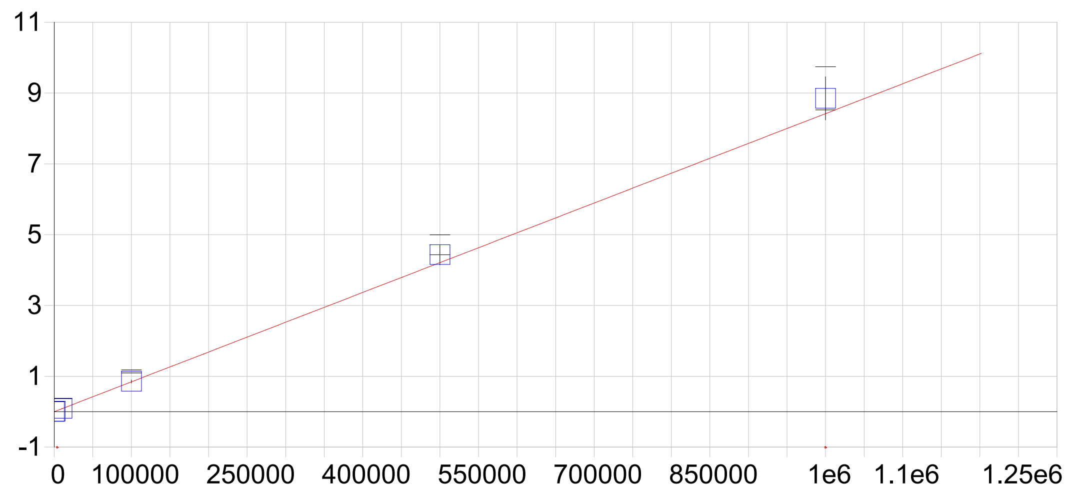



**Al 309.271 {109}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.001031 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999953 | Status: | OK . |
| Std Error of Est: | 0.000016 | | |
| Predicted MDL: | 12.905999 | | |
| Predicted MQL: | 43.019998 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .04093 | .041 | .000 | .00103 | .000 | 1 |
| CalStd10=10 | 10000. | 10245. | 245. | 2.45 | .03613 | .002 | 1 |
| CalStd9=100 | 1000.0 | 936.37 | -63.6 | -6.36 | .00424 | .000 | 1 |
| CalStd12-100 | 100000. | 99818. | -182. | -.182 | .34297 | .017 | 1 |

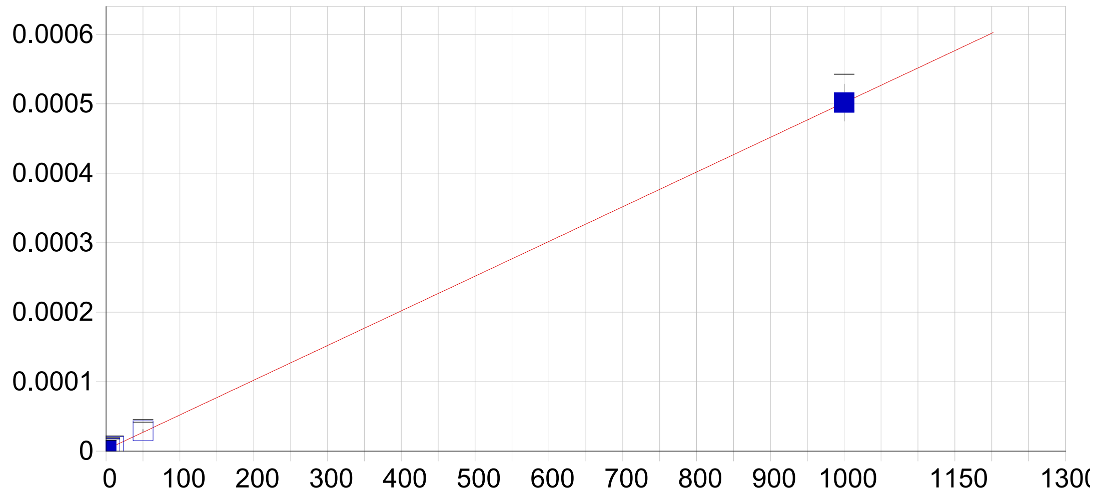



**Al 396.152 { 85}**

| | | | | | |
|---|---|---|---|---|---|
| Date o▯ Fit: | 06/18/2015 12:46:09 | Type o▯ Fit: | Linear | ▯ eighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (O▯▯set): | -0.000023 | Re-Slope: | 1.000000 |
| A1 (▯ ain): | 0.000008 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E▯ ponent): | 1.000000 | | |
| Correlation: | 0.998888 | Status: | O▯ . |
| Std Error o▯ Est: | 0.000148 | | |
| Predicted MDL: | 7.878314 | | |
| Predicted MQL: | 26.261048 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 2.0637 | 2.06 | .000 | -.00001 | .000 | 1 |
| CalStd14-100 | 1000000. | 1051100. | 51100. | 5.11 | 8.8507 | .611 | 1 |
| CalStd13=50 | 500000. | 526190. | 26200. | 5.24 | 4.4307 | .280 | 1 |
| CalStd10=10 | 10000. | 10480. | 480. | 4.80 | .08822 | .005 | 1 |
| CalStd12-100 | 100000. | 101260. | 1260. | 1.26 | .85266 | .043 | 1 |
| CalStd9=100 | 1000.0 | 947.44 | -52.6 | -5.26 | .00795 | .000 | 1 |

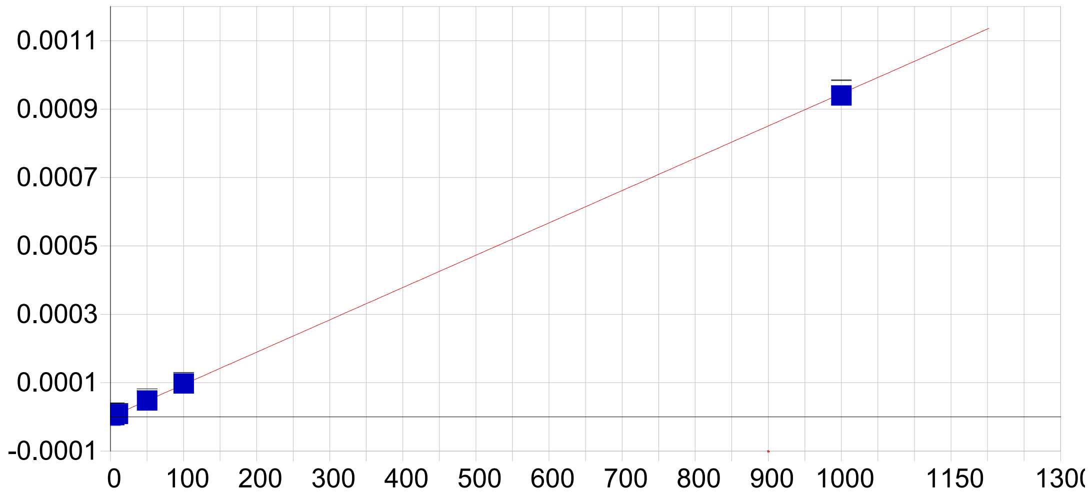



**Al 167.079 {502}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000002 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999983 | Status: | O . |
| Std Error o Est: | 0.000001 | | |
| Predicted MDL: | 1.589316 | | |
| Predicted MQL: | 5.297721 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -2.8231 | -2.82 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.80 | -.202 | -.020 | .00050 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.006 | .006 | .058 | .00001 | .000 | 1 |
| CalStd4=5 | 5.0000 | 3.8588 | -1.14 | -22.8 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 54.161 | 4.16 | 8.32 | .00003 | .000 | 1 |

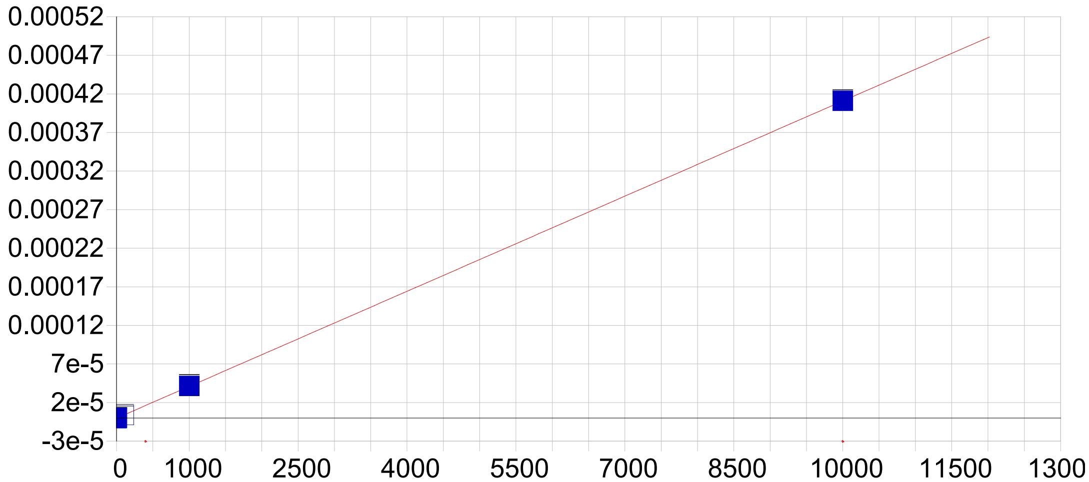



**As 193.759 {474}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000000 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999798 | Status: | O . |
| Std Error o Est: | 0.000002 | | |
| Predicted MDL: | 6.527768 | | |
| Predicted MQL: | 21.759225 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 3.0518 | 3.05 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 993.52 | -6.48 | -.648 | .00094 | .000 | 1 |
| CalStd7=50 | 50.000 | 50.041 | .041 | .083 | .00005 | .000 | 1 |
| CalStd5=10 | 10.000 | 8.6646 | -1.34 | -13.4 | .00001 | .000 | 1 |
| CalStd8=100 | 100.00 | 102.85 | 2.85 | 2.85 | .00010 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.8933 | -.107 | -2.13 | .00000 | .000 | 1 |

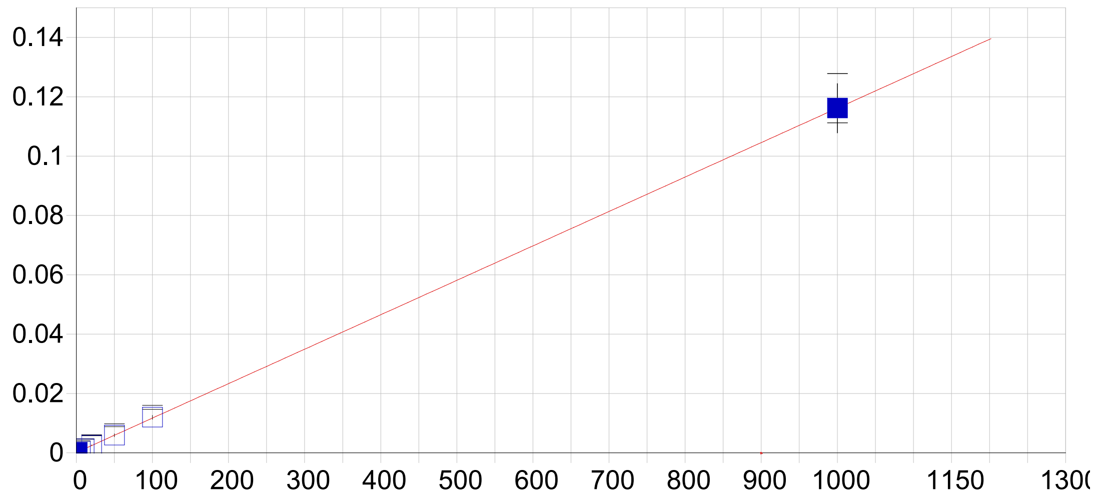



**As 189.042 {479}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000000 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999999 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 20.590398 | | |
| Predicted MQL: | 68.634659 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -8.0385 | -8.04 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1011.5 | 11.5 | 1.15 | .00004 | .000 | 1 |
| CalStd10=10 | 10000. | 9998.9 | -1.10 | -.011 | .00041 | .000 | 1 |
| CalStd8=100 | 100.00 | 95.397 | -4.60 | -4.60 | .00000 | .000 | 1 |
| CalStd4=5 | 5.0000 | 7.2719 | 2.27 | 45.4 | .00000 | .000 | 1 |

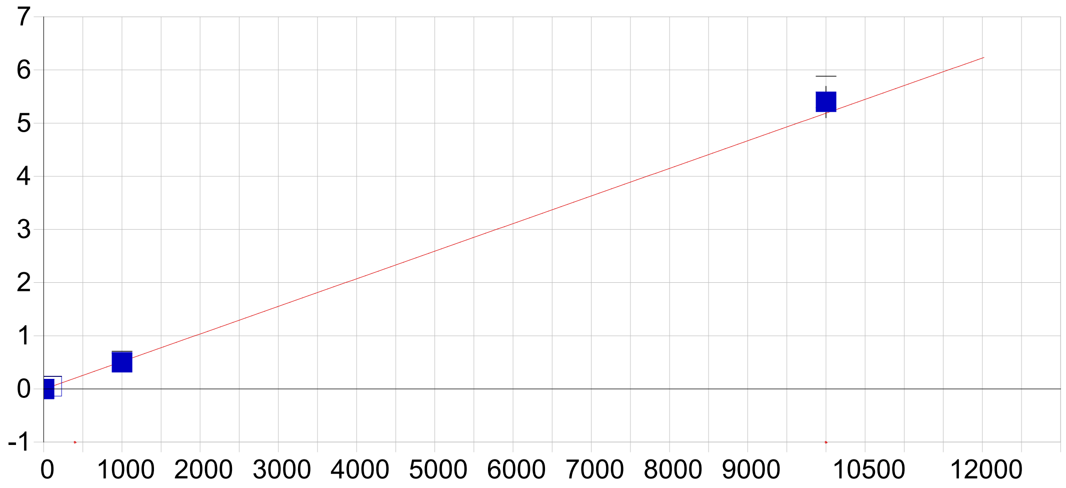



**Ba 455.403 { 74}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000108 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000116 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999996 | Status: | O . |
| Std Error o Est: | 0.000117 | | |
| Predicted MDL: | 0.169570 | | |
| Predicted MQL: | 0.565234 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.82322 | -.823 | .000 | .00001 | .000 | 1 |
| CalStd7=50 | 50.000 | 50.027 | .027 | .053 | .00591 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.074 | .074 | .741 | .00128 | .000 | 1 |
| CalStd6=20 | 20.000 | 20.820 | .820 | 4.10 | .00252 | .000 | 1 |
| CalStd8=100 | 100.00 | 102.09 | 2.09 | 2.09 | .01196 | .001 | 1 |
| CalStd4=5 | 5.0000 | 4.3811 | -.619 | -12.4 | .00062 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.78 | -.224 | -.022 | .11614 | .008 | 1 |
| CalStd3=1 | 1.0000 | .40554 | -.594 | -59.4 | .00015 | .000 | 1 |
| CalStd2=0.5 | .50000 | -.25366 | -.754 | -151. | .00008 | .000 | 1 |

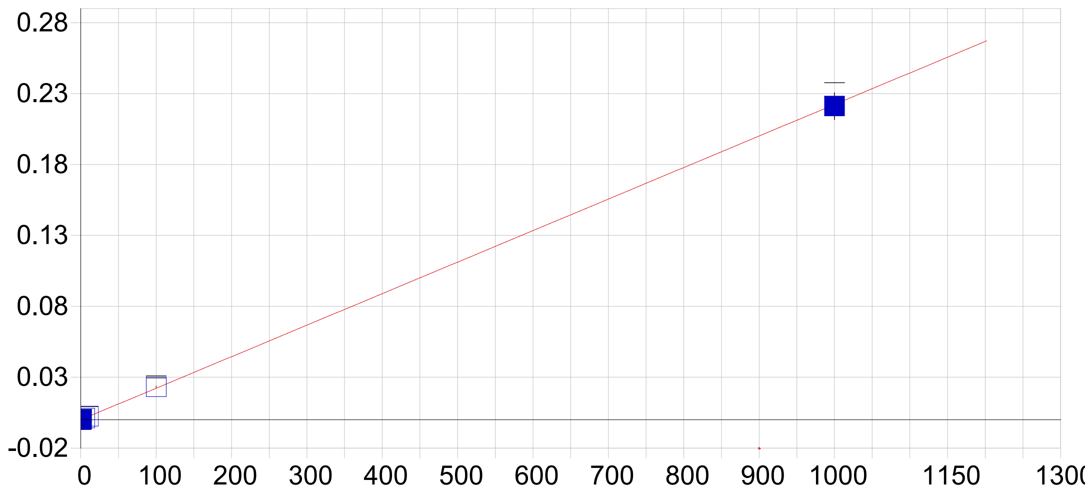



**Ba 493.409 { 68}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (O set): | -0.005215 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000519 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999661 | Status: | O . |
| Std Error o Est: | 0.000264 | | |
| Predicted MDL: | 0.523476 | | |
| Predicted MQL: | 1.744919 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .05914 | .059 | .000 | -.00518 | .000 | 1 |
| CalStd9=100 | 1000.0 | 969.29 | -30.7 | -3.07 | .49819 | .022 | 1 |
| CalStd10=10 | 10000. | 10403. | 403. | 4.03 | 5.3977 | .296 | 1 |
| CalStd8=100 | 100.00 | 100.83 | .832 | .832 | .04714 | .002 | 1 |
| CalStd4=5 | 5.0000 | 4.9151 | -.085 | -1.70 | -.00266 | .000 | 1 |

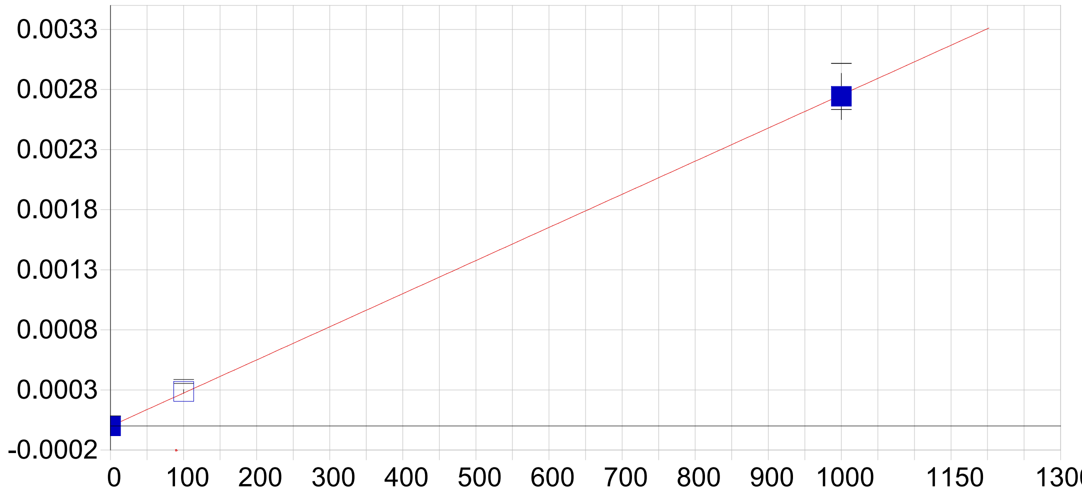



**Be 313.042 {108}**

| | | | | | |
|---|---|---|---|---|---|
| Date o□ Fit: | 06/18/2015 12:46:09 | Type o□ Fit: | Linear | □ eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O□□set): | 0.000002 | Re-Slope: | 1.000000 |
| A1 (□ ain): | 0.000222 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E□ ponent): | 1.000000 | | |
| Correlation: | 0.999871 | Status: | O□ . |
| Std Error o□ Est: | 0.000002 | | |
| Predicted MDL: | 0.088853 | | |
| Predicted MQL: | 0.296175 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00004 | .000 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.672 | .672 | 6.72 | .00238 | .000 | 1 |
| CalStd8=100 | 100.00 | 104.33 | 4.33 | 4.33 | .02320 | .001 | 1 |
| CalStd2=0.5 | .50000 | .51090 | .011 | 2.18 | .00012 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.2711 | .271 | 5.42 | .00117 | .000 | 1 |
| CalStd1=0.25 | .25000 | .22436 | -.026 | -10.3 | .00005 | .000 | 1 |
| CalStd9=100 | 1000.0 | 994.64 | -5.36 | -.536 | .22116 | .009 | 1 |
| CalStd3=1 | 1.0000 | 1.0972 | .097 | 9.72 | .00025 | .000 | 1 |

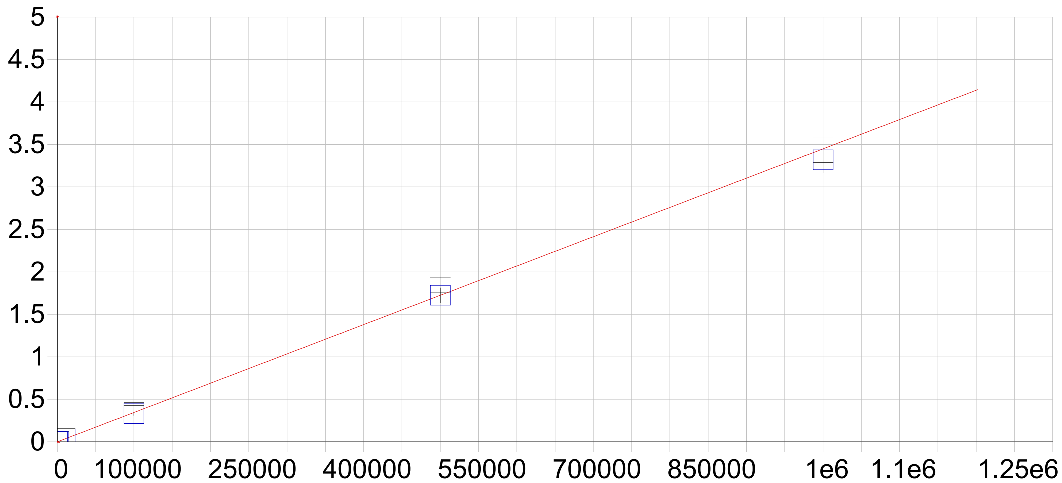



**Be 234.861 {144}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O set): | -0.000002 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999900 | Status: | O . |
| Std Error o Est: | 0.000001 | | |
| Predicted MDL: | 0.980620 | | |
| Predicted MQL: | 3.268735 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00403 | -.004 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 995.53 | -4.47 | -.447 | .00274 | .000 | 1 |
| CalStd8=100 | 100.00 | 104.47 | 4.47 | 4.47 | .00029 | .000 | 1 |

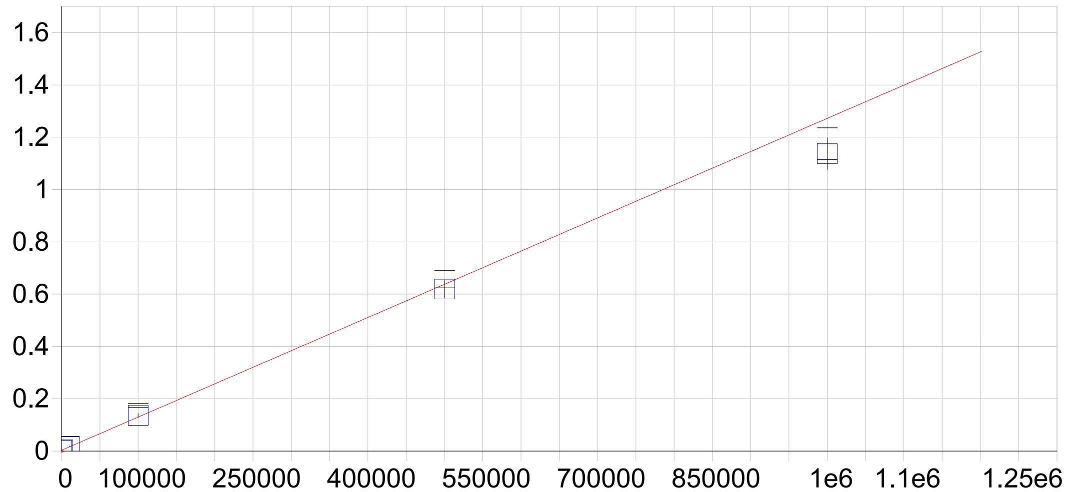



**Ca 315.887 {107}**

Date of Fit: 06/18/2015 12:46:09 Type of Fit: Curvilinear Weighting: 1/Conc

A0 (Offset): 0.000317 Re-Slope: 1.000000
A1 (Gain): 0.000003 Y-int: 0.000000
A2 (Curvature): 0.000000
n (Exponent): 1.000000
Correlation: 0.999890 Status: OK .
Std Error of Est: 0.000089
Predicted MDL: 8.041294
Predicted MQL: 26.804314

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .11768 | .118 | .000 | .00032 | .000 | 1 |
| CalStd10=10 | 10000. | 9849.4 | -151. | -1.51 | .03428 | .002 | 1 |
| CalStd13=50 | 500000. | 499630. | -374. | -.075 | 1.7230 | .088 | 1 |
| CalStd14-100 | 1000000. | 962340. | -37700. | -3.77 | 3.3185 | .151 | 1 |
| CalStd9=100 | 1000.0 | 927.13 | -72.9 | -7.29 | .00351 | .000 | 1 |
| CalStd12-100 | 100000. | 95384. | -4620. | -4.62 | .32920 | .017 | 1 |

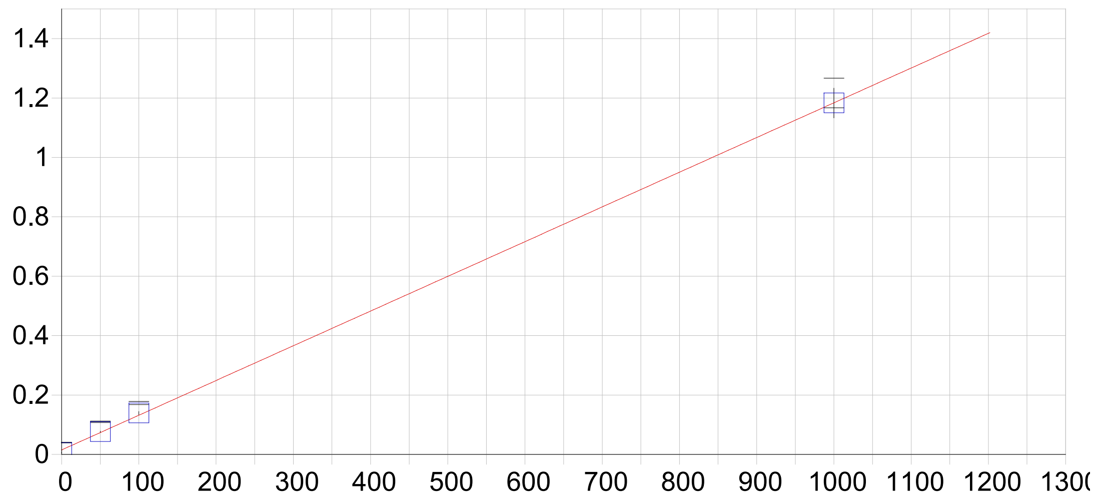



**Ca 317.933 {106}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.003373 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.995988 | Status: | O . |
| Std Error o Est: | 0.000342 | | |
| Predicted MDL: | 4.076126 | | |
| Predicted MQL: | 13.587085 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -42.993 | -43.0 | .000 | .00332 | .000 | 1 |
| CalStd10=10 | 10000. | 11240. | 1240. | 12.4 | .01764 | .001 | 1 |
| CalStd13=50 | 500000. | 485260. | -14700. | -2.95 | .61921 | .033 | 1 |
| CalStd14-100 | 1000000. | 893280. | -107000. | -10.7 | 1.1370 | .061 | 1 |
| CalStd9=100 | 1000.0 | 1081.4 | 81.4 | 8.14 | .00475 | .000 | 1 |
| CalStd12-100 | 100000. | 104430. | 4430. | 4.43 | .13590 | .008 | 1 |

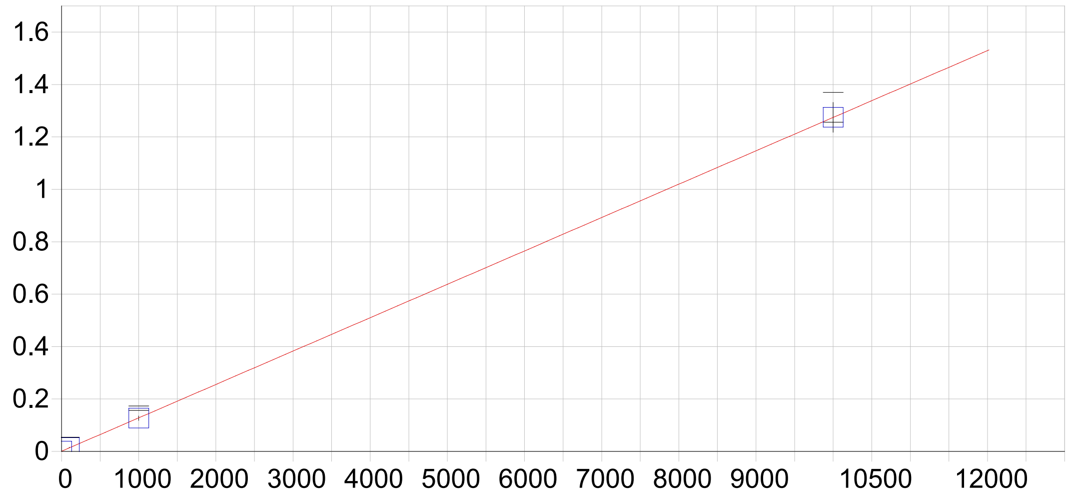



**Ca 393.366 { 86}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.015084 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.001169 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999924 | Status: | OK . |
| Std Error of Est: | 0.008395 | | |
| Predicted MDL: | 0.043403 | | |
| Predicted MQL: | 0.144677 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -7.6822 | -7.68 | .000 | .00610 | .001 | 1 |
| CalStd7=50 | 50.000 | 52.181 | 2.18 | 4.36 | .07608 | .002 | 1 |
| CalStd9=100 | 1000.0 | 999.27 | -.732 | -.073 | 1.1831 | .050 | 1 |
| CalStd8=100 | 100.00 | 106.23 | 6.23 | 6.23 | .13926 | .005 | 1 |

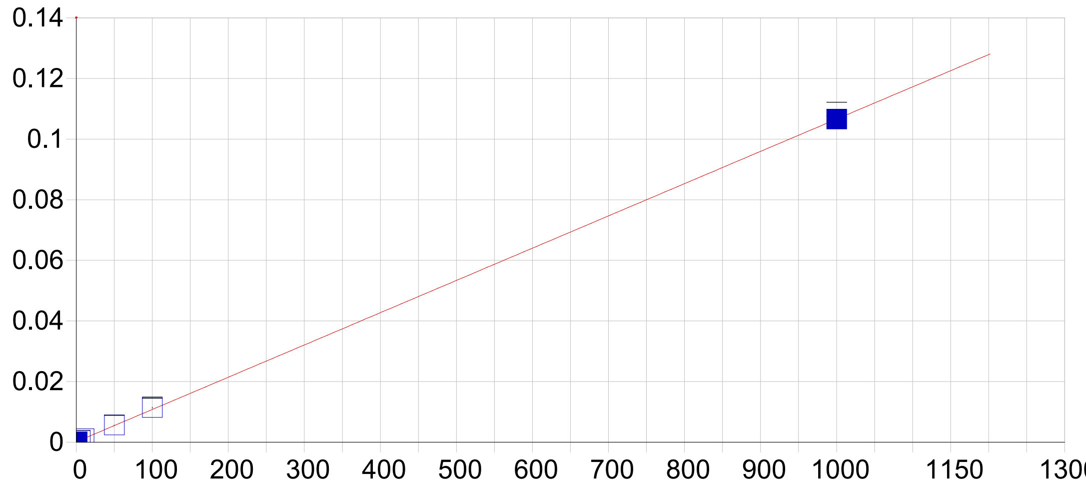



**Ca 396.847 { 85}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000687 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000127 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999998 | Status: | O . |
| Std Error o Est: | 0.001393 | | |
| Predicted MDL: | 0.072995 | | |
| Predicted MQL: | 0.243318 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.41182 | -.412 | .000 | .00064 | .000 | 1 |
| CalStd10=10 | 10000. | 10001. | 1.01 | .010 | 1.2747 | .057 | 1 |
| CalStd8=100 | 100.00 | 110.60 | 10.6 | 10.6 | .01478 | .001 | 1 |
| CalStd9=100 | 1000.0 | 988.80 | -11.2 | -1.12 | .12665 | .009 | 1 |

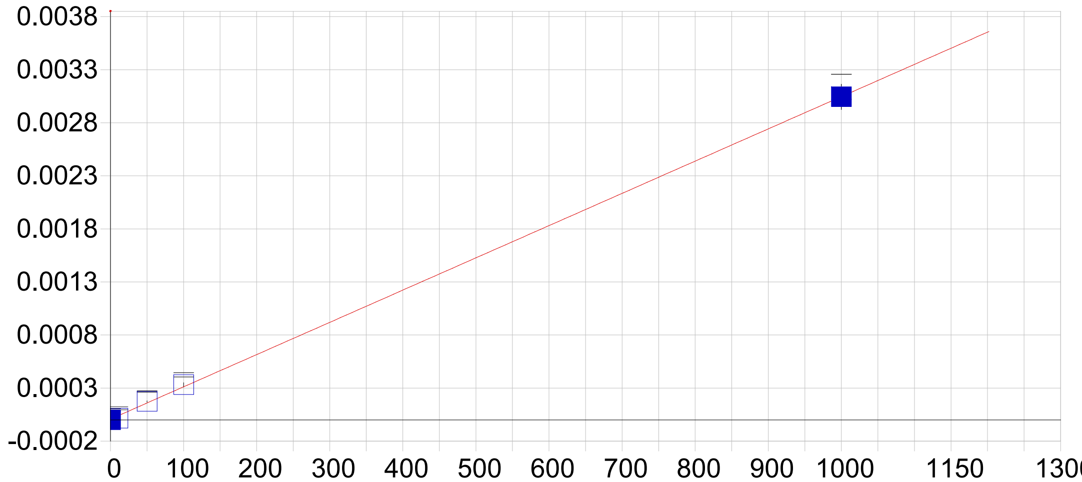



**Cd 214.438 {457}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000163 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000106 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999977 | Status: | OK . |
| Std Error of Est: | 0.000273 | | |
| Predicted MDL: | 0.072962 | | |
| Predicted MQL: | 0.243208 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -1.3708 | -1.37 | .000 | .00002 | .000 | 1 |
| CalStd7=50 | 50.000 | 51.022 | 1.02 | 2.04 | .00559 | .000 | 1 |
| CalStd3=1 | 1.0000 | -.38992 | -1.39 | -139. | .00012 | .000 | 1 |
| CalStd2=0.5 | .50000 | -.83833 | -1.34 | -268. | .00007 | .000 | 1 |
| CalStd4=5 | 5.0000 | 3.8273 | -1.17 | -23.5 | .00057 | .000 | 1 |
| CalStd8=100 | 100.00 | 105.53 | 5.53 | 5.53 | .01140 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.3074 | -.693 | -6.93 | .00115 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.41 | -.589 | -.059 | .10654 | .002 | 1 |

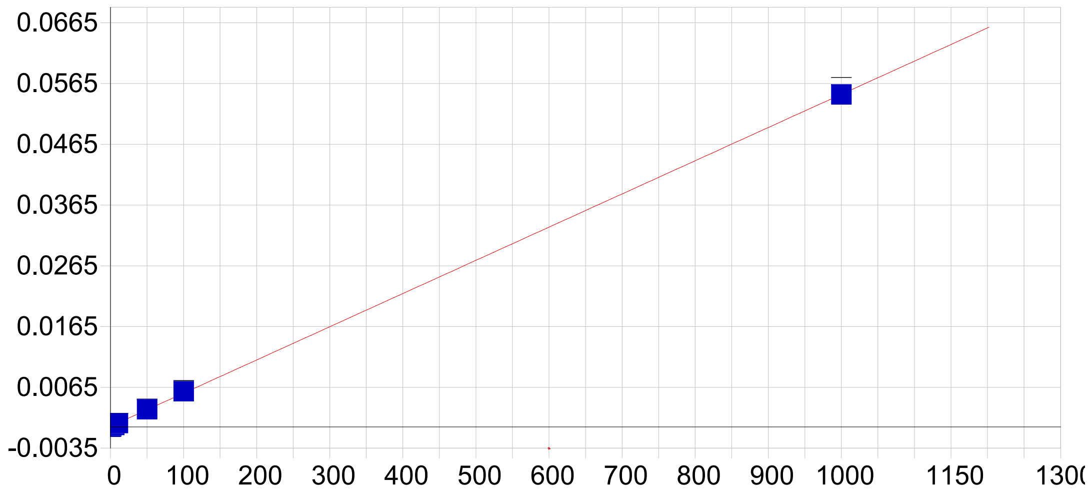



**Cd 226.502 {149}**

Date o Fit: 06/18/2015 12:46:09 Type o Fit: Linear  eighting: None

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000008 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999916 | Status: | O . |
| Std Error o Est: | 0.000020 | | |
| Predicted MDL: | 4.648351 | | |
| Predicted MQL: | 15.494502 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -2.6124 | -2.61 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 54.692 | 4.69 | 9.38 | .00017 | .000 | 1 |
| CalStd8=100 | 100.00 | 106.25 | 6.25 | 6.25 | .00033 | .000 | 1 |
| CalStd5=10 | 10.000 | 2.4500 | -7.55 | -75.5 | .00002 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.22 | -.785 | -.078 | .00304 | .000 | 1 |

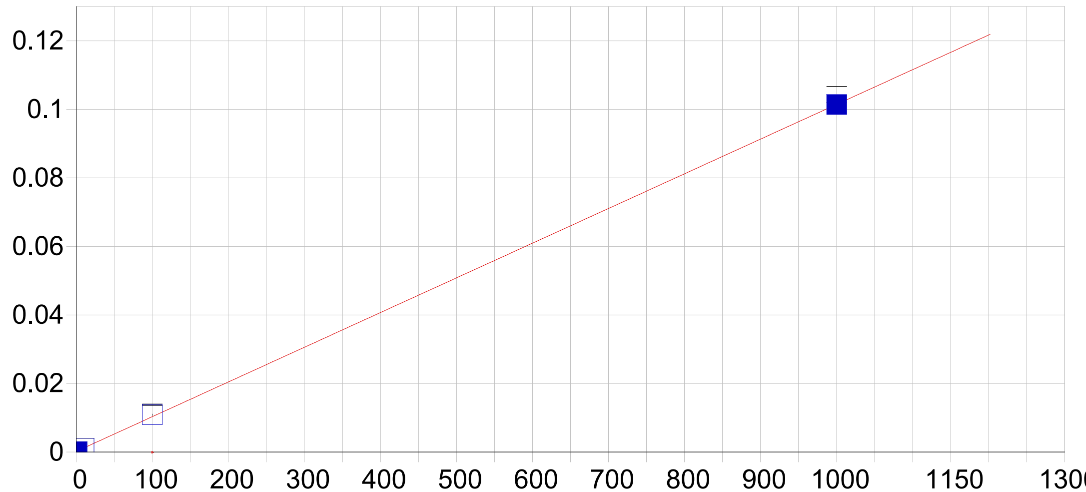



**Cd 226.502 {449}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000079 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000055 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999975 | Status: | OK . |
| Std Error of Est: | 0.000144 | | |
| Predicted MDL: | 0.155629 | | |
| Predicted MQL: | 0.518763 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -1.4088 | -1.41 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 51.089 | 1.09 | 2.18 | .00287 | .000 | 1 |
| CalStd3=1 | 1.0000 | -.39306 | -1.39 | -139. | .00006 | .000 | 1 |
| CalStd2=0.5 | .50000 | -.93163 | -1.43 | -286. | .00003 | .000 | 1 |
| CalStd4=5 | 5.0000 | 3.7743 | -1.23 | -24.5 | .00029 | .000 | 1 |
| CalStd8=100 | 100.00 | 105.67 | 5.67 | 5.67 | .00585 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.3041 | -.696 | -6.96 | .00059 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.39 | -.606 | -.061 | .05469 | .001 | 1 |

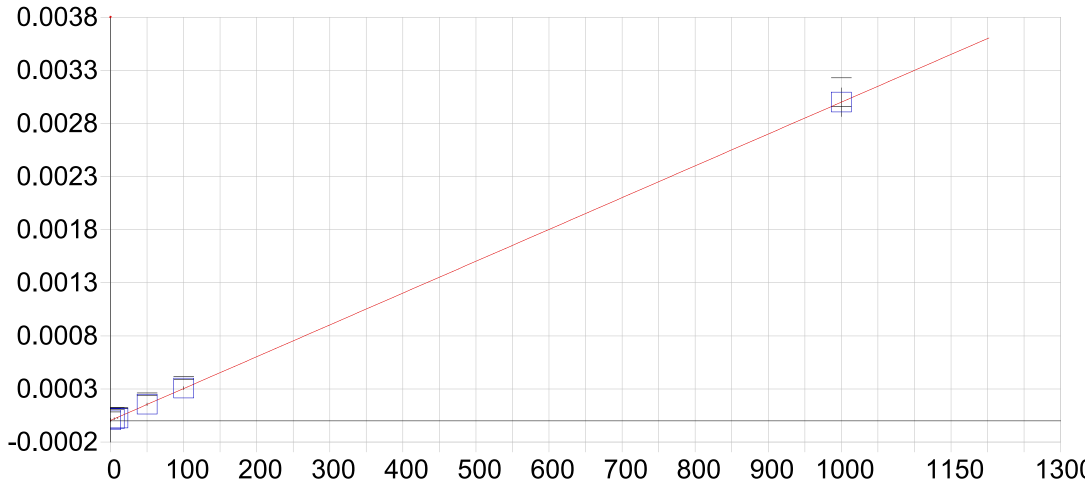



**Cd 228.802 {447}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000185 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000101 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999978 | Status: | OK . |
| Std Error of Est: | 0.000302 | | |
| Predicted MDL: | 0.119347 | | |
| Predicted MQL: | 0.397823 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -1.3873 | -1.39 | .000 | .00004 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.47 | -.530 | -.053 | .10139 | .002 | 1 |
| CalStd8=100 | 100.00 | 105.40 | 5.40 | 5.40 | .01086 | .000 | 1 |
| CalStd2=0.5 | .50000 | -.80756 | -1.31 | -262. | .00010 | .000 | 1 |
| CalStd3=1 | 1.0000 | -.40038 | -1.40 | -140. | .00014 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.2294 | -.771 | -7.71 | .00112 | .000 | 1 |

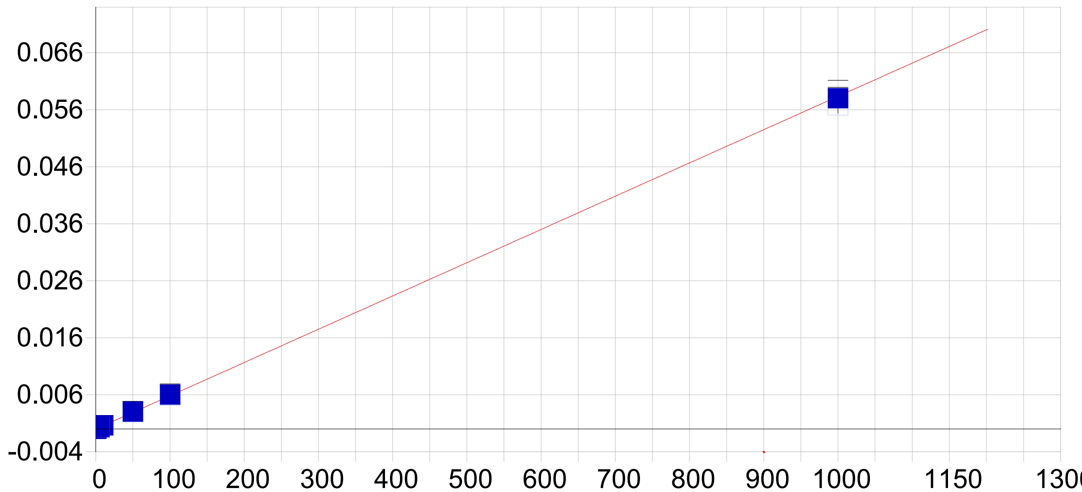



**Co 228.616 {147}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000004 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Eponent): | 1.000000 | | |
| Correlation: | 0.999994 | Status: | O . |
| Std Error o Est: | 0.000005 | | |
| Predicted MDL: | 4.640105 | | |
| Predicted MQL: | 15.467016 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .83631 | .836 | .000 | .00001 | .000 | 1 |
| CalStd7=50 | 50.000 | 50.442 | .442 | .884 | .00016 | .000 | 1 |
| CalStd5=10 | 10.000 | 7.2935 | -2.71 | -27.1 | .00003 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.1704 | .170 | 3.41 | .00002 | .000 | 1 |
| CalStd8=100 | 100.00 | 101.39 | 1.39 | 1.39 | .00031 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.86 | -.135 | -.014 | .00300 | .000 | 1 |

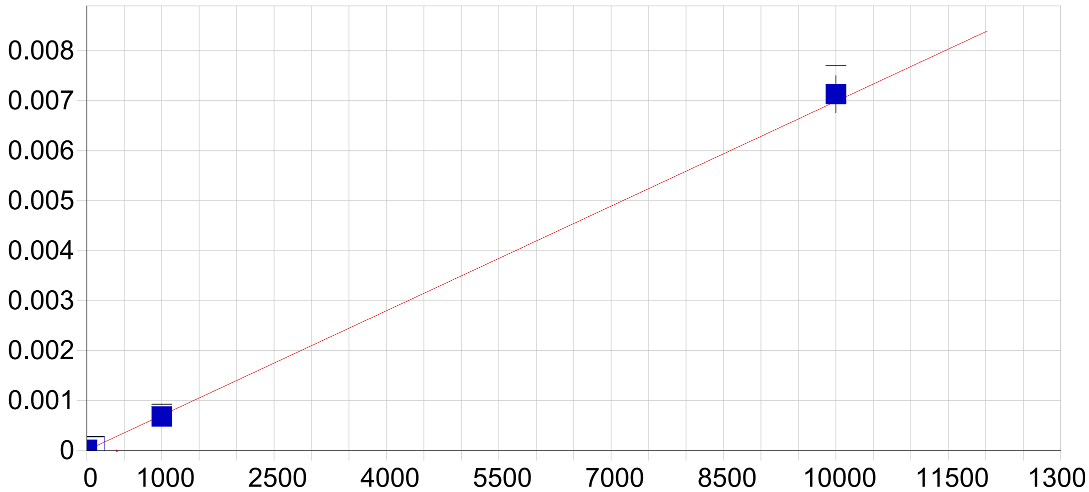



**Co 228.616 {447}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000017 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000058 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Eponent): | 1.000000 | | |
| Correlation: | 0.999890 | Status: | O . |
| Std Error o Est: | 0.000001 | | |
| Predicted MDL: | 0.186253 | | |
| Predicted MQL: | 0.620844 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00020 | .000 | .000 | -.00002 | .000 | 1 |
| CalStd7=50 | 50.000 | 51.972 | 1.97 | 3.94 | .00295 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.662 | .662 | 6.62 | .00059 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.1808 | .181 | 3.62 | .00028 | .000 | 1 |
| CalStd8=100 | 100.00 | 102.89 | 2.89 | 2.89 | .00586 | .000 | 1 |
| CalStd9=100 | 1000.0 | 994.26 | -5.74 | -.574 | .05678 | .001 | 1 |
| CalStd3=1 | 1.0000 | 1.0384 | .038 | 3.84 | .00004 | .000 | 1 |

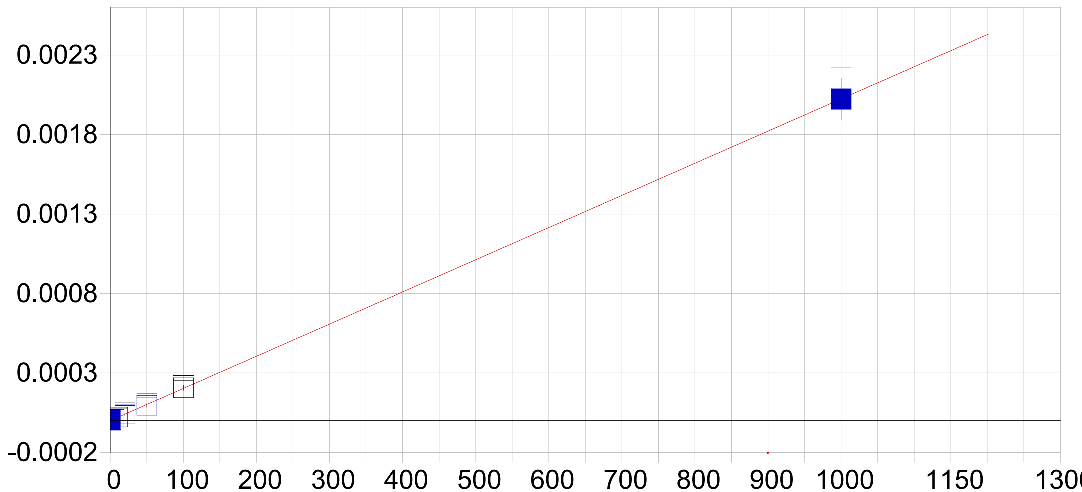



**Co 238.892 {141}**

Date o▯ Fit: 06/18/2015 12:46:09 Type o▯ Fit: Linear ▯ eighting: 1/Var

| | | | |
|---|---|---|---|
| A0 (O▯▯set): | 0.000005 | Re-Slope: | 1.000000 |
| A1 (▯ ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E▯ ponent): | 1.000000 | | |
| Correlation: | 0.999688 | Status: | O▯ . |
| Std Error o▯ Est: | 0.000003 | | |
| Predicted MDL: | 5.103061 | | |
| Predicted MQL: | 17.010204 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .10938 | .109 | .000 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 966.52 | -33.5 | -3.35 | .00068 | .000 | 1 |
| CalStd10=10 | 10000. | 10208. | 208. | 2.08 | .00713 | .000 | 1 |
| CalStd8=100 | 100.00 | 100.23 | .228 | .228 | .00008 | .000 | 1 |

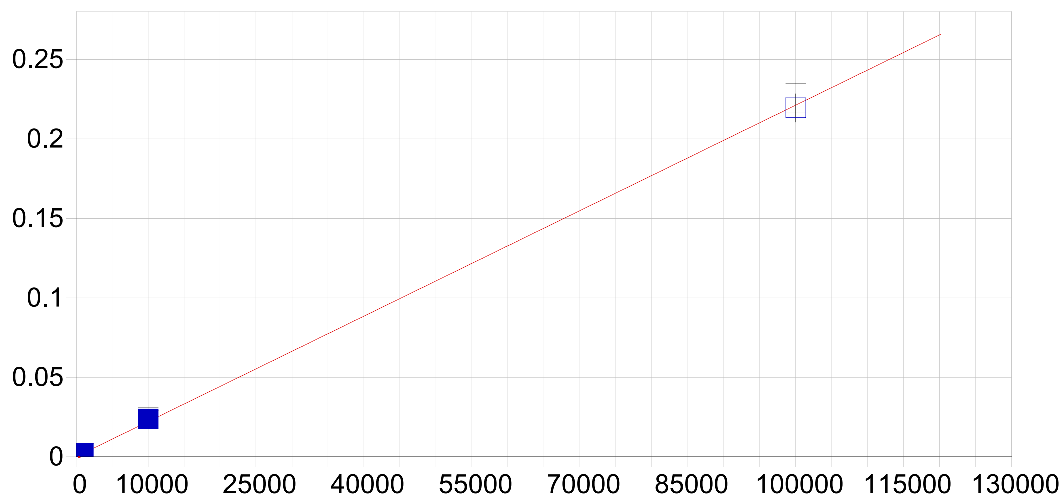



**Cr 267.716 {126}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000000 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000002 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999991 | Status: | OK . |
| Std Error of Est: | 0.000003 | | |
| Predicted MDL: | 2.528205 | | |
| Predicted MQL: | 8.427350 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .53406 | .534 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.693 | .693 | 6.93 | .00002 | .000 | 1 |
| CalStd7=50 | 50.000 | 46.979 | -3.02 | -6.04 | .00010 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.98 | -.023 | -.002 | .00202 | .000 | 1 |
| CalStd6=20 | 20.000 | 19.682 | -.318 | -1.59 | .00004 | .000 | 1 |
| CalStd8=100 | 100.00 | 101.76 | 1.76 | 1.76 | .00021 | .000 | 1 |
| CalStd3=1 | 1.0000 | 2.1996 | 1.20 | 120. | .00000 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.1721 | -.828 | -16.6 | .00001 | .000 | 1 |

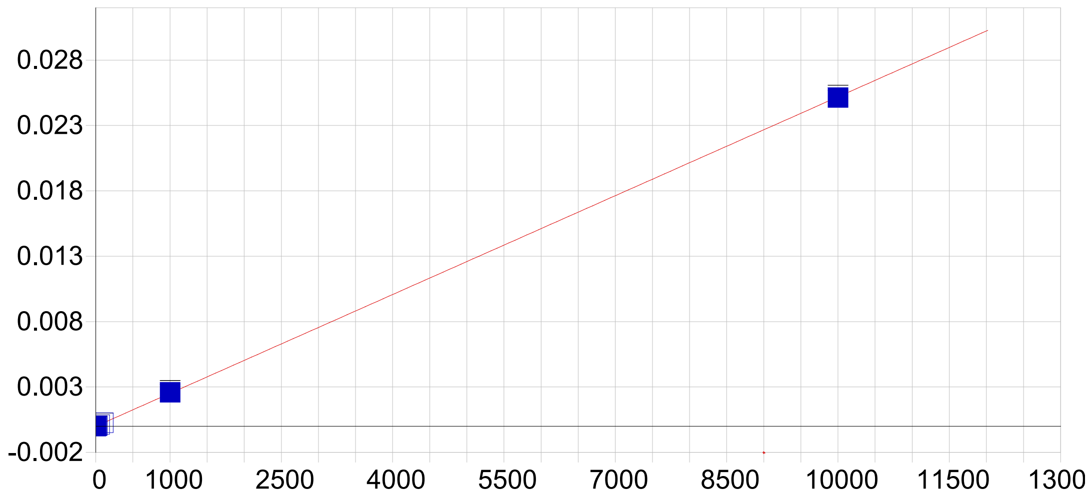



**Cr 283.563 {119}**

| | | | | | |
|---|---|---|---|---|---|
| Date o▯ Fit: | 06/18/2015 12:46:09 | Type o▯ Fit: | Linear | ▯ eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O▯▯set): | 0.000012 | Re-Slope: | 1.000000 |
| A1 (▯ ain): | 0.000002 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E▯ ponent): | 1.000000 | | |
| Correlation: | 0.999714 | Status: | O▯ . |
| Std Error o▯ Est: | 0.000005 | | |
| Predicted MDL: | 2.425741 | | |
| Predicted MQL: | 8.085803 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00738 | -.007 | .000 | .00001 | .000 | 1 |
| CalStd7=50 | 50.000 | 51.149 | 1.15 | 2.30 | .00012 | .000 | 1 |
| CalStd8=100 | 100.00 | 103.14 | 3.14 | 3.14 | .00024 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1025.6 | 25.6 | 2.56 | .00228 | .000 | 1 |
| CalStd10=10 | 10000. | 10753. | 753. | 7.53 | .02383 | .001 | 1 |
| CalStd11-100 | 100000. | 99216. | -784. | -.784 | .21953 | .009 | 1 |

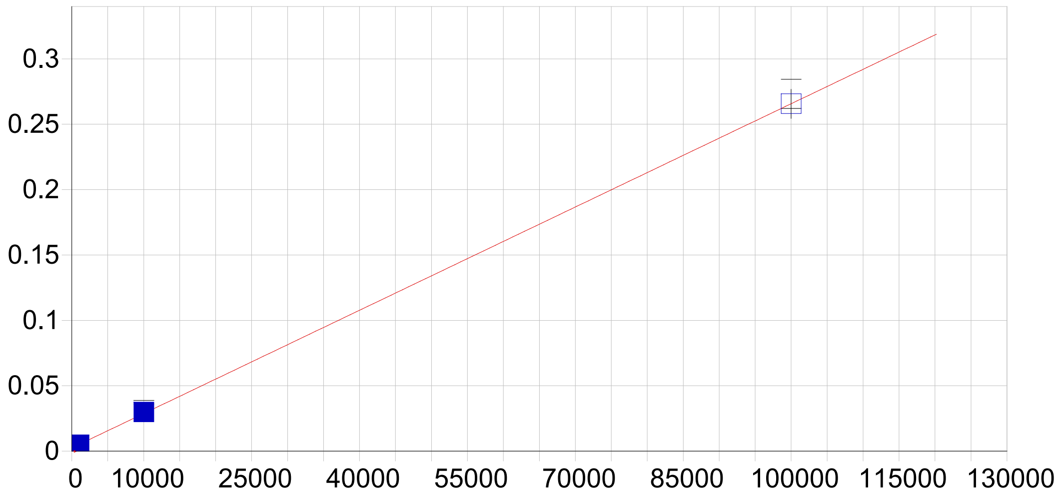



**Cu 224.700 {450}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000008 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999928 | Status: | OK. |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 0.435102 | | |
| Predicted MQL: | 1.450339 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00086 | .001 | .000 | -.00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1027.6 | 27.6 | 2.76 | .00258 | .000 | 1 |
| CalStd7=50 | 50.000 | 49.822 | -.178 | -.356 | .00012 | .000 | 1 |
| CalStd8=100 | 100.00 | 103.32 | 3.32 | 3.32 | .00025 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.0645 | -.936 | -9.36 | .00002 | .000 | 1 |
| CalStd10=10 | 10000. | 9971.9 | -28.1 | -.281 | .02512 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.6883 | -.312 | -6.23 | .00000 | .000 | 1 |
| CalStd6=20 | 20.000 | 19.299 | -.701 | -3.50 | .00004 | .000 | 1 |
| CalStd3=1 | 1.0000 | .27482 | -.725 | -72.5 | -.00001 | .000 | 1 |

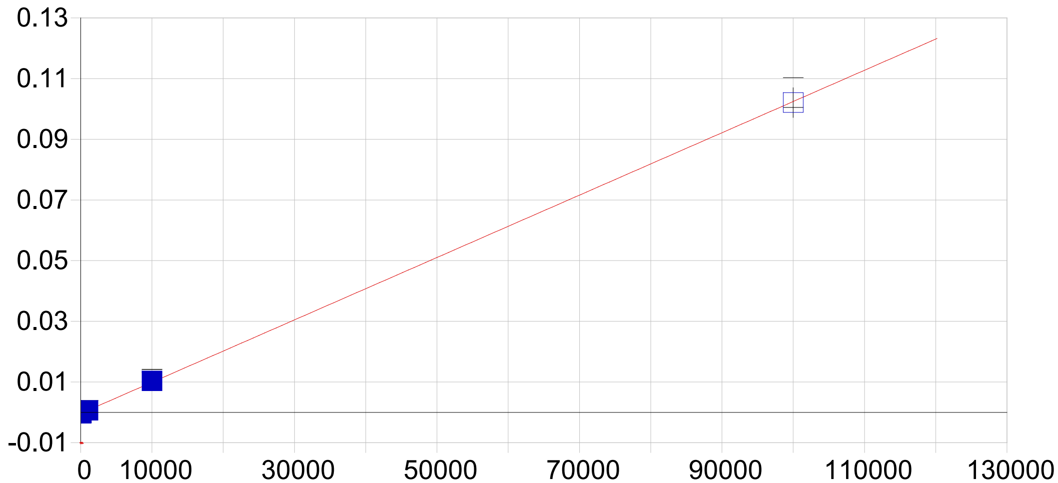



**Cu 324.754 {104}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.002422 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999987 | Status: | OK . |
| Std Error of Est: | 0.000688 | | |
| Predicted MDL: | 2.742590 | | |
| Predicted MQL: | 9.141967 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -129.59 | -130. | .000 | .00208 | .000 | 1 |
| CalStd9=100 | 1000.0 | 884.37 | -116. | -11.6 | .00475 | .000 | 1 |
| CalStd8=100 | 100.00 | -15.776 | -116. | -116. | .00238 | .000 | 1 |
| CalStd10=10 | 10000. | 10400. | 400. | 4.00 | .02980 | .001 | 1 |
| CalStd11-100 | 100000. | 99961. | -38.7 | -.039 | .26558 | .011 | 1 |

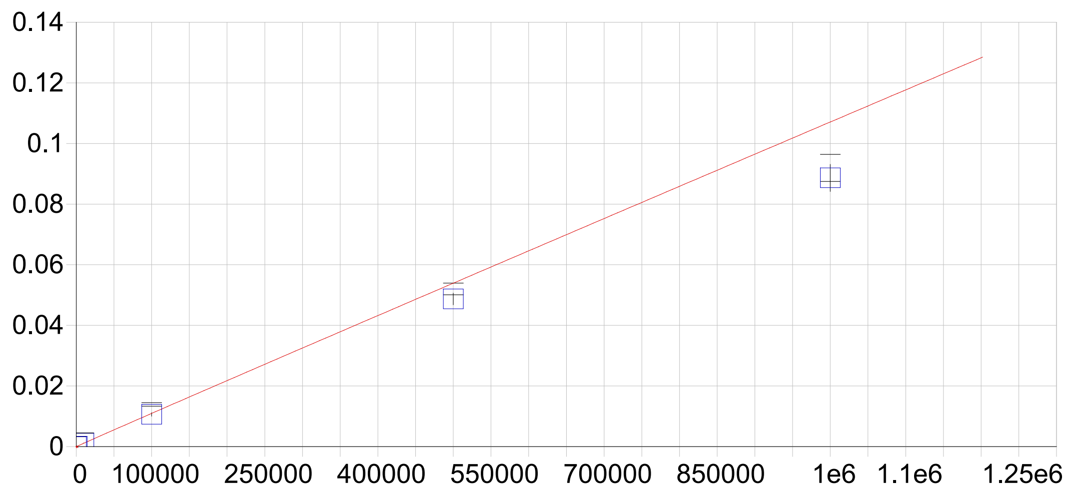



**Cu 327.396 {103}**

| | | | | | |
|---|---|---|---|---|---|
| Date o□ Fit: | 06/18/2015 12:46:09 | Type o□ Fit: | Linear | □ eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O□□set): | -0.000368 | Re-Slope: | 1.000000 |
| A1 (□ ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E□ ponent): | 1.000000 | | |
| Correlation: | 0.999894 | Status: | O□ . |
| Std Error o□ Est: | 0.000001 | | |
| Predicted MDL: | 11.363624 | | |
| Predicted MQL: | 37.878746 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00951 | .010 | .000 | -.00037 | .000 | 1 |
| CalStd6=20 | 20.000 | 15.374 | -4.63 | -23.1 | -.00035 | .000 | 1 |
| CalStd7=50 | 50.000 | 42.671 | -7.33 | -14.7 | -.00032 | .000 | 1 |
| CalStd8=100 | 100.00 | 90.176 | -9.82 | -9.82 | -.00027 | .000 | 1 |
| CalStd9=100 | 1000.0 | 961.92 | -38.1 | -3.81 | .00062 | .000 | 1 |
| CalStd10=10 | 10000. | 10421. | 421. | 4.21 | .01035 | .000 | 1 |
| CalStd11-100 | 100000. | 99639. | -361. | -.361 | .10207 | .005 | 1 |

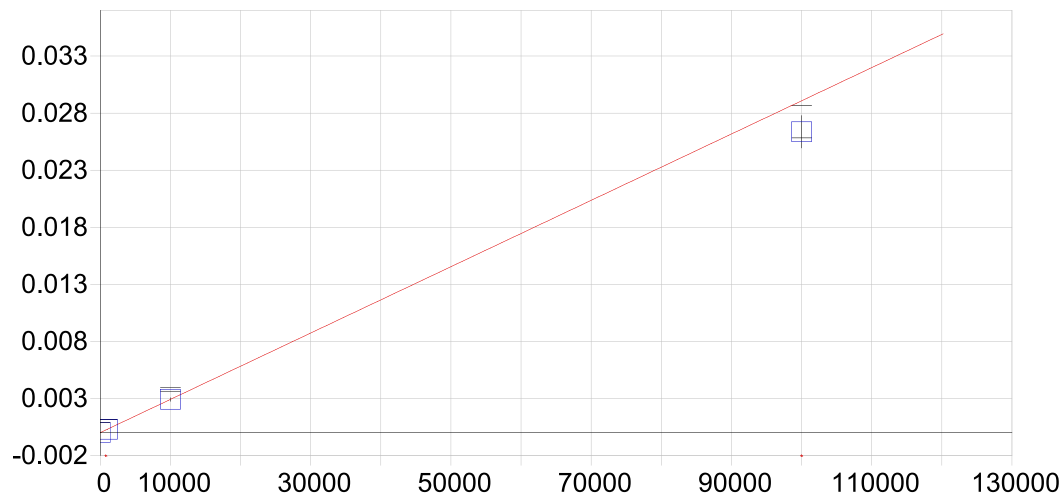



**Fe 234.349 {144}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Full Fit | Weighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000002 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 0.990000 | | |
| Correlation: | 0.999838 | Status: | OK . |
| Std Error of Est: | 0.000003 | | |
| Predicted MDL: | 14.609984 | | |
| Predicted MQL: | 48.699948 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 1.0983 | 1.10 | .000 | .00000 | .000 | 1 |
| CalStd10=10 | 10000. | 10355. | 355. | 3.55 | .00116 | .000 | 1 |
| CalStd13=50 | 500000. | 451100. | -48900. | -9.78 | .04870 | .002 | 1 |
| CalStd14-100 | 1000000. | 826130. | -174000. | -17.4 | .08864 | .004 | 1 |
| CalStd9=100 | 1000.0 | 988.99 | -11.0 | -1.10 | .00012 | .000 | 1 |
| CalStd12-100 | 100000. | 96614. | -3390. | -3.39 | .01059 | .001 | 1 |

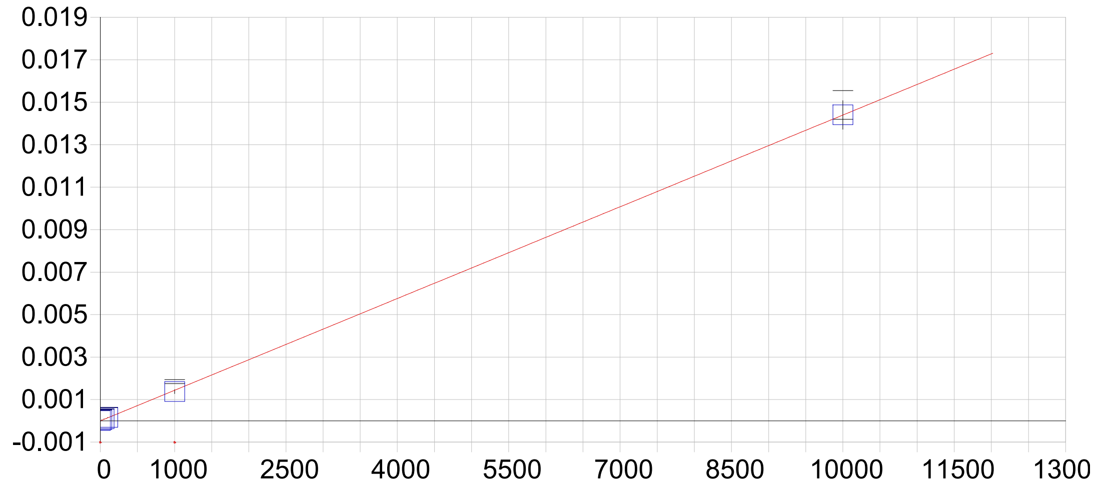



**Fe 239.562 {141}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Curvilinear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000003 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999985 | Status: | OK . |
| Std Error of Est: | 0.000001 | | |
| Predicted MDL: | 7.112729 | | |
| Predicted MQL: | 23.709096 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .04384 | .044 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 949.86 | -50.1 | -5.01 | .00028 | .000 | 1 |
| CalStd10=10 | 10000. | 9960.8 | -39.2 | -.392 | .00290 | .000 | 1 |
| CalStd12-100 | 100000. | 90658. | -9340. | -9.34 | .02636 | .001 | 1 |

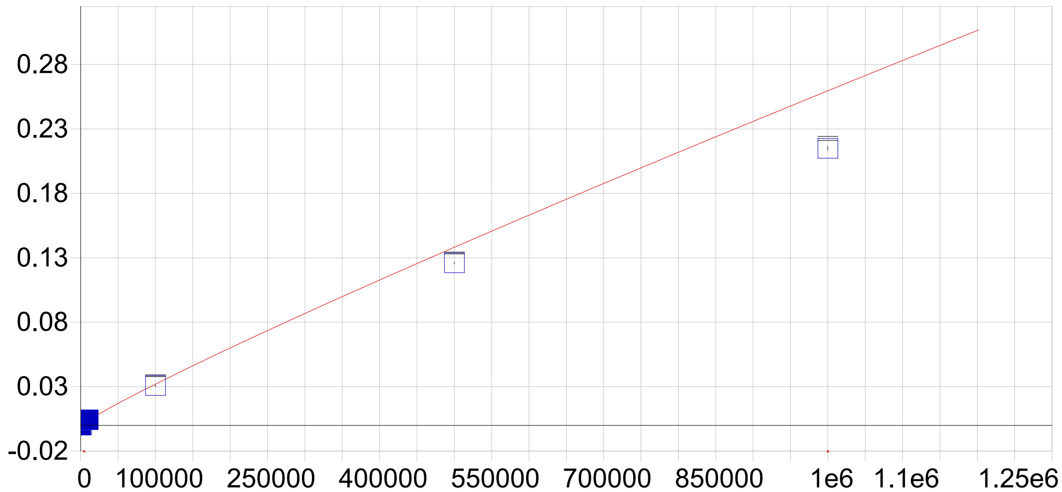



**Fe 259.940 {130}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000003 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999986 | Status: | OK . |
| Std Error of Est: | 0.000035 | | |
| Predicted MDL: | 2.856975 | | |
| Predicted MQL: | 9.523250 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 6.0519 | 6.05 | .000 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 956.44 | -43.6 | -4.36 | .00137 | .000 | 1 |
| CalStd7=50 | 50.000 | 61.649 | 11.6 | 23.3 | .00009 | .000 | 1 |
| CalStd8=100 | 100.00 | 109.80 | 9.80 | 9.80 | .00015 | .000 | 1 |
| CalStd6=20 | 20.000 | 31.884 | 11.9 | 59.4 | .00004 | .000 | 1 |
| CalStd10=10 | 10000. | 10004. | 4.18 | .042 | .01440 | .001 | 1 |

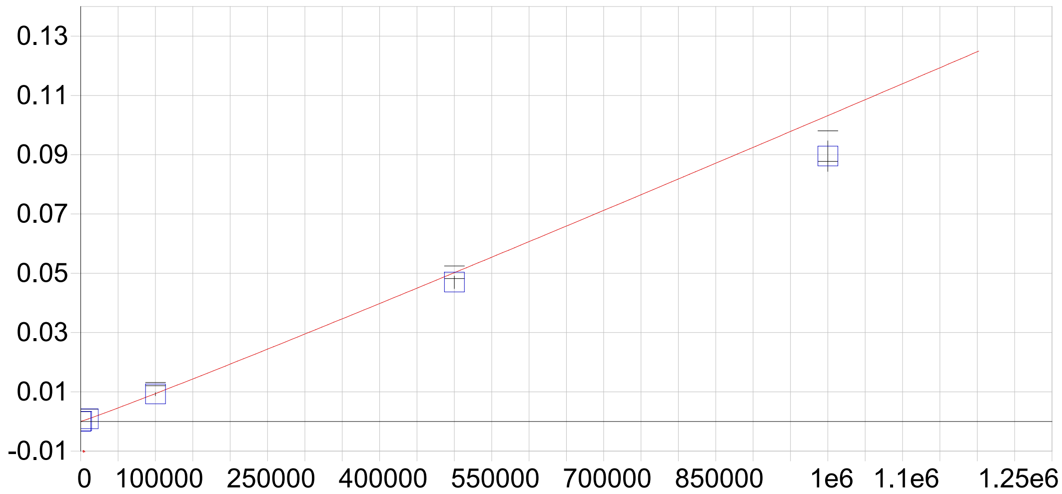



**Mg 202.582 {466}**

Date o▯ Fit: 06/18/2015 12:46:09 Type o▯ Fit: Full Fit ▯ eighting: 1/Conc

A0 (O▯▯set): -0.000006 Re-Slope: 1.000000
A1 (▯ ain): 0.000001 Y-int: 0.000000
A2 (Curvature): 0.000000
n (E▯ ponent): 0.910000
Correlation: 0.999925 Status: O▯ .
Std Error o▯ Est: 0.000006
Predicted MDL: 1.519810
Predicted MQL: 5.066034

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .02491 | .025 | .000 | -.00001 | .000 | 1 |
| CalStd13=50 | 500000. | 451830. | -48200. | -9.63 | .12598 | .001 | 1 |
| CalStd10=10 | 10000. | 10744. | 744. | 7.44 | .00419 | .000 | 1 |
| CalStd14-100 | 1000000. | 812260. | -188000. | -18.8 | .21484 | .002 | 1 |
| CalStd12-100 | 100000. | 95977. | -4020. | -4.02 | .03076 | .001 | 1 |
| CalStd9=100 | 1000.0 | 876.40 | -124. | -12.4 | .00042 | .000 | 1 |

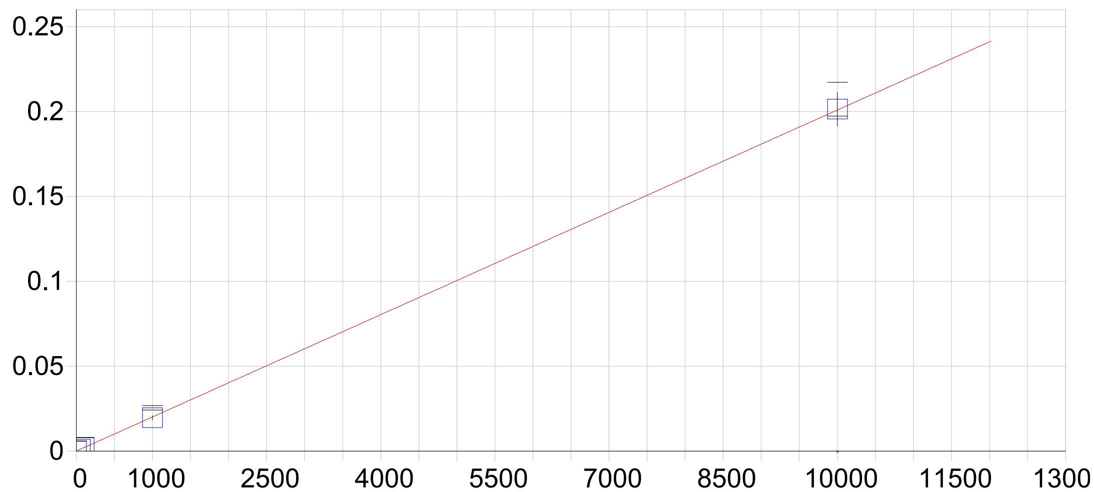



**Mg 279.079 {121}**

| | | | | | |
|---|---|---|---|---|---|
| Date o▯ Fit: | 06/18/2015 12:46:09 | Type o▯ Fit: | Full Fit | ▯ eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O▯▯set): | -0.000009 | Re-Slope: | 1.000000 |
| A1 (▯ ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E▯ ponent): | 1.040000 | | |
| Correlation: | 1.000000 | Status: | O▯ . |
| Std Error o▯ Est: | 0.000034 | | |
| Predicted MDL: | 46.693549 | | |
| Predicted MQL: | 155.645162 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 102.73 | 103. | .000 | .00000 | .000 | 1 |
| CalStd13=50 | 500000. | 469090. | -30900. | -6.18 | .04696 | .002 | 1 |
| CalStd10=10 | 10000. | 9959.7 | -40.3 | -.403 | .00085 | .000 | 1 |
| CalStd14-100 | 1000000. | 872190. | -128000. | -12.8 | .08951 | .005 | 1 |
| CalStd12-100 | 100000. | 98445. | -1550. | -1.55 | .00925 | .001 | 1 |
| CalStd9=100 | 1000.0 | 1288.3 | 288. | 28.8 | .00009 | .000 | 1 |

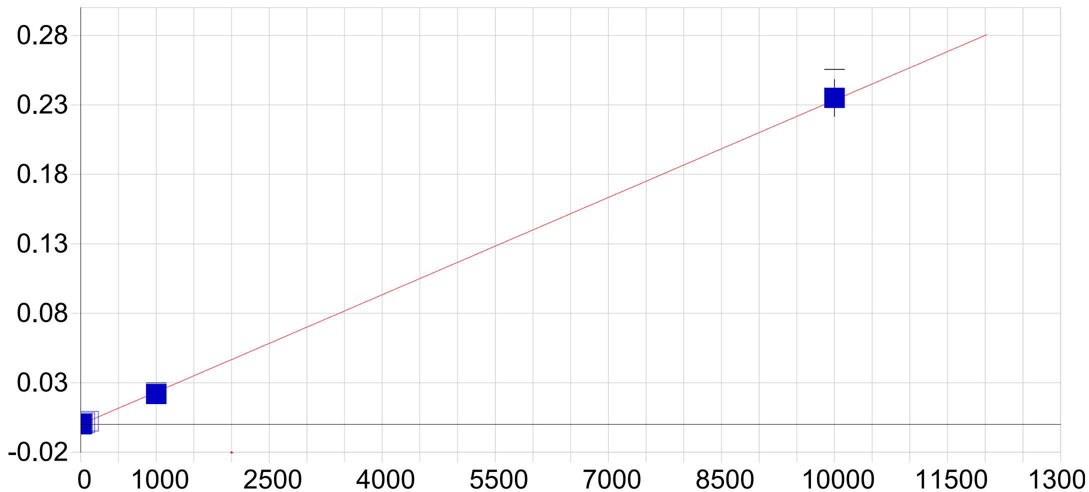



**Mg 280.270 {120}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000049 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000020 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999964 | Status: | OK . |
| Std Error of Est: | 0.000005 | | |
| Predicted MDL: | 0.132530 | | |
| Predicted MQL: | 0.441768 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00095 | -.001 | .000 | .00005 | .000 | 1 |
| CalStd9=100 | 1000.0 | 973.83 | -26.2 | -2.62 | .01961 | .001 | 1 |
| CalStd10=10 | 10000. | 10023. | 23.3 | .233 | .20139 | .010 | 1 |
| CalStd8=100 | 100.00 | 101.40 | 1.40 | 1.40 | .00209 | .000 | 1 |
| CalStd7=50 | 50.000 | 51.444 | 1.44 | 2.89 | .00108 | .000 | 1 |

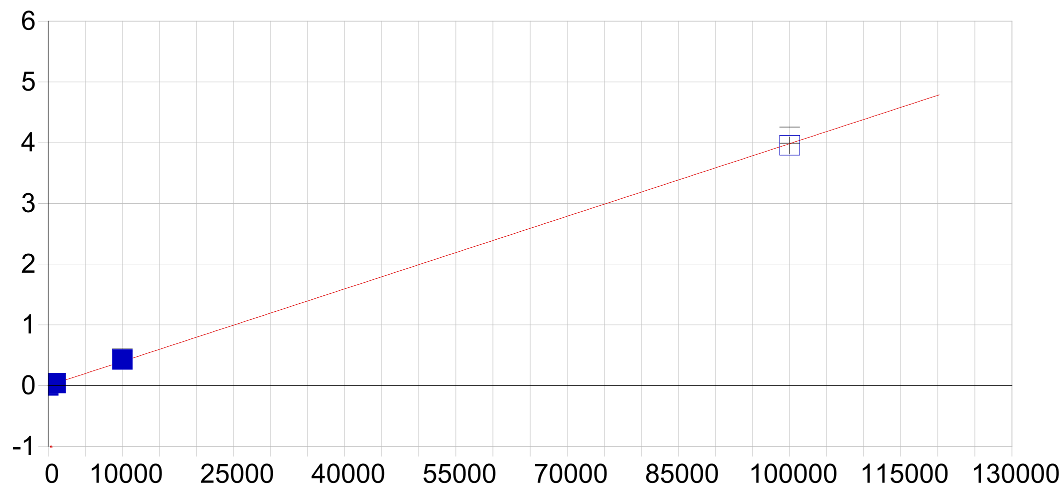



**Mn 257.610 {131}**

| | | | | | |
|---|---|---|---|---|---|
| Date o□ Fit: | 06/18/2015 12:46:09 | Type o□ Fit: | Linear | □ eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O□□set): | -0.000002 | Re-Slope: | 1.000000 |
| A1 (□ ain): | 0.000023 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E□ ponent): | 1.000000 | | |
| Correlation: | 0.999795 | Status: | O□ . |
| Std Error o□ Est: | 0.000004 | | |
| Predicted MDL: | 0.510757 | | |
| Predicted MQL: | 1.702524 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00027 | .000 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.116 | .116 | 1.16 | .00023 | .000 | 1 |
| CalStd7=50 | 50.000 | 49.142 | -.858 | -1.72 | .00115 | .000 | 1 |
| CalStd6=20 | 20.000 | 20.551 | .551 | 2.76 | .00048 | .000 | 1 |
| CalStd8=100 | 100.00 | 96.475 | -3.52 | -3.52 | .00225 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.0754 | .075 | 1.51 | .00012 | .000 | 1 |
| CalStd9=100 | 1000.0 | 936.86 | -63.1 | -6.31 | .02187 | .001 | 1 |
| CalStd10=10 | 10000. | 10067. | 66.8 | .668 | .23498 | .013 | 1 |

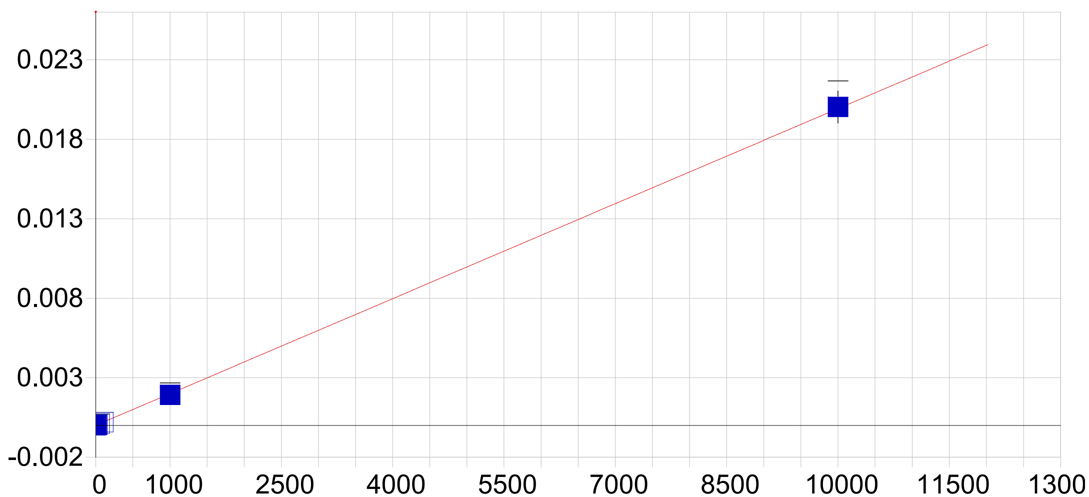



**Mn 259.373 {130}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000002 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000040 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999732 | Status: | O . |
| Std Error o Est: | 0.000435 | | |
| Predicted MDL: | 0.539595 | | |
| Predicted MQL: | 1.798648 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.05666 | -.057 | .000 | .00000 | .000 | 1 |
| CalStd10=10 | 10000. | 10736. | 736. | 7.36 | .42826 | .024 | 1 |
| CalStd11-100 | 100000. | 99272. | -728. | -.728 | 3.9545 | .136 | 1 |
| CalStd9=100 | 1000.0 | 990.31 | -9.69 | -.969 | .03951 | .002 | 1 |

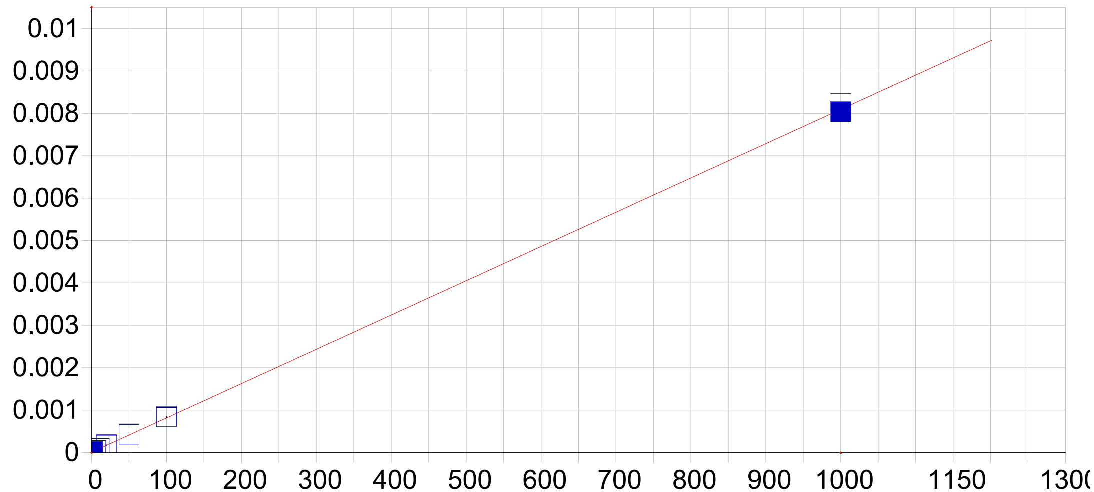



**Mn 293.930 {115}**

Date o Fit: 06/18/2015 12:46:09 Type o Fit: Linear  eighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000002 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000002 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999864 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 2.826324 | | |
| Predicted MQL: | 9.421081 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00159 | .002 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 11.007 | 1.01 | 10.1 | .00002 | .000 | 1 |
| CalStd7=50 | 50.000 | 46.437 | -3.56 | -7.13 | .00009 | .000 | 1 |
| CalStd6=20 | 20.000 | 20.056 | .056 | .281 | .00004 | .000 | 1 |
| CalStd8=100 | 100.00 | 98.402 | -1.60 | -1.60 | .00020 | .000 | 1 |
| CalStd4=5 | 5.0000 | 3.5219 | -1.48 | -29.6 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 955.60 | -44.4 | -4.44 | .00191 | .000 | 1 |
| CalStd10=10 | 10000. | 10050. | 50.0 | .500 | .02003 | .001 | 1 |

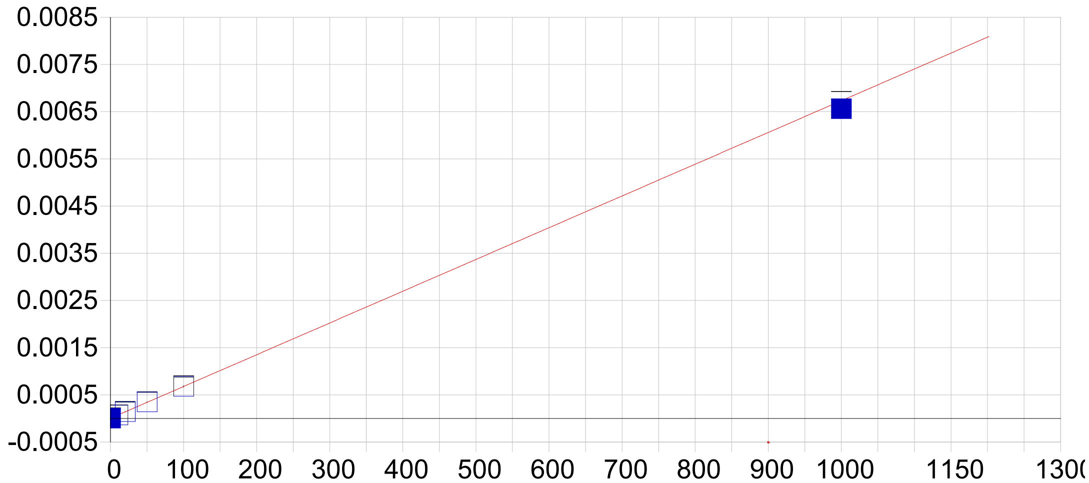



**Mo 203.844 {465}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000007 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000008 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999735 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 0.872780 | | |
| Predicted MQL: | 2.909268 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00079 | -.001 | .000 | .00001 | .000 | 1 |
| CalStd7=50 | 50.000 | 51.946 | 1.95 | 3.89 | .00043 | .000 | 1 |
| CalStd3=1 | 1.0000 | 1.6004 | .600 | 60.0 | .00002 | .000 | 1 |
| CalStd6=20 | 20.000 | 20.779 | .779 | 3.90 | .00017 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.559 | .559 | 5.59 | .00009 | .000 | 1 |
| CalStd8=100 | 100.00 | 102.76 | 2.76 | 2.76 | .00084 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.1793 | .179 | 3.59 | .00005 | .000 | 1 |
| CalStd9=100 | 1000.0 | 993.18 | -6.82 | -.682 | .00804 | .000 | 1 |

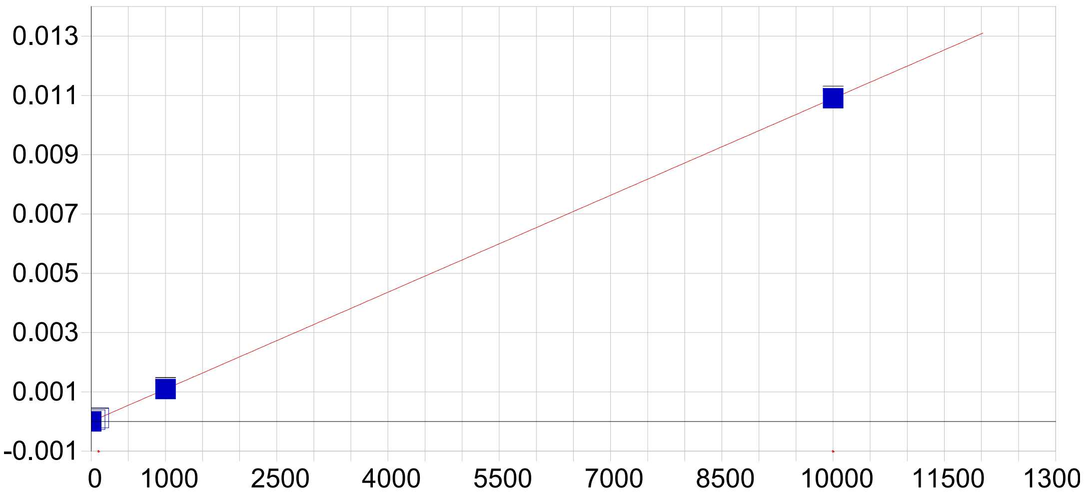



**Mo 202.030 {467}**

Date o▯ Fit: 06/18/2015 12:46:09 Type o▯ Fit: Linear ▯ eighting: 1/Var

| | | | |
|---|---|---|---|
| A0 (O▯▯set): | 0.000005 | Re-Slope: | 1.000000 |
| A1 (▯ ain): | 0.000007 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E▯ ponent): | 1.000000 | | |
| Correlation: | 0.999754 | Status: | O▯ . |
| Std Error o▯ Est: | 0.000003 | | |
| Predicted MDL: | 0.774638 | | |
| Predicted MQL: | 2.582127 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.18622 | -.186 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 50.956 | .956 | 1.91 | .00035 | .000 | 1 |
| CalStd6=20 | 20.000 | 20.458 | .458 | 2.29 | .00014 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.9372 | -.063 | -.628 | .00007 | .000 | 1 |
| CalStd8=100 | 100.00 | 100.21 | .210 | .210 | .00068 | .000 | 1 |
| CalStd9=100 | 1000.0 | 974.16 | -25.8 | -2.58 | .00656 | .000 | 1 |

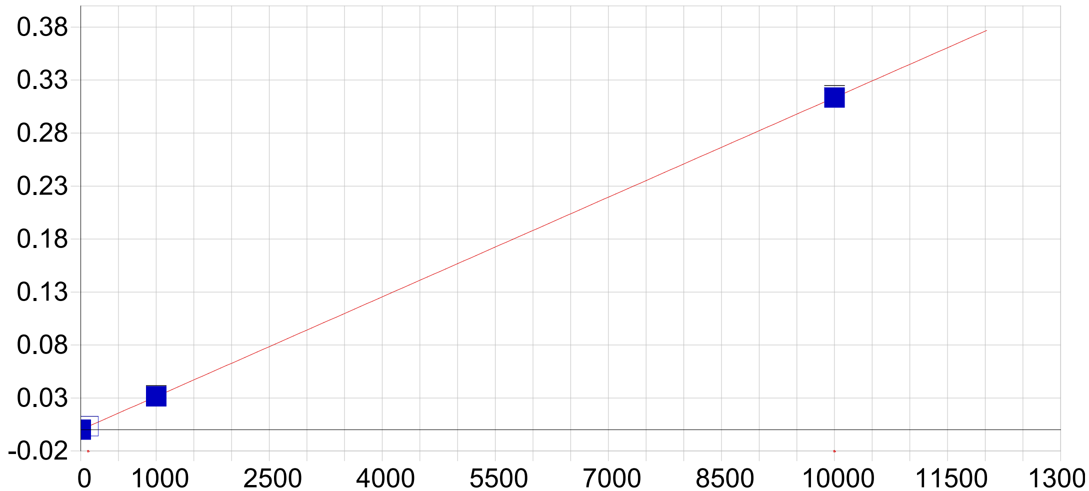



**Mo 204.598 {465}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000001 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | O . |
| Std Error o Est: | 0.000003 | | |
| Predicted MDL: | 1.170769 | | |
| Predicted MQL: | 3.902563 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.31792 | -.318 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 996.75 | -3.25 | -.325 | .00109 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .296 | .003 | .01090 | .000 | 1 |
| CalStd7=50 | 50.000 | 50.847 | .847 | 1.69 | .00006 | .000 | 1 |
| CalStd8=100 | 100.00 | 102.42 | 2.42 | 2.42 | .00011 | .000 | 1 |

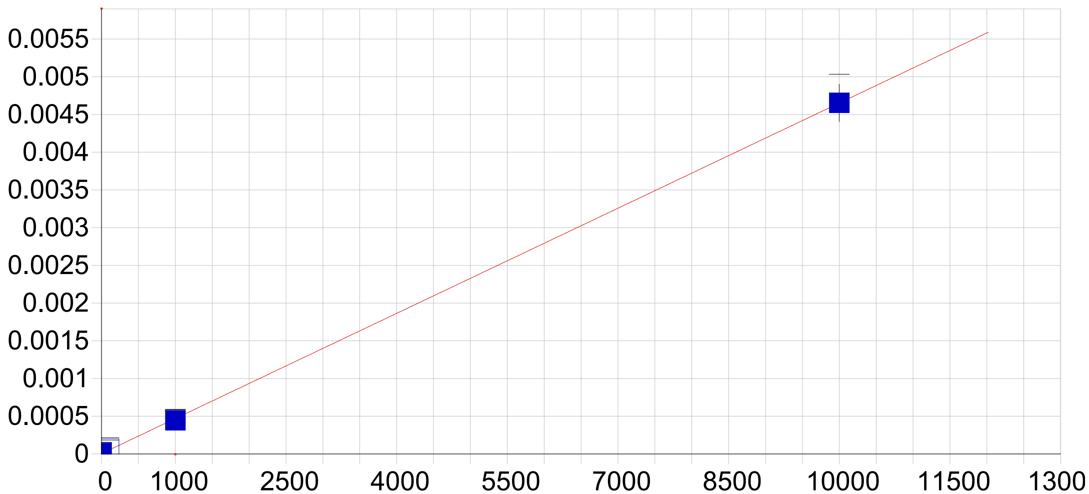



**Ni 221.647 {452}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000001 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000031 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999987 | Status: | OK . |
| Std Error of Est: | 0.000008 | | |
| Predicted MDL: | 0.390683 | | |
| Predicted MQL: | 1.302276 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00549 | -.005 | .000 | .00000 | .000 | 1 |
| CalStd10=10 | 10000. | 9992.5 | -7.51 | -.075 | .31332 | .002 | 1 |
| CalStd8=100 | 100.00 | 105.35 | 5.35 | 5.35 | .00330 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1002.2 | 2.16 | .216 | .03142 | .001 | 1 |

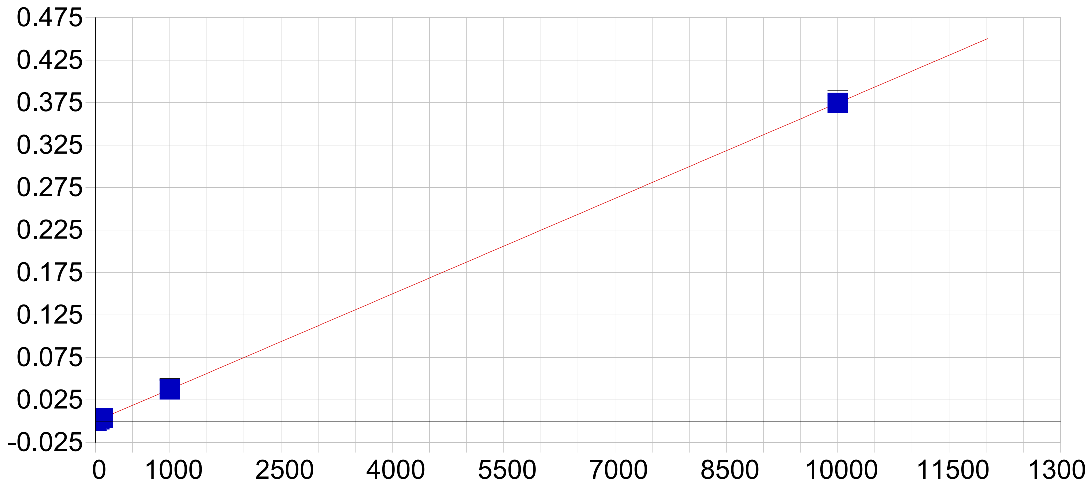



**Ni 231.604 {146}**

Date of Fit: 06/18/2015 12:46:09 Type of Fit: Linear Weighting: None

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000005 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999969 | Status: | OK . |
| Std Error of Est: | 0.000022 | | |
| Predicted MDL: | 32.328428 | | |
| Predicted MQL: | 107.761425 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 16.198 | 16.2 | .000 | .00001 | .000 | 1 |
| CalStd10=10 | 10000. | 10005. | 5.12 | .051 | .00465 | .000 | 1 |
| CalStd8=100 | 100.00 | 133.15 | 33.2 | 33.2 | .00007 | .000 | 1 |
| CalStd9=100 | 1000.0 | 945.53 | -54.5 | -5.45 | .00044 | .000 | 1 |

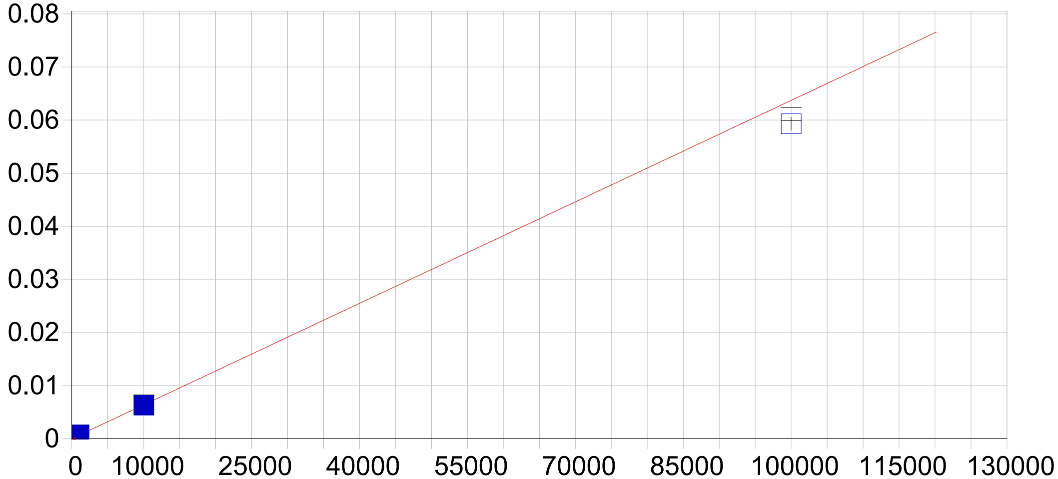



**Ni 231.604 {445}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000002 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000037 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999983 | Status: | OK . |
| Std Error of Est: | 0.000001 | | |
| Predicted MDL: | 0.414335 | | |
| Predicted MQL: | 1.381116 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00038 | .000 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 52.519 | 2.52 | 5.04 | .00197 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.559 | .559 | 5.59 | .00039 | .000 | 1 |
| CalStd8=100 | 100.00 | 103.53 | 3.53 | 3.53 | .00388 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.2574 | .257 | 5.15 | .00019 | .000 | 1 |
| CalStd9=100 | 1000.0 | 993.54 | -6.46 | -.646 | .03722 | .001 | 1 |
| CalStd3=1 | 1.0000 | 1.1942 | .194 | 19.4 | .00004 | .000 | 1 |
| CalStd10=10 | 10000. | 9999.4 | -.604 | -.006 | .37458 | .003 | 1 |

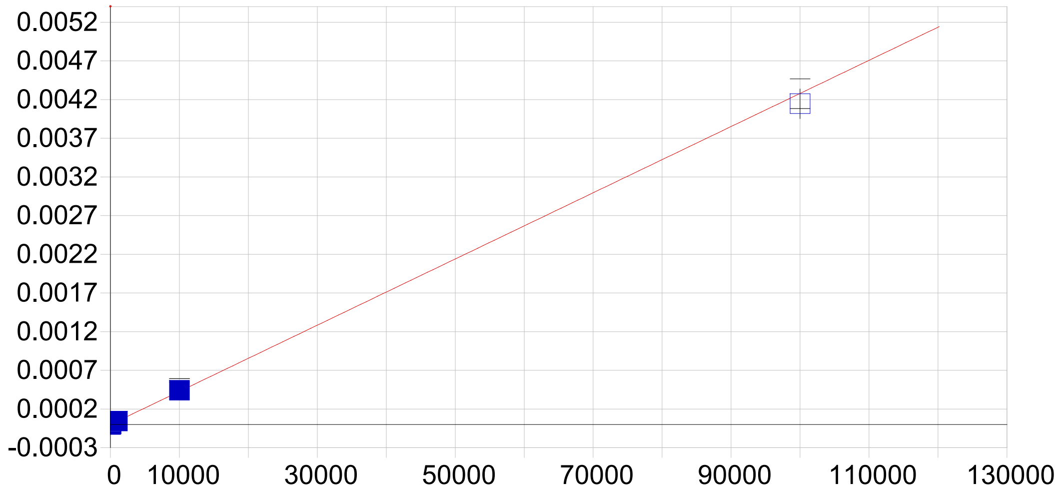



**Pb 216.999 {455}**

| | | | | | |
|---|---|---|---|---|---|
| Date o▯ Fit: | 06/18/2015 12:46:09 | Type o▯ Fit: | Curvilinear | ▯ eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O▯▯set): | 0.000006 | Re-Slope: | 1.000000 |
| A1 (▯ ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E▯ ponent): | 1.000000 | | |
| Correlation: | 0.999955 | Status: | O▯ . |
| Std Error o▯ Est: | 0.000000 | | |
| Predicted MDL: | 3.358194 | | |
| Predicted MQL: | 11.193979 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00177 | .002 | .000 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1080.9 | 80.9 | 8.09 | .00070 | .000 | 1 |
| CalStd10=10 | 10000. | 9837.8 | -162. | -1.62 | .00628 | .000 | 1 |
| CalStd11-100 | 100000. | 93072. | -6930. | -6.93 | .05929 | .001 | 1 |
| CalStd8=100 | 100.00 | 106.29 | 6.29 | 6.29 | .00007 | .000 | 1 |
| CalStd4=5 | 5.0000 | 3.6556 | -1.34 | -26.9 | .00001 | .000 | 1 |
| CalStd5=10 | 10.000 | 7.7889 | -2.21 | -22.1 | .00001 | .000 | 1 |

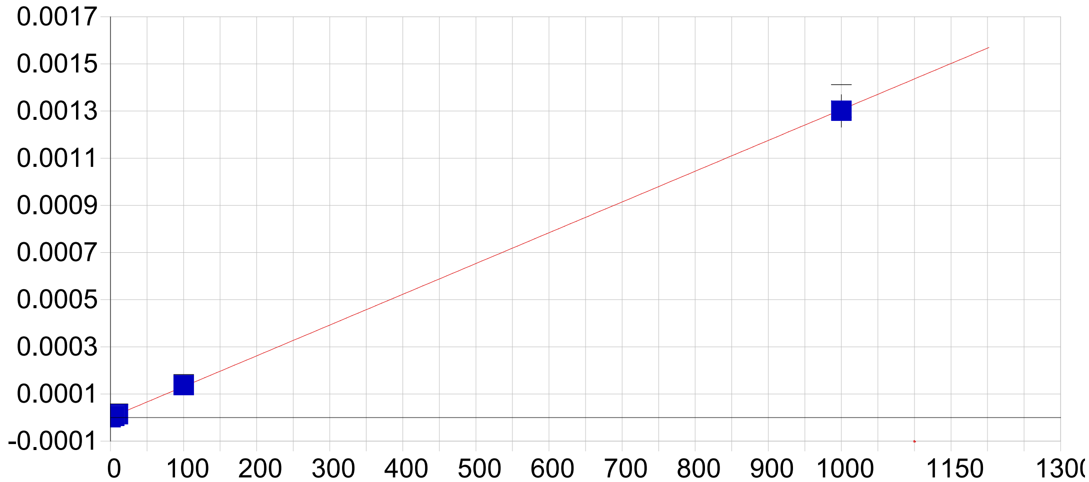



**Pb 220.353 {153}**

Date o Fit: 06/18/2015 12:46:09 Type o Fit: Linear  eighting: 1/Var

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000001 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999481 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 59.916520 | | |
| Predicted MQL: | 199.721732 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -42.588 | -42.6 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1009.1 | 9.07 | .907 | .00004 | .000 | 1 |
| CalStd10=10 | 10000. | 10321. | 321. | 3.21 | .00044 | .000 | 1 |
| CalStd8=100 | 100.00 | 99.375 | -.625 | -.625 | .00000 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.7940 | -.206 | -4.12 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 24.770 | 14.8 | 148. | .00000 | .000 | 1 |
| CalStd11-100 | 100000. | 96873. | -3130. | -3.13 | .00415 | .000 | 1 |

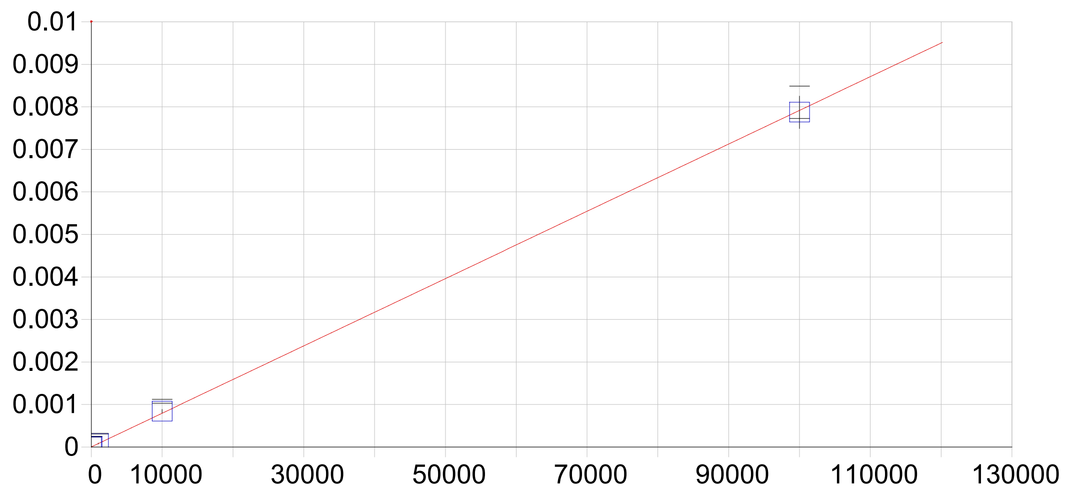



**Pb 220.353 {453}**

Date o Fit: 06/18/2015 12:46:09 Type o Fit: Linear eighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000001 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999898 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 1.899750 | | |
| Predicted MQL: | 6.332500 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00026 | .000 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.7556 | -.244 | -2.44 | .00001 | .000 | 1 |
| CalStd8=100 | 100.00 | 104.31 | 4.31 | 4.31 | .00014 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.6657 | -.334 | -6.69 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 996.27 | -3.73 | -.373 | .00130 | .000 | 1 |

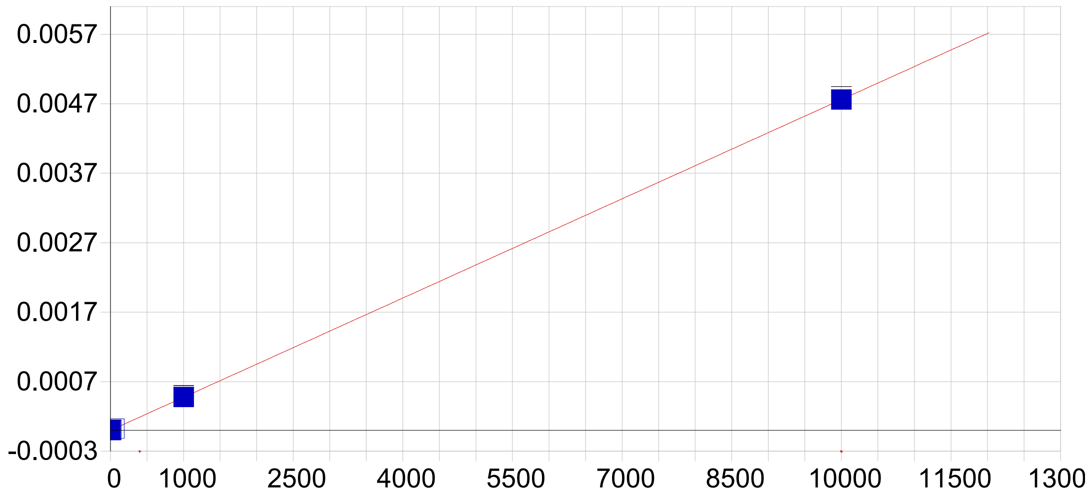



**Pb 283.306 {119}**

Date o Fit: 06/18/2015 12:46:09 Type o Fit: Linear  eighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000005 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999837 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 77.884110 | | |
| Predicted MQL: | 259.613700 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00022 | .000 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1005.4 | 5.40 | .540 | .00008 | .000 | 1 |
| CalStd10=10 | 10000. | 10570. | 570. | 5.70 | .00084 | .000 | 1 |
| CalStd11-100 | 100000. | 99430. | -570. | -.570 | .00787 | .000 | 1 |
| CalStd8=100 | 100.00 | 94.113 | -5.89 | -5.89 | .00001 | .000 | 1 |

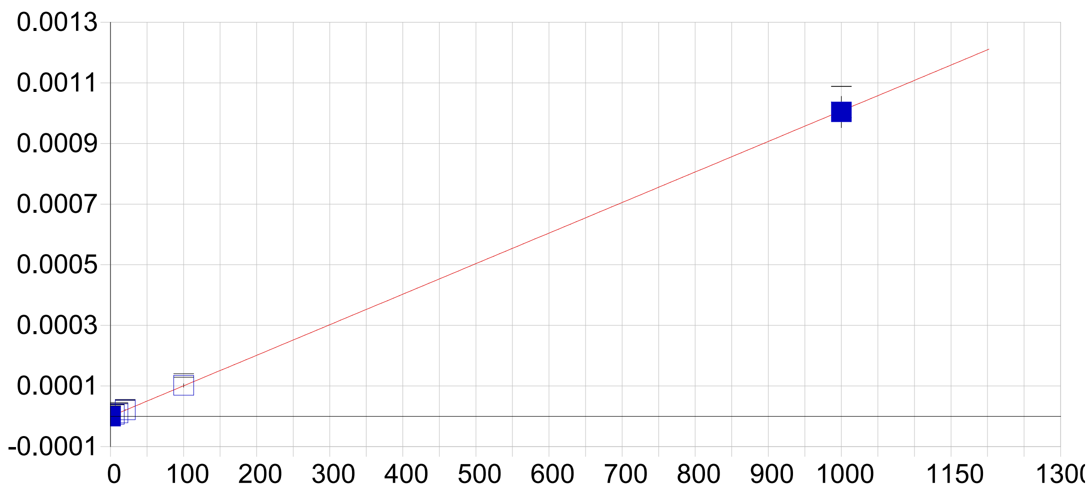



**Sb 206.833 {463}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000001 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999996 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 2.879264 | | |
| Predicted MQL: | 9.597546 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00076 | .001 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1004.8 | 4.81 | .481 | .00048 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.4347 | -.565 | -5.65 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 48.801 | -1.20 | -2.40 | .00002 | .000 | 1 |
| CalStd10=10 | 10000. | 9997.0 | -3.05 | -.030 | .00476 | .000 | 1 |

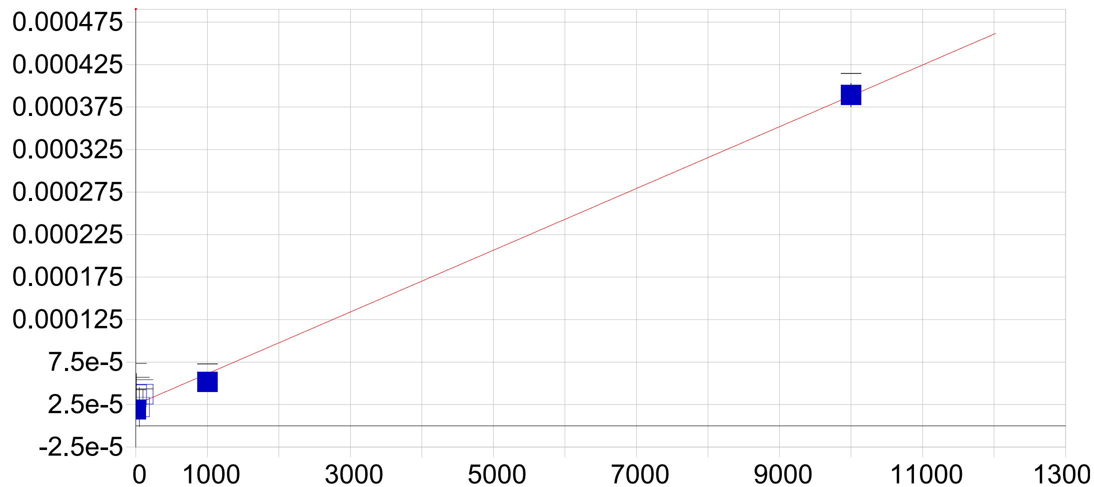



**Sb 217.581 {455}**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Date o□ Fit: | 06/18/2015 12:46:09 | | Type o□ Fit: | Linear | □ eighting: | 1/Conc | |

| | | | |
|---|---|---|---|
| A0 (O□□set): | -0.000000 | Re-Slope: | 1.000000 |
| A1 (□ ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E□ ponent): | 1.000000 | | |
| Correlation: | 0.999848 | Status: | O□ . |
| Std Error o□ Est: | 0.000000 | | |
| Predicted MDL: | 1.843464 | | |
| Predicted MQL: | 6.144879 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00159 | -.002 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 996.37 | -3.63 | -.363 | .00100 | .000 | 1 |
| CalStd6=20 | 20.000 | 21.102 | 1.10 | 5.51 | .00002 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.332 | .332 | 3.32 | .00001 | .000 | 1 |
| CalStd8=100 | 100.00 | 101.09 | 1.09 | 1.09 | .00010 | .000 | 1 |
| CalStd4=5 | 5.0000 | 6.1109 | 1.11 | 22.2 | .00001 | .000 | 1 |

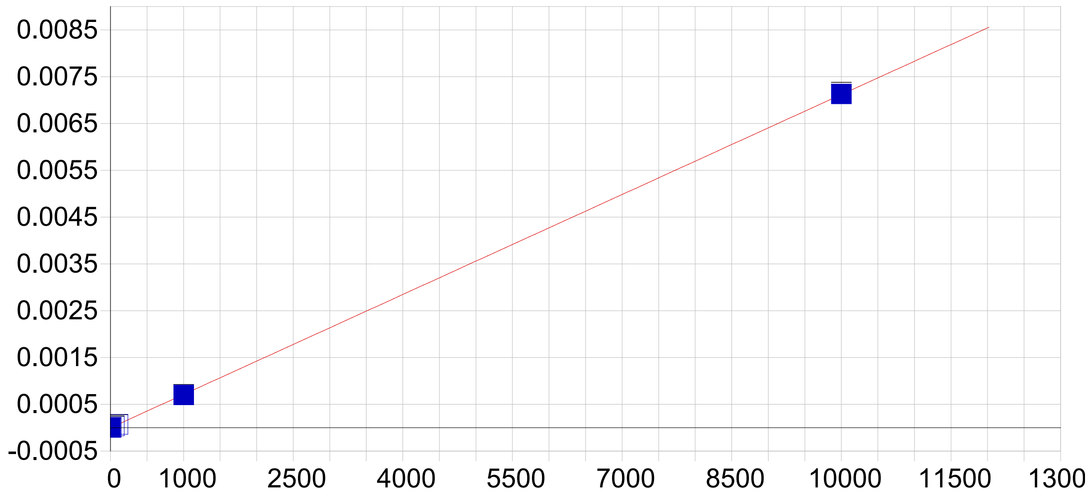



**Se 196.090 {172}**

| | | | | | |
|---|---|---|---|---|---|
| Date o□ Fit: | 06/18/2015 12:46:09 | Type o□ Fit: | Linear | □ eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O□□set): | 0.000025 | Re-Slope: | 1.000000 |
| A1 (□ ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E□ponent): | 1.000000 | | |
| Correlation: | 0.998366 | Status: | O□ . |
| Std Error o□ Est: | 0.000009 | | |
| Predicted MDL: | 396.124353 | | |
| Predicted MQL: | 1320.414511 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -162.17 | -162. | .000 | .00002 | .000 | 1 |
| CalStd7=50 | 50.000 | -80.861 | -131. | -262. | .00002 | .000 | 1 |
| CalStd9=100 | 1000.0 | 731.22 | -269. | -26.9 | .00005 | .000 | 1 |
| CalStd5=10 | 10.000 | 314.30 | 304. | 3040. | .00004 | .000 | 1 |
| CalStd8=100 | 100.00 | 332.61 | 233. | 233. | .00004 | .000 | 1 |
| CalStd10=10 | 10000. | 10025. | 24.9 | .249 | .00039 | .000 | 1 |

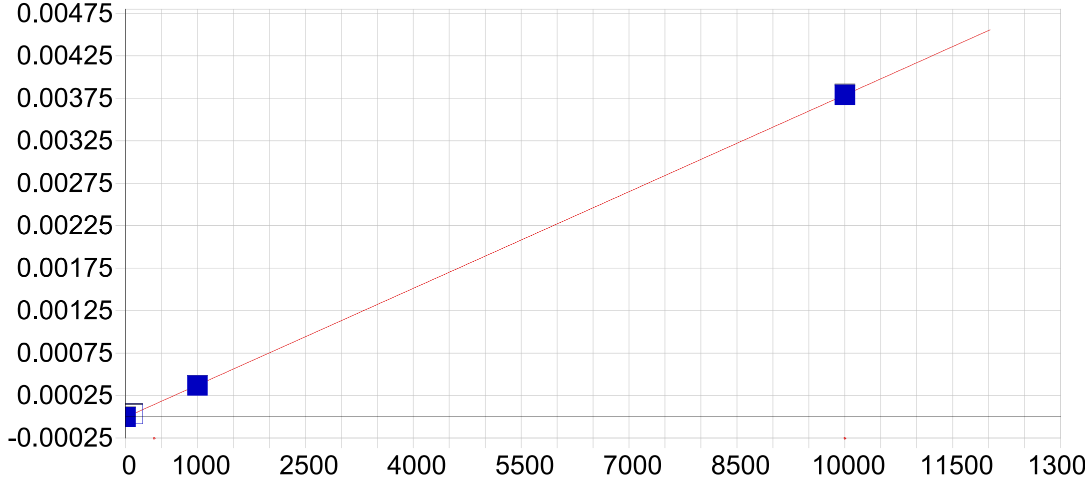



**Se 196.090 {472}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000002 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999986 | Status: | OK . |
| Std Error of Est: | 0.000002 | | |
| Predicted MDL: | 6.955159 | | |
| Predicted MQL: | 23.183865 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 1.0845 | 1.08 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 50.089 | .089 | .178 | .00003 | .000 | 1 |
| CalStd9=100 | 1000.0 | 979.80 | -20.2 | -2.02 | .00070 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.919 | .919 | 9.19 | .00001 | .000 | 1 |
| CalStd8=100 | 100.00 | 99.642 | -.358 | -.358 | .00007 | .000 | 1 |
| CalStd10=10 | 10000. | 10013. | 13.0 | .130 | .00713 | .000 | 1 |

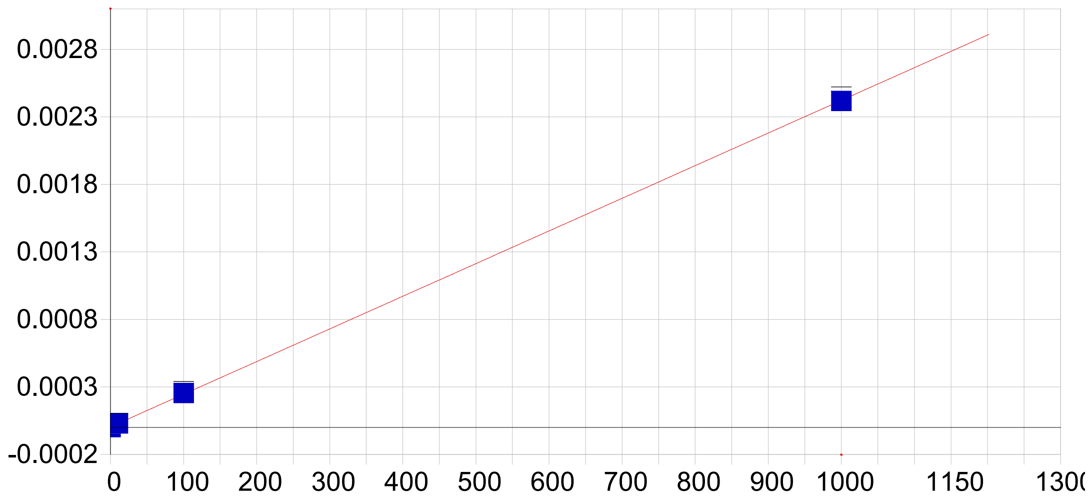



**Se 206.279 {463}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O set): | -0.000007 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999997 | Status: | O . |
| Std Error o Est: | 0.000005 | | |
| Predicted MDL: | 19.643816 | | |
| Predicted MQL: | 65.479388 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 6.2794 | 6.28 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 984.09 | -15.9 | -1.59 | .00037 | .000 | 1 |
| CalStd10=10 | 10000. | 10002. | 1.51 | .015 | .00379 | .000 | 1 |
| CalStd8=100 | 100.00 | 108.12 | 8.12 | 8.12 | .00003 | .000 | 1 |

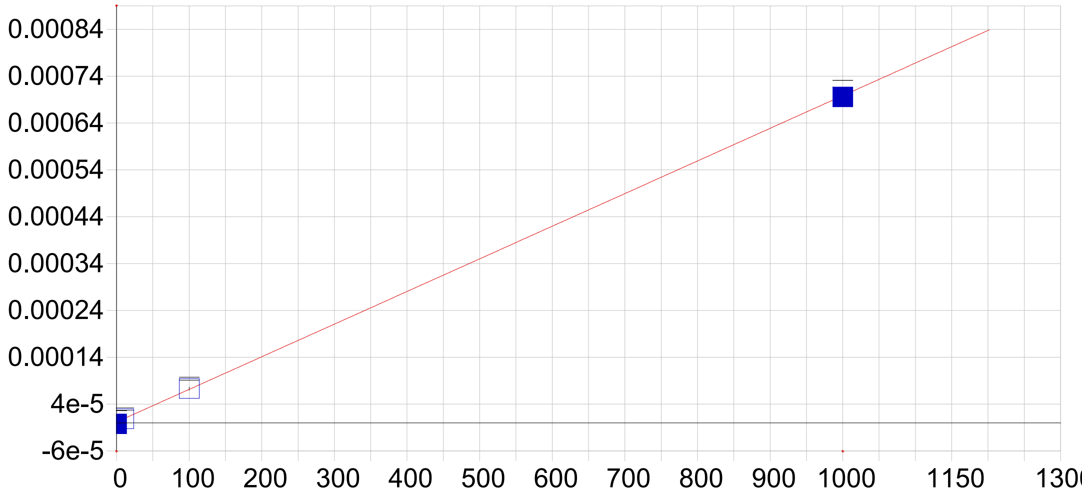



**Tl 190.856 {476}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000004 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000002 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999951 | Status: | O . |
| Std Error o Est: | 0.000003 | | |
| Predicted MDL: | 2.730416 | | |
| Predicted MQL: | 9.101387 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.99623 | -.996 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 997.79 | -2.21 | -.221 | .00242 | .000 | 1 |
| CalStd8=100 | 100.00 | 103.24 | 3.24 | 3.24 | .00025 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.096 | .096 | .960 | .00003 | .000 | 1 |

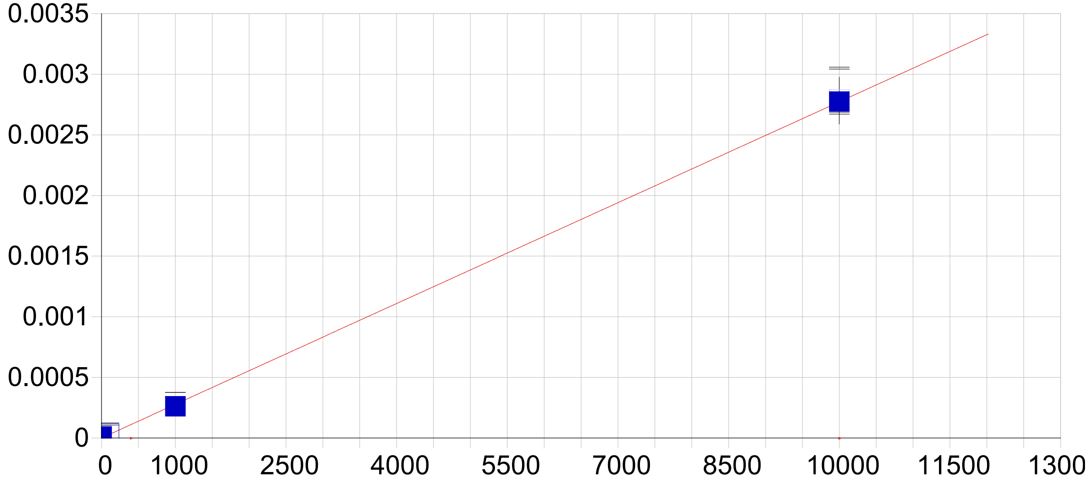



**Tl 190.856 {477}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000002 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999857 | Status: | O . |
| Std Error o Est: | 0.000002 | | |
| Predicted MDL: | 7.849793 | | |
| Predicted MQL: | 26.165977 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -6.0421 | -6.04 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 995.68 | -4.32 | -.432 | .00070 | .000 | 1 |
| CalStd8=100 | 100.00 | 102.10 | 2.10 | 2.10 | .00007 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.5137 | -.486 | -4.86 | .00001 | .000 | 1 |

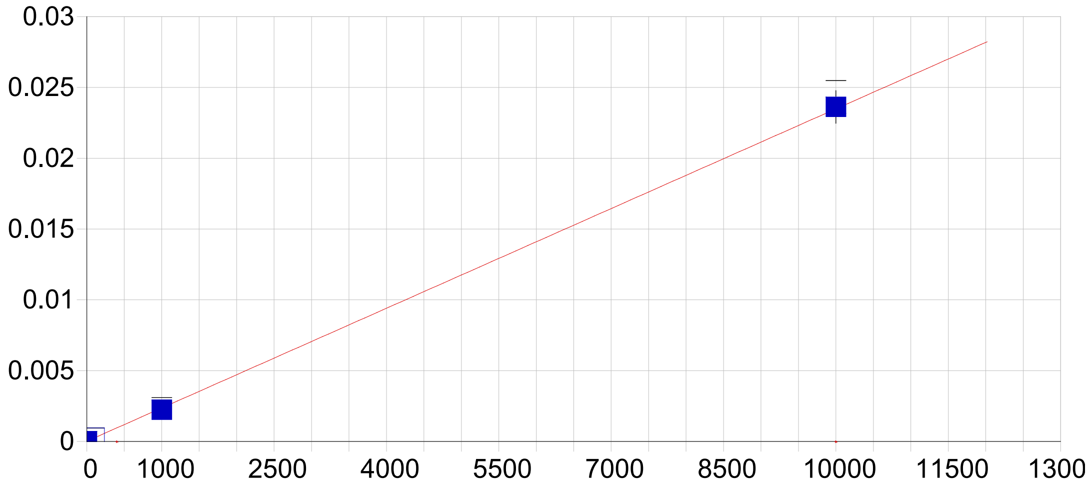



**Tl 276.787 {122}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear |  eighting: | None |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000000 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Eponent): | 1.000000 | | |
| Correlation: | 0.999958 | Status: | O . |
| Std Error o Est: | 0.000015 | | |
| Predicted MDL: | 76.577090 | | |
| Predicted MQL: | 255.256966 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 41.345 | 41.3 | .000 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 936.84 | -63.2 | -6.32 | .00026 | .000 | 1 |
| CalStd10=10 | 10000. | 10006. | 6.16 | .062 | .00279 | .000 | 1 |
| CalStd8=100 | 100.00 | 115.65 | 15.7 | 15.7 | .00003 | .000 | 1 |

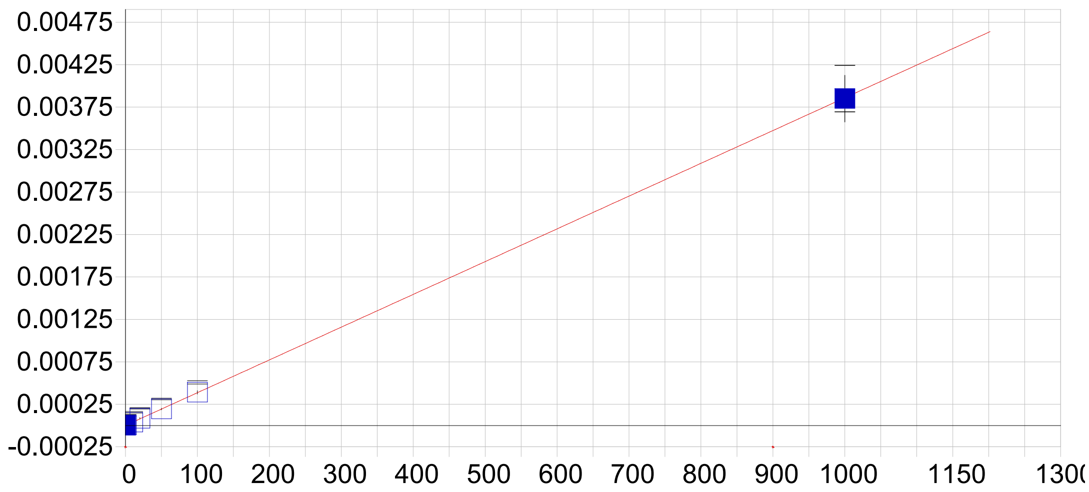



**V 290.882 {116}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000016 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000002 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999847 | Status: | OK . |
| Std Error of Est: | 0.000002 | | |
| Predicted MDL: | 2.745354 | | |
| Predicted MQL: | 9.151178 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00616 | .006 | .000 | .00002 | .000 | 1 |
| CalStd9=100 | 1000.0 | 944.58 | -55.4 | -5.54 | .00223 | .000 | 1 |
| CalStd10=10 | 10000. | 10057. | 56.6 | .566 | .02362 | .001 | 1 |
| CalStd8=100 | 100.00 | 98.813 | -1.19 | -1.19 | .00025 | .000 | 1 |

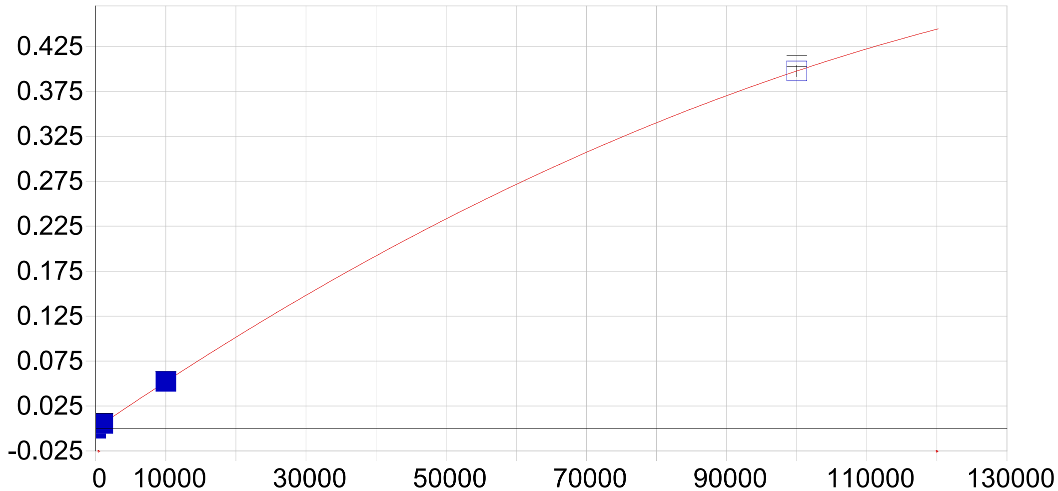



**V 292.402 {115}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000001 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000004 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999928 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 2.345889 | | |
| Predicted MQL: | 7.819629 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00001 | .000 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 50.179 | .179 | .357 | .00019 | .000 | 1 |
| CalStd9=100 | 1000.0 | 997.38 | -2.62 | -.262 | .00385 | .000 | 1 |
| CalStd6=20 | 20.000 | 21.707 | 1.71 | 8.54 | .00008 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.8507 | -.149 | -1.49 | .00004 | .000 | 1 |
| CalStd8=100 | 100.00 | 100.95 | .953 | .953 | .00039 | .000 | 1 |
| CalStd3=1 | 1.0000 | .93357 | -.066 | -6.64 | .00000 | .000 | 1 |

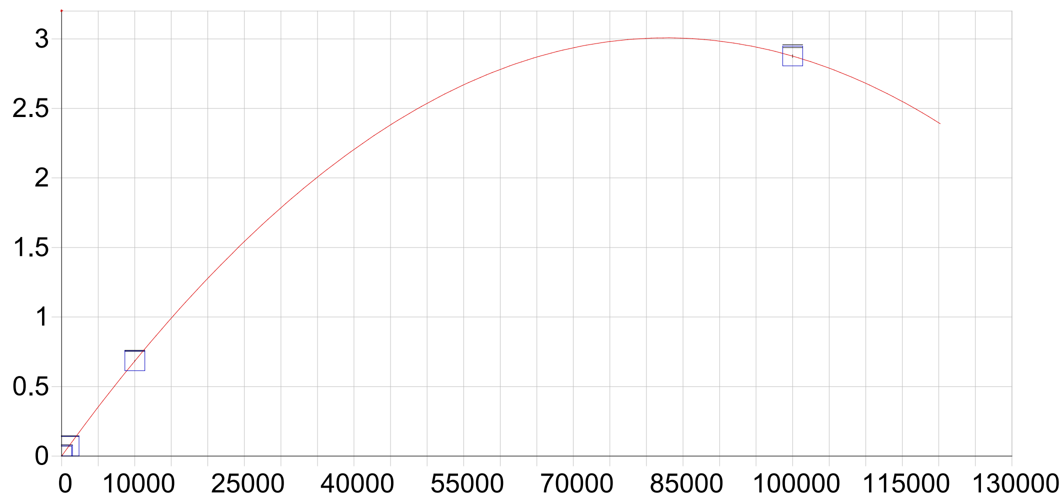



**Zn 206.200 {463}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Full Fit | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000000 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000005 | Y-int: | 0.000000 |
| A2 (Curvature): | -0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 0.282711 | | |
| Predicted MQL: | 0.942372 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| CalStd10=10 | 10000. | 9992.5 | -7.52 | -.075 | .05208 | .000 | 1 |
| Blank | .00000 | .00000 | .000 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1006.5 | 6.52 | .652 | .00537 | .000 | 1 |
| CalStd11-100 | 100000. | 100000. | 1.33 | .001 | .39757 | .006 | 1 |

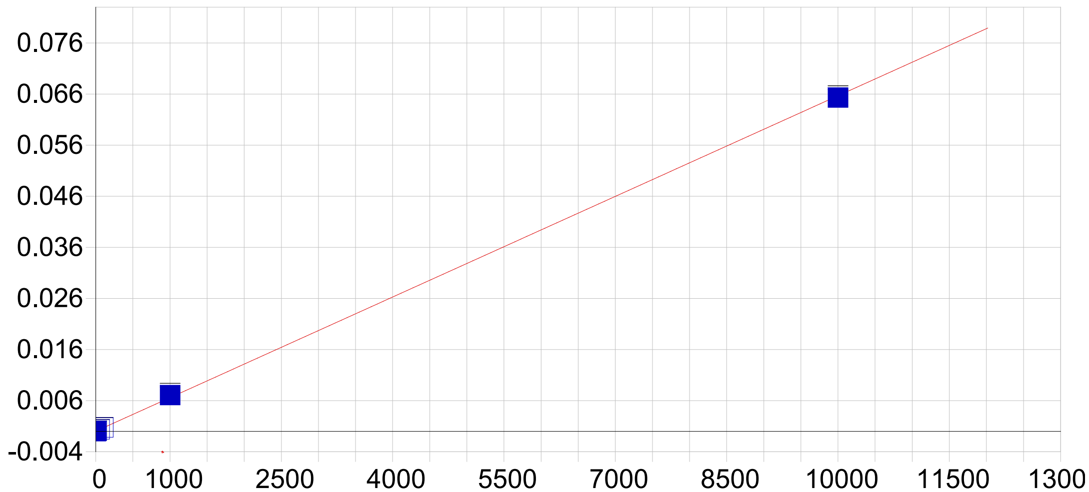



**Zn 213.856 {457}**

Date of Fit: 06/18/2015 12:46:09 Type of Fit: Curvilinear Weighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000027 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000073 | Y-int: | 0.000000 |
| A2 (Curvature): | -0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999994 | Status: | OK . |
| Std Error of Est: | 0.000021 | | |
| Predicted MDL: | 0.114672 | | |
| Predicted MQL: | 0.382240 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| CalStd10=10 | 10000. | 10019. | 19.1 | .191 | .68424 | .004 | 1 |
| Blank | .00000 | .00008 | .000 | .000 | .00003 | .000 | 1 |
| CalStd9=100 | 1000.0 | 983.06 | -16.9 | -1.69 | .07106 | .002 | 1 |
| CalStd11-100 | 100000. | 65457. | -34500. | -34.5 | 2.8759 | .010 | 1 |
| CalStd8=100 | 100.00 | 101.43 | 1.43 | 1.43 | .00740 | .000 | 1 |




**Zn 213.856 {458}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000002 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000007 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999639 | Status: | O . |
| Std Error o Est: | 0.000005 | | |
| Predicted MDL: | 0.218362 | | |
| Predicted MQL: | 0.727874 | | |

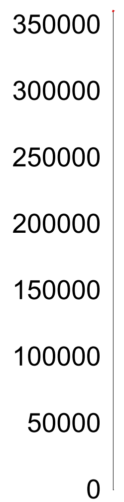
| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.23279 | -.233 | .000 | .00000 | .000 | 1 |
| CalStd8=100 | 100.00 | 110.40 | 10.4 | 10.4 | .00073 | .000 | 1 |
| CalStd7=50 | 50.000 | 54.537 | 4.54 | 9.07 | .00036 | .000 | 1 |
| CalStd5=10 | 10.000 | 11.530 | 1.53 | 15.3 | .00008 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1076.6 | 76.6 | 7.66 | .00707 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.3973 | .397 | 7.95 | .00004 | .000 | 1 |
| CalStd10=10 | 10000. | 9941.8 | -58.2 | -.582 | .06530 | .000 | 1 |


**Y 224.306 {450}***

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000000 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.000000 | Status: | Warning Zero Gain |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | n/a | | |
| Predicted MQL: | n/a | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | 72134. | 400. | 1 |

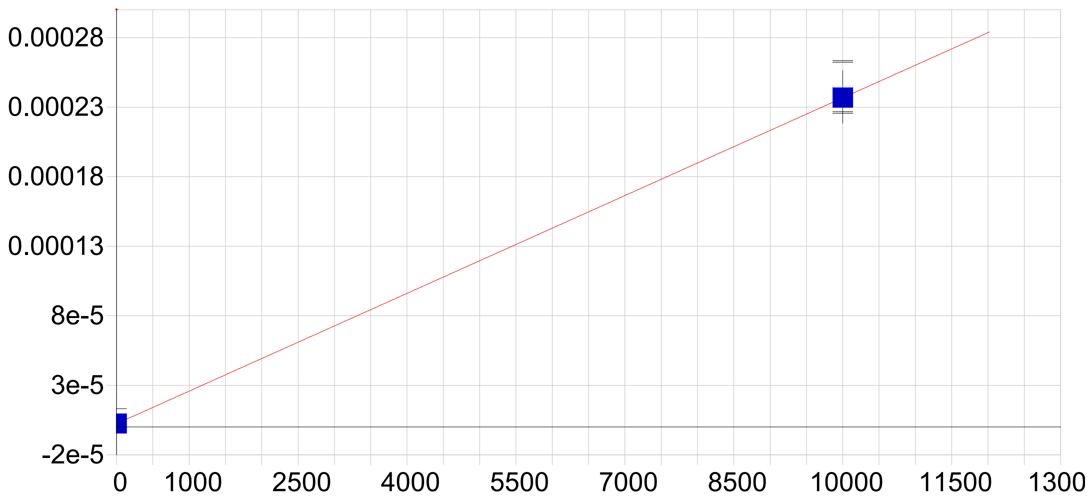



**Y 371.030 { 91}***

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000000 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.000000 | Status: | Warning Zero Gain |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | n/a | | |
| Predicted MQL: | n/a | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | 327890. | 15100. | 1 |

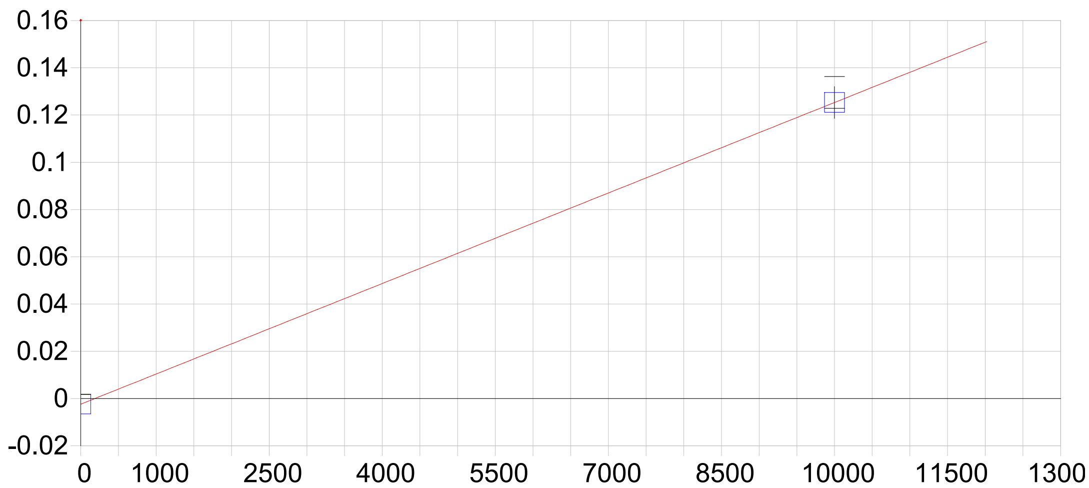



**Na 330.298 {102}**

Date o Fit: 06/18/2015 12:46:09 Type o Fit: Linear eighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000002 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 499.179170 | | |
| Predicted MQL: | 1663.930568 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00000 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .00024 | .000 | 1 |

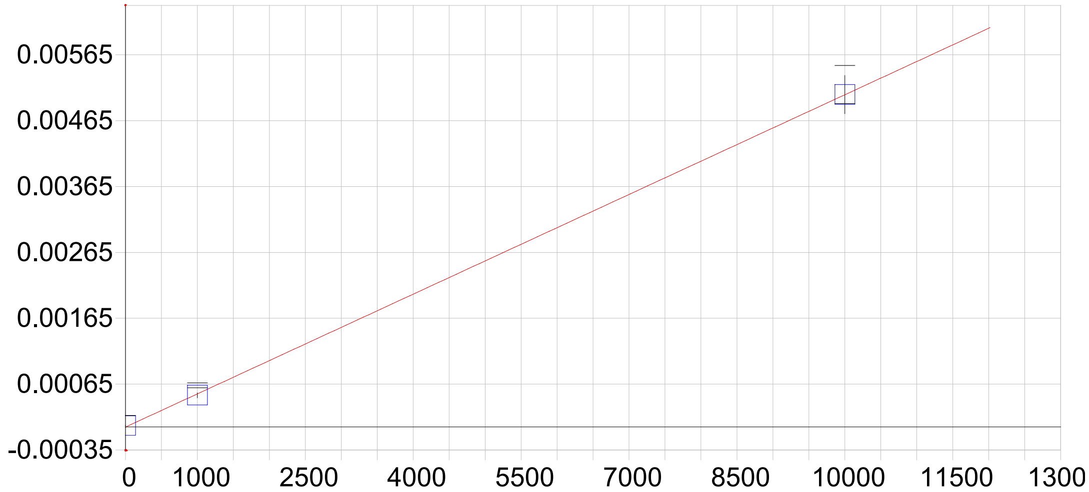



**Na 588.995 { 57}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.002397 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000013 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 3.619868 | | |
| Predicted MQL: | 12.066226 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | -.00240 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .12533 | .007 | 1 |

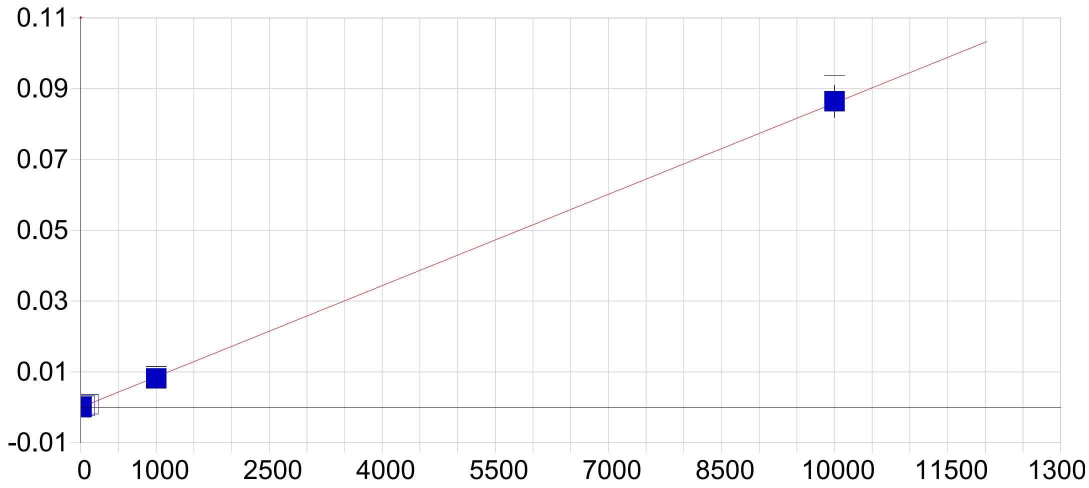



**Si 251.611 {134}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000002 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999969 | Status: | OK . |
| Std Error of Est: | 0.000031 | | |
| Predicted MDL: | 8.420008 | | |
| Predicted MQL: | 28.066693 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 40.598 | 40.6 | .000 | .00002 | .000 | 1 |
| CalStd10=10 | 10000. | 10005. | 4.51 | .045 | .00505 | .000 | 1 |
| CalStd9=100 | 1000.0 | 954.89 | -45.1 | -4.51 | .00048 | .000 | 1 |

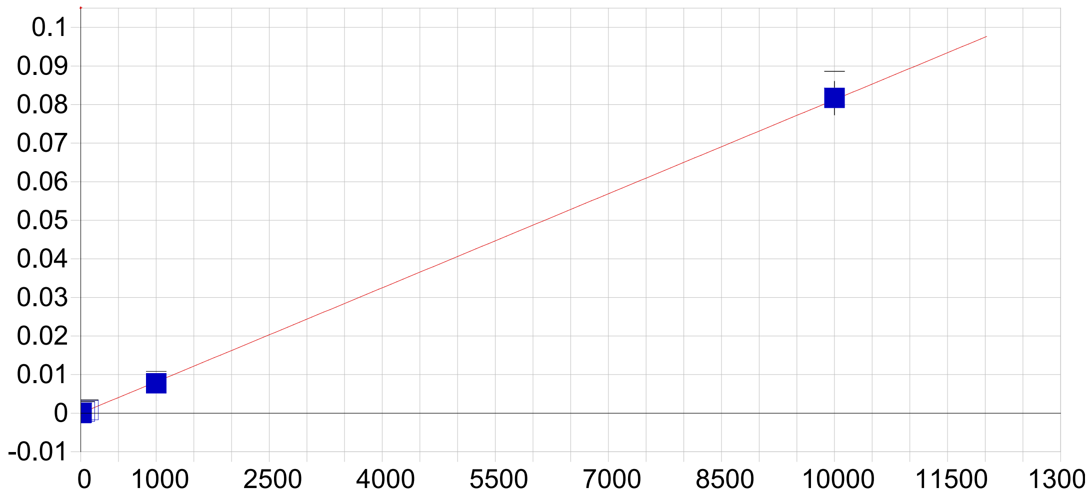



**Ti 334.941 {101}**

Date o Fit: 06/18/2015 12:46:09 Type o Fit: Linear  eighting: 1/Conc

A0 (Oset): 0.000000 Re-Slope: 1.000000
A1 ( ain): 0.000009 Y-int: 0.000000
A2 (Curvature): 0.000000
n (E ponent): 1.000000
Correlation: 0.999856 Status: O .
Std Error o Est: 0.000001
Predicted MDL: 0.880851
Predicted MQL: 2.936171

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00005 | .000 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.989 | .989 | 9.89 | .00009 | .000 | 1 |
| CalStd8=100 | 100.00 | 97.544 | -2.46 | -2.46 | .00084 | .000 | 1 |
| CalStd9=100 | 1000.0 | 948.52 | -51.5 | -5.15 | .00815 | .001 | 1 |
| CalStd10=10 | 10000. | 10055. | 55.1 | .551 | .08642 | .005 | 1 |
| CalStd7=50 | 50.000 | 47.812 | -2.19 | -4.38 | .00041 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.0259 | .026 | .517 | .00004 | .000 | 1 |

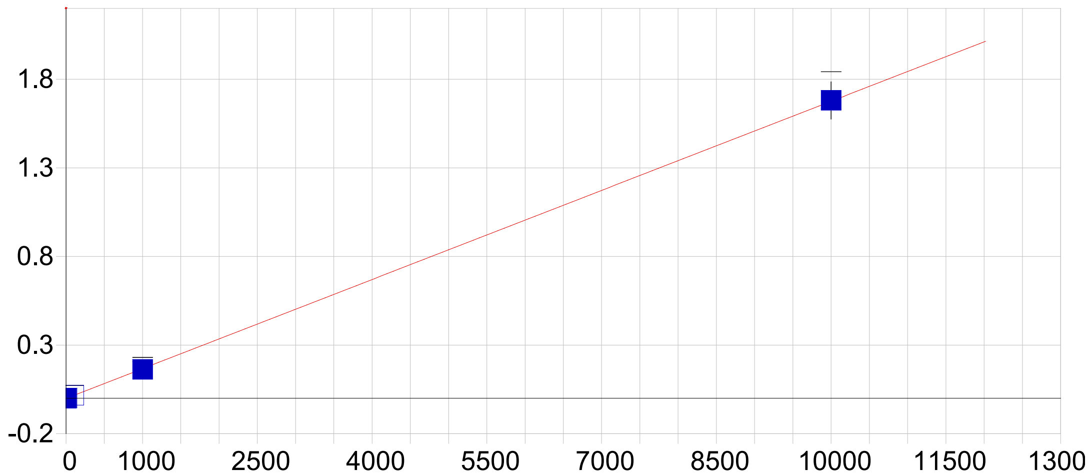



**Ti 337.280 {100}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O set): | -0.000010 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000008 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999875 | Status: | O . |
| Std Error o Est: | 0.000001 | | |
| Predicted MDL: | 1.237312 | | |
| Predicted MQL: | 4.124372 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00065 | .001 | .000 | -.00001 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.555 | .555 | 5.55 | .00008 | .000 | 1 |
| CalStd8=100 | 100.00 | 97.874 | -2.13 | -2.13 | .00079 | .000 | 1 |
| CalStd9=100 | 1000.0 | 951.29 | -48.7 | -4.87 | .00772 | .001 | 1 |
| CalStd10=10 | 10000. | 10052. | 52.0 | .520 | .08167 | .004 | 1 |
| CalStd7=50 | 50.000 | 48.797 | -1.20 | -2.41 | .00039 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.5201 | -.480 | -9.60 | .00003 | .000 | 1 |

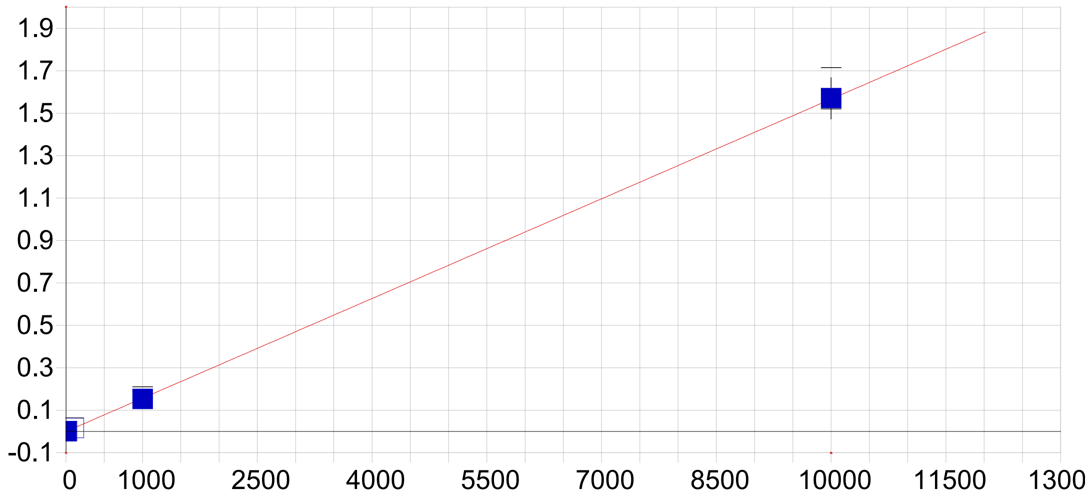



**Sr 407.771 { 83}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O set): | -0.000890 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000168 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999960 | Status: | O . |
| Std Error o Est: | 0.000006 | | |
| Predicted MDL: | 0.084305 | | |
| Predicted MQL: | 0.281015 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00004 | .000 | .000 | -.00089 | .000 | 1 |
| CalStd3=1 | 1.0000 | .98109 | -.019 | -1.89 | -.00073 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.1516 | .152 | 3.03 | -.00003 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.452 | .452 | 4.52 | .00086 | .000 | 1 |
| CalStd8=100 | 100.00 | 100.57 | .572 | .572 | .01598 | .001 | 1 |
| CalStd9=100 | 1000.0 | 971.76 | -28.2 | -2.82 | .16207 | .011 | 1 |
| CalStd10=10 | 10000. | 10027. | 27.1 | .271 | 1.6806 | .105 | 1 |

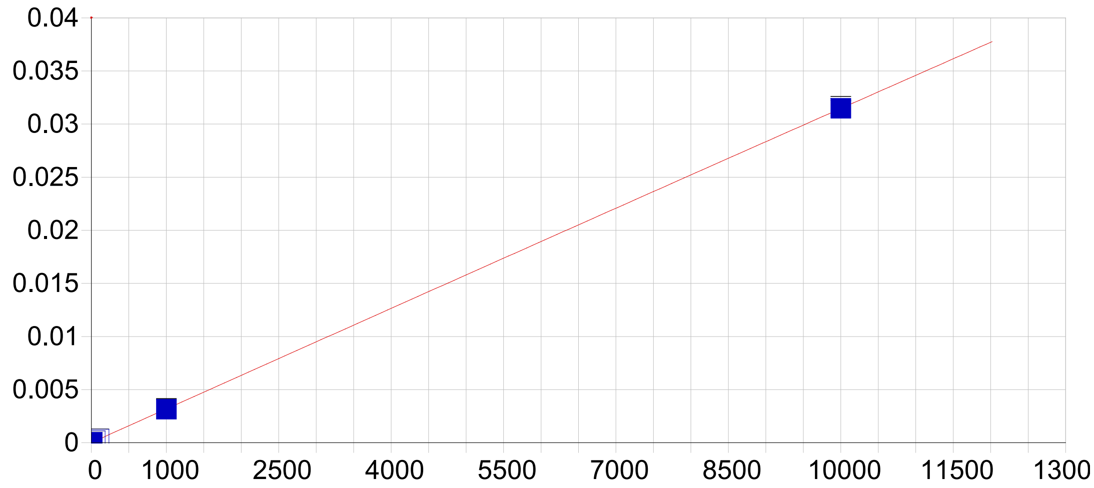



**Sr 421.552 { 80}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O set): | -0.000018 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000157 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999968 | Status: | O . |
| Std Error o Est: | 0.000005 | | |
| Predicted MDL: | 0.086084 | | |
| Predicted MQL: | 0.286947 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00005 | .000 | .000 | -.00002 | .000 | 1 |
| CalStd3=1 | 1.0000 | 1.0123 | .012 | 1.23 | .00014 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.0143 | .014 | .287 | .00077 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.507 | .507 | 5.07 | .00163 | .000 | 1 |
| CalStd8=100 | 100.00 | 100.51 | .515 | .515 | .01573 | .001 | 1 |
| CalStd9=100 | 1000.0 | 975.19 | -24.8 | -2.48 | .15277 | .011 | 1 |
| CalStd10=10 | 10000. | 10024. | 23.8 | .238 | 1.5705 | .097 | 1 |

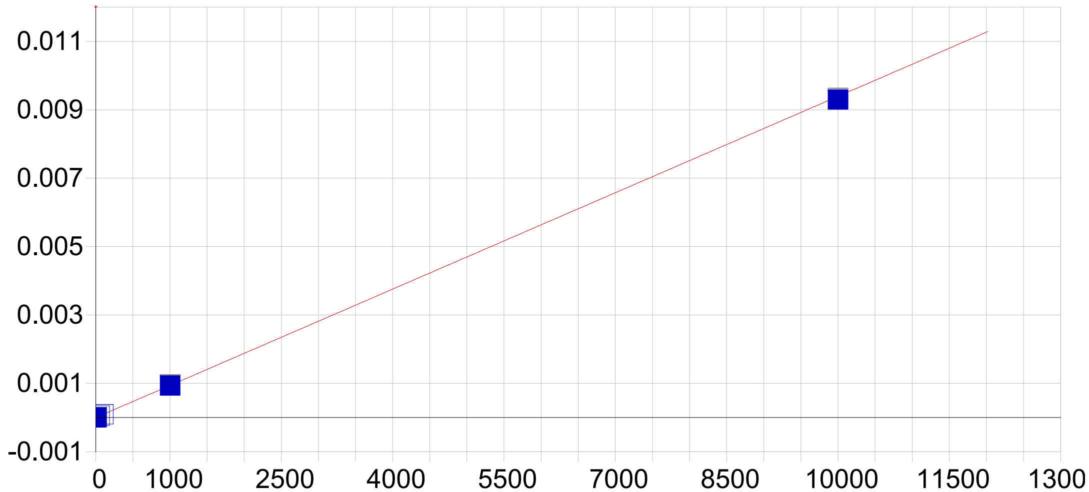



**Sn 189.989 {477}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Curvilinear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000006 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | -0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999971 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 1.265929 | | |
| Predicted MQL: | 4.219762 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00161 | -.002 | .000 | .00001 | .000 | 1 |
| CalStd10=10 | 10000. | 10001. | .925 | .009 | .03147 | .000 | 1 |
| CalStd9=100 | 1000.0 | 990.31 | -9.69 | -.969 | .00314 | .000 | 1 |
| CalStd8=100 | 100.00 | 103.87 | 3.87 | 3.87 | .00034 | .000 | 1 |
| CalStd5=10 | 10.000 | 11.085 | 1.08 | 10.8 | .00004 | .000 | 1 |
| CalStd7=50 | 50.000 | 53.212 | 3.21 | 6.42 | .00017 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.5980 | .598 | 12.0 | .00002 | .000 | 1 |

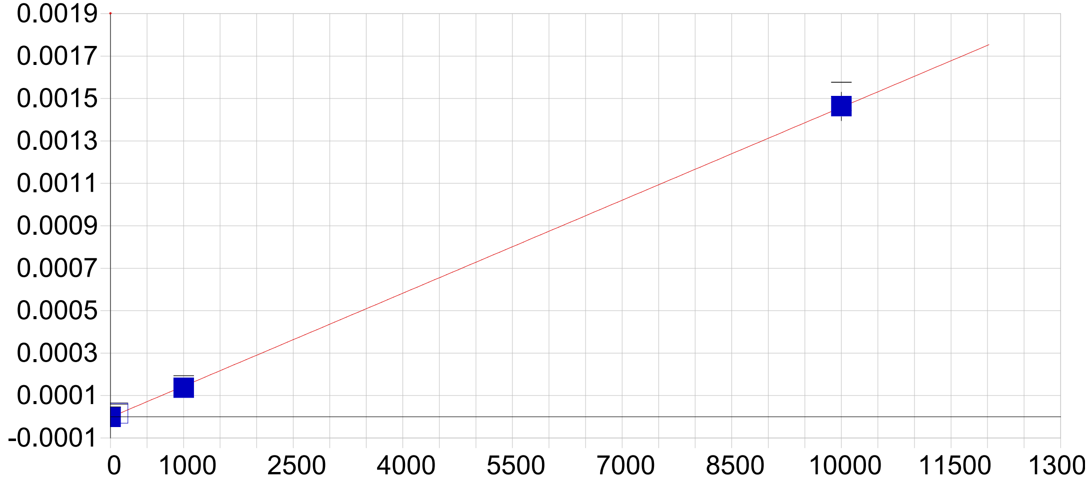



**Sn 189.989 {478}**

Date o Fit: 06/18/2015 12:46:09 Type o Fit: Curvilinear  eighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000001 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999984 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 4.046327 | | |
| Predicted MQL: | 13.487756 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00067 | -.001 | .000 | .00000 | .000 | 1 |
| CalStd10=10 | 10000. | 9898.0 | -102. | -1.02 | .00930 | .000 | 1 |
| CalStd9=100 | 1000.0 | 993.14 | -6.86 | -.686 | .00093 | .000 | 1 |
| CalStd8=100 | 100.00 | 100.97 | .968 | .968 | .00009 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.402 | .402 | 4.02 | .00001 | .000 | 1 |
| CalStd7=50 | 50.000 | 53.831 | 3.83 | 7.66 | .00005 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.0679 | .068 | 1.36 | .00000 | .000 | 1 |

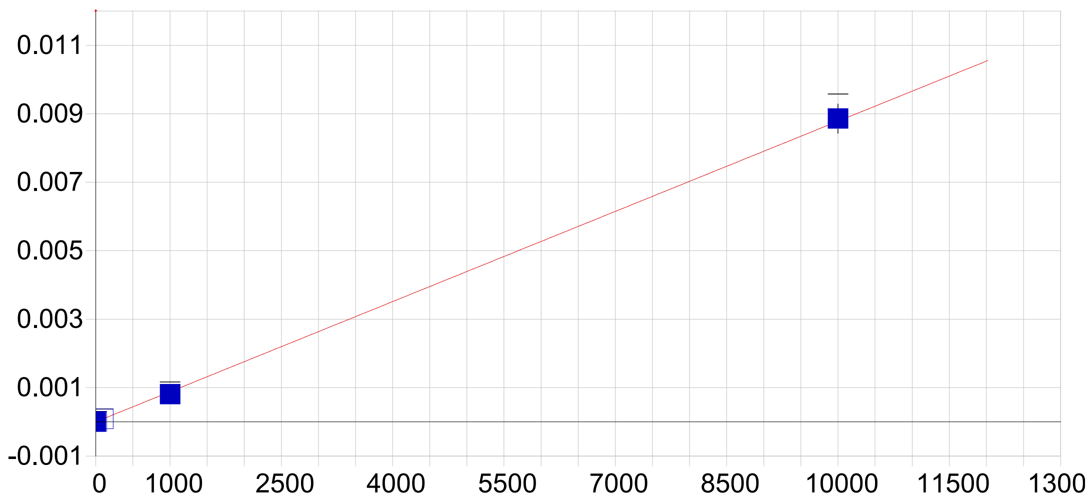



**Sn 283.999 {119}**

Date of Fit: 06/18/2015 12:46:09 Type of Fit: Linear Weighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000002 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999705 | Status: | OK. |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 31.148820 | | |
| Predicted MQL: | 103.829400 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.01449 | -.014 | .000 | .00000 | .000 | 1 |
| CalStd10=10 | 10000. | 10032. | 32.4 | .324 | .00146 | .000 | 1 |
| CalStd9=100 | 1000.0 | 948.22 | -51.8 | -5.18 | .00014 | .000 | 1 |
| CalStd8=100 | 100.00 | 119.34 | 19.3 | 19.3 | .00002 | .000 | 1 |

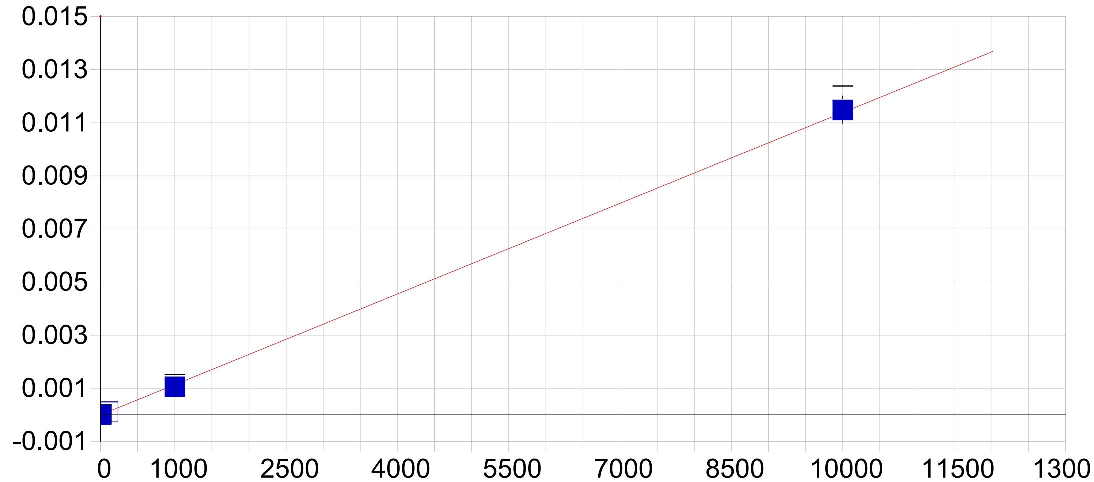



**B 249.678 {135}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000000 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999650 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 4.955407 | | |
| Predicted MQL: | 16.518023 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00063 | .001 | .000 | .00000 | .000 | 1 |
| CalStd8=100 | 100.00 | 98.211 | -1.79 | -1.79 | .00009 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.298 | .298 | 2.98 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 916.24 | -83.8 | -8.38 | .00080 | .000 | 1 |
| CalStd10=10 | 10000. | 10085. | 85.3 | .853 | .00885 | .000 | 1 |

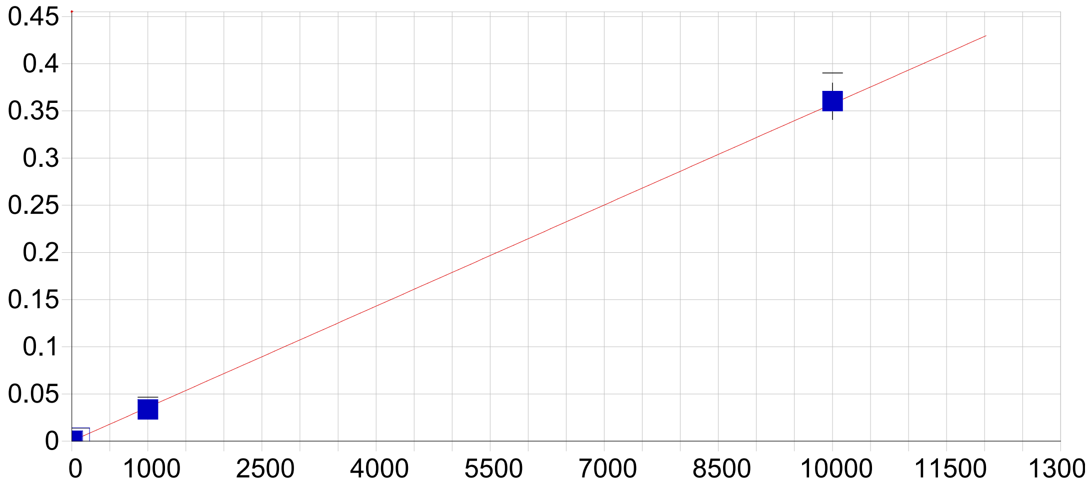



**B 249.773 {135}**

Date of Fit: 06/18/2015 12:46:09 Type of Fit: Linear Weighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000004 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999720 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 3.636354 | | |
| Predicted MQL: | 12.121180 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00084 | .001 | .000 | .00000 | .000 | 1 |
| CalStd8=100 | 100.00 | 95.561 | -4.44 | -4.44 | .00010 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.261 | .261 | 2.61 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 926.20 | -73.8 | -7.38 | .00105 | .000 | 1 |
| CalStd10=10 | 10000. | 10078. | 78.0 | .780 | .01150 | .001 | 1 |

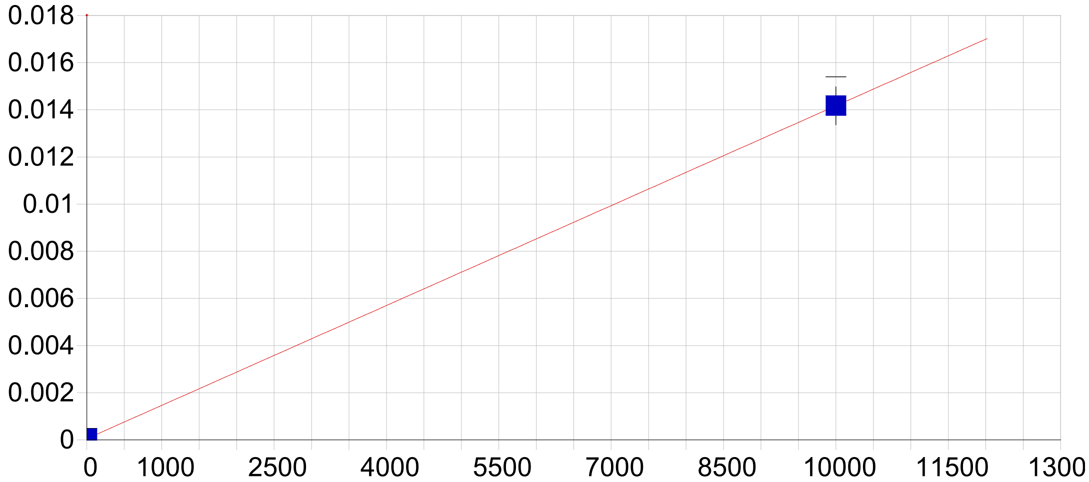



**Li 670.784 { 50}**

| | | | | | |
|---|---|---|---|---|---|
| Date o▯ Fit: | 06/18/2015 12:46:09 | Type o▯ Fit: | Linear | ▯ eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O▯▯set): | 0.000111 | Re-Slope: | 1.000000 |
| A1 (▯ ain): | 0.000036 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E▯ ponent): | 1.000000 | | |
| Correlation: | 0.999750 | Status: | O▯ . |
| Std Error o▯ Est: | 0.000011 | | |
| Predicted MDL: | 0.894437 | | |
| Predicted MQL: | 2.981455 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00115 | .001 | .000 | .00011 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.9856 | -.014 | -.144 | .00047 | .000 | 1 |
| CalStd8=100 | 100.00 | 94.843 | -5.16 | -5.16 | .00350 | .000 | 1 |
| CalStd9=100 | 1000.0 | 931.08 | -68.9 | -6.89 | .03339 | .003 | 1 |
| CalStd10=10 | 10000. | 10074. | 74.1 | .741 | .36015 | .019 | 1 |

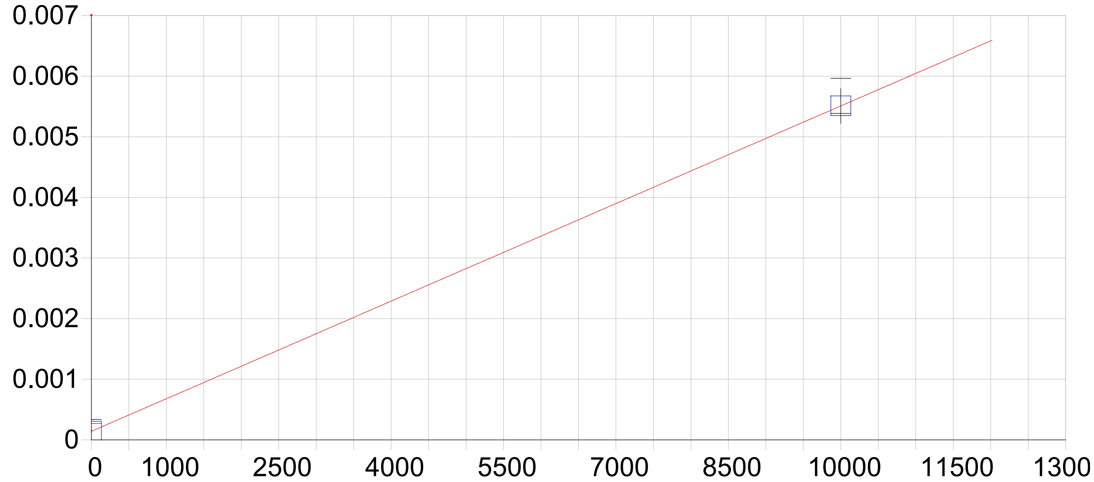



**K 766.490 { 44}**

Date of Fit: 06/18/2015 12:46:09 Type of Fit: Linear Weighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000051 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 18.110026 | | |
| Predicted MQL: | 60.366755 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00005 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .01417 | .001 | 1 |

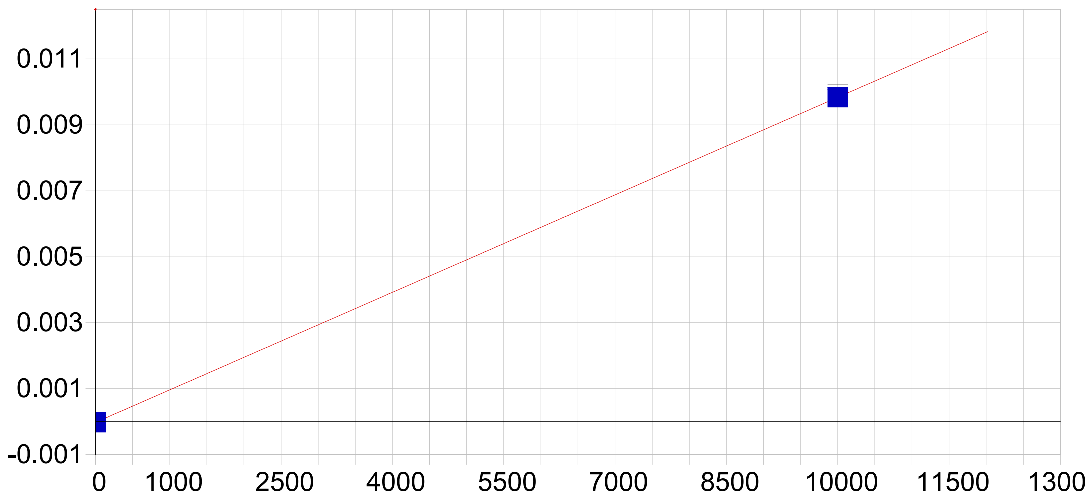



**K 769.896 { 44}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000141 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 42.491678 | | |
| Predicted MQL: | 141.638926 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00014 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .00551 | .000 | 1 |

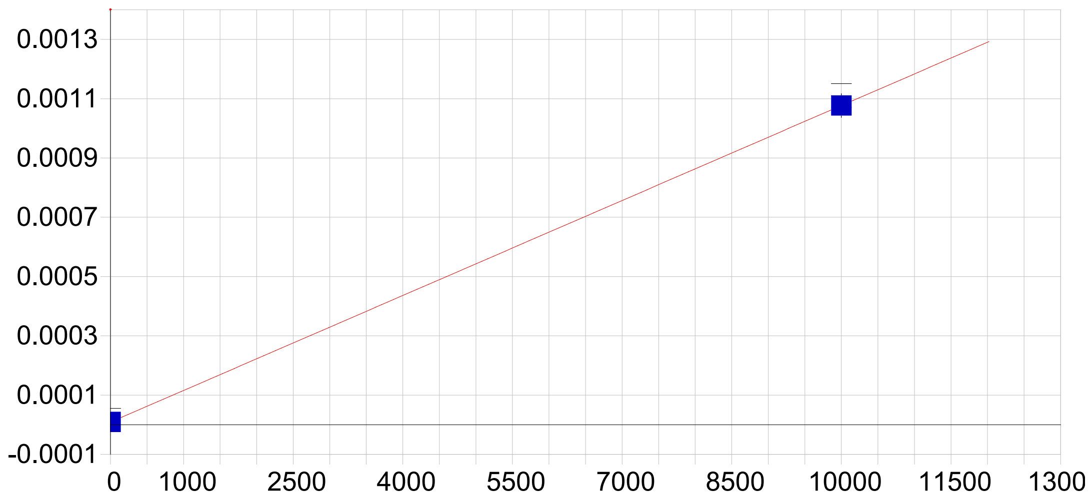



**P 177.495 {489}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O set): | -0.000023 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 3.927797 | | |
| Predicted MQL: | 13.092655 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | -.00002 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .00984 | .000 | 1 |

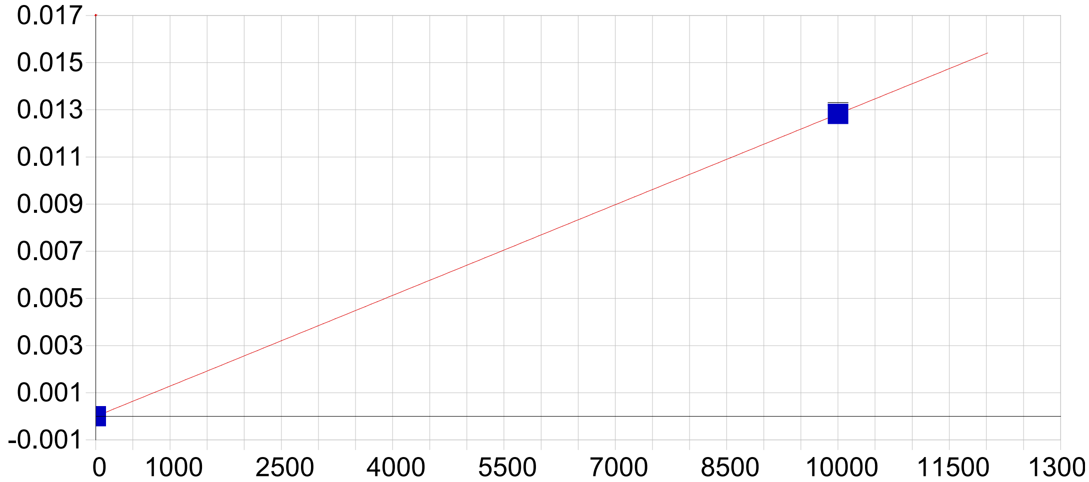



**P 213.618 {158}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000009 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 110.032959 | | |
| Predicted MQL: | 366.776532 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00001 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .00108 | .000 | 1 |

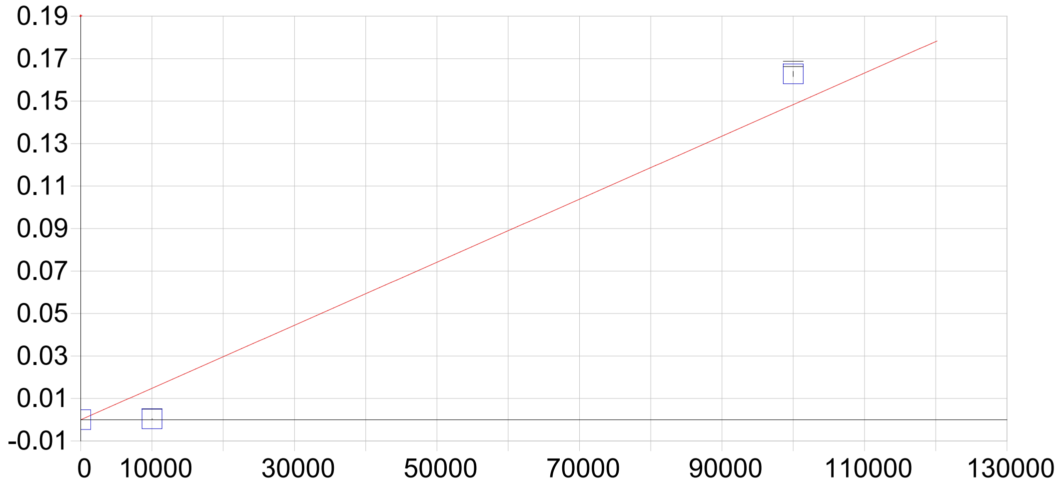



**P 213.618 {457}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000003 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | OK. |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 5.437197 | | |
| Predicted MQL: | 18.123989 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00000 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .01282 | .000 | 1 |

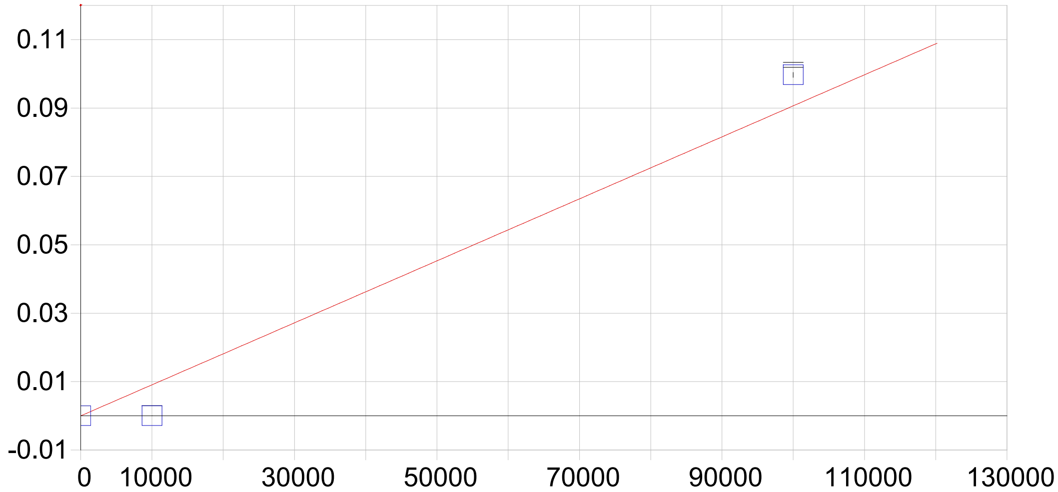



**S 180.731 {486}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000032 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.955729 | Status: | O . |
| Std Error o Est: | 0.000829 | | |
| Predicted MDL: | 3.255044 | | |
| Predicted MQL: | 10.850148 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 8.7576 | 8.76 | .000 | -.00002 | .000 | 1 |
| CalStd12-100 | 100000. | 109730. | 9730. | 9.73 | .16280 | .001 | 1 |
| CalStd10=10 | 10000. | 269.33 | -9730. | -97.3 | .00037 | .000 | 1 |

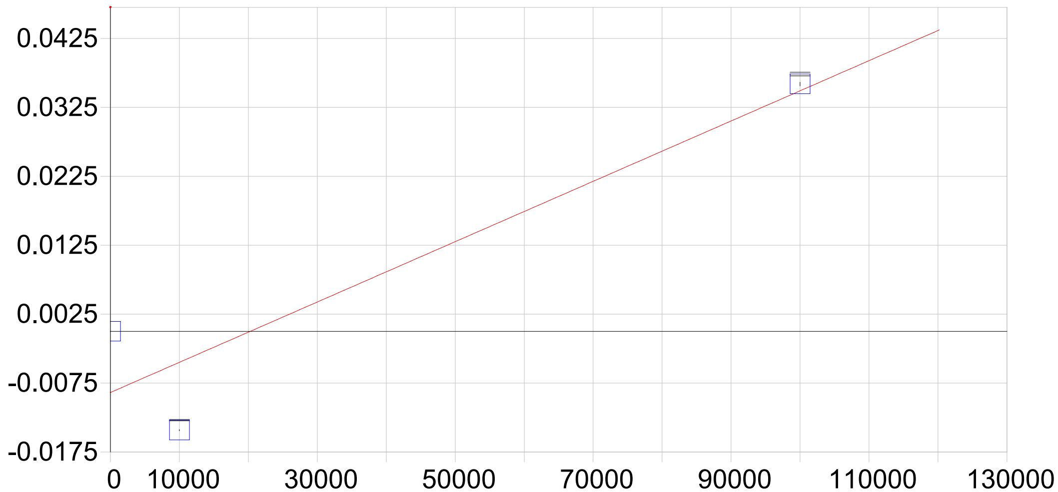



**S 182.034 {485}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000005 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.953597 | Status: | O . |
| Std Error o Est: | 0.000520 | | |
| Predicted MDL: | 5.130027 | | |
| Predicted MQL: | 17.100090 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 8.9811 | 8.98 | .000 | .00000 | .000 | 1 |
| CalStd12-100 | 100000. | 109980. | 9980. | 9.98 | .09968 | .001 | 1 |
| CalStd10=10 | 10000. | 20.982 | -9980. | -99.8 | .00001 | .000 | 1 |

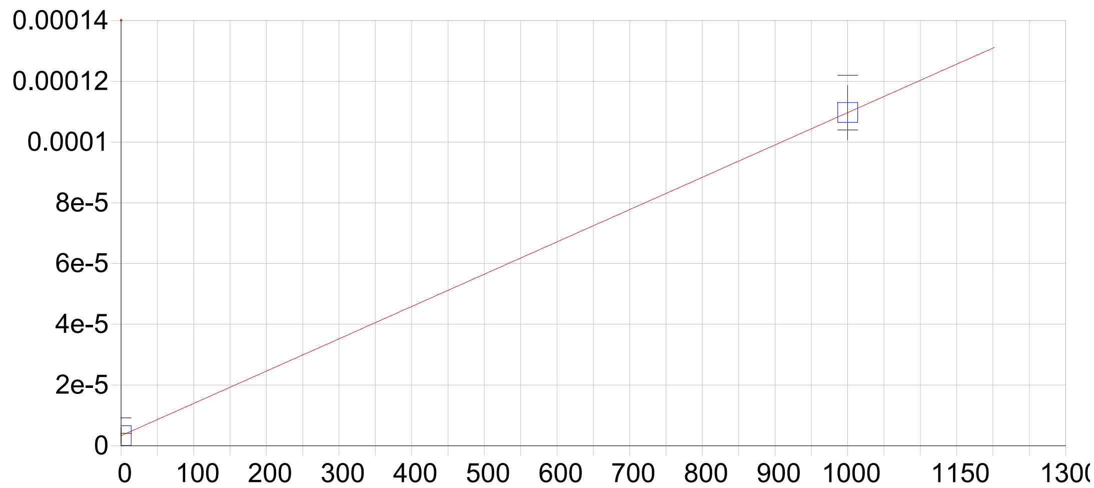



**S 182.624 {484}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/18/2015 12:46:09 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.008868 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.931745 | Status: | Ok . |
| Std Error of Est: | 0.013286 | | |
| Predicted MDL: | 11.056224 | | |
| Predicted MQL: | 36.854081 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 20250. | 20300. | .000 | -.00001 | .000 | 1 |
| CalStd12-100 | 100000. | 102250. | 2250. | 2.25 | .03589 | .000 | 1 |
| CalStd10=10 | 10000. | -12500. | -22500. | -225. | -.01434 | .000 | 1 |

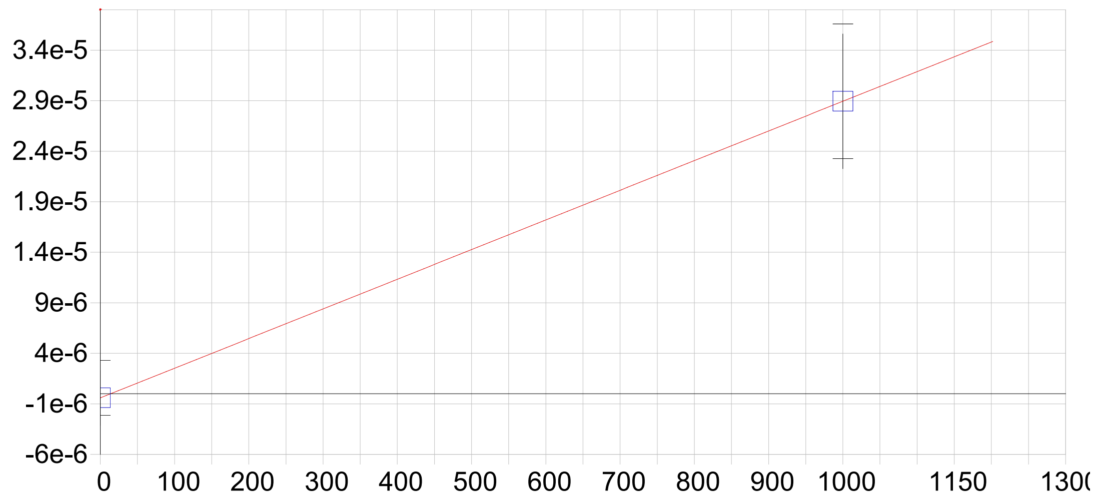



**W 239.709 {140}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Ooset): | 0.000003 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 32.243362 | | |
| Predicted MQL: | 107.477875 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1000.0 | .000 | .000 | .00011 | .000 | 1 |




**W 245.148 {137}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/18/2015 12:46:09 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000000 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 126.792416 | | |
| Predicted MQL: | 422.641387 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1000.0 | .000 | .000 | .00003 | .000 | 1 |

Sample Name: Blank Acquired: 06/17/2015 13:17:48 Type: Cal
Method: DOD Calibration Updated 060614(v644) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al3961 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Be2348 | Ca3158 | Ca3933 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.001** | **.000** | **.000** | **.000** | **.000** | **.000** | **-.005** | **.000** | **.000** | **.000** | **.006** |
| Stddev | .000 | .000 | .00 | .000 | .000 | .00 | .000 | .000 | .000 | .00 | .000 | .001 |
| %RSD | 38.1 | 1.82 | 1040. | 19.0 | 177. | 225. | 46.3 | 5.06 | 1130. | 114. | 9.23 | 18.0 |

| Elem | Cd2265 | Cd2288 | Co2286 | Co2388 | Cr2677 | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Fe2599 | Mg2025 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.002** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .00 | .000 | .000 | .000 | .00 | .000 | .000 | .000 | .000 | .00 |
| %RSD | 178. | 19.6 | 19.1 | 67.5 | 300. | 39.9 | 27.0 | 3.27 | 72.1 | 122. | 104. | 14.0 |

| Elem | Mg2802 | Mn2576 | Mn2593 | Mo2020 | Mo2045 | Ni2316 | Pb2169 | Pb2203 | Sb2068 | Sb2175 | Se1960 | Se2062 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .00 | .00 | .000 | .000 | .00 | .000 | .000 | .00 | .00 | .00 | .00 |
| %RSD | 3.55 | 773. | 3600. | 135. | 335. | 394. | 46.7 | 208. | 210. | 498. | 578. | 59.7 |

| Elem | Tl1908 | Tl2767 | V_2908 | V_2924 | Zn2062 | Zn2138 |
|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 433. | 92.0 | 32.0 | 957. | 2350. | 101. |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **72134.** | **327890.** |
| Stddev | 400. | 15135. |
| %RSD | .55475 | 4.6159 |

Sample Name: CalStd1=0.25 Acquired: 06/17/2015 13:22:12 Type: Cal
Method: DOD Calibration Updated 060614(v644) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Be3130 |
| --- | --- |
| Units | Cts/S |
| Avg | **.000** |
| Stddev | .000 |
| %RSD | 23.4 |

| Int. Std. | Y_2243 |
| --- | --- |
| Units | Cts/S |
| Avg | **71347.** |
| Stddev | 207. |
| %RSD | .28976 |

Sample Name: CalStd2=0.5 Acquired: 06/17/2015 13:26:35 Type: Cal

Method: DOD Calibration Updated 060614(v644) Mode: IR Corr. Factor: 1.000000

User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1

Comment:

| Elem | Ba4554 | Be3130 | Cd2265 | Cd2288 |
|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 |
| %RSD | 25.5 | 15.4 | 15.0 | 14.4 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **71699.** | **326590.** |
| Stddev | 266. | 18678. |
| %RSD | .37036 | 5.7190 |

Sample Name: CalStd3=1 Acquired: 06/17/2015 13:31:00 Type: Cal
Method: DOD Calibration Updated 060614(v644) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Ba4554 | Be3130 | Cd2265 | Cd2288 | Co2286 | Cr2677 | Cu2247 | Ni2316 | V_2924 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .00 | .000 | .000 |
| %RSD | 51.9 | 6.88 | 15.0 | 11.6 | 5.34 | 9.97 | 34.2 | 22.7 | 20.7 | 280. |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **71850.** | **321420.** |
| Stddev | 526. | 12128. |
| %RSD | .73253 | 3.7731 |

Sample Name: CalStd4=5  Acquired: 06/17/2015 13:35:24  Type: Cal
Method: DOD Calibration Updated 060614(v644)  Mode: IR  Corr. Factor: 1.000000
User: NAH  ICAP6500:  Prep Batch:  Post Digestion dilution: 1
Comment:

| Elem | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Mn2576 | Ni2316 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.001** | **-.003** | **.001** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 29.7 | 137. | 2190. | 6.52 | 10.7 | 3.70 | 3.67 | 3.18 | 32.7 | 41.1 | 8.31 | 4.52 |

| Elem | Pb2169 | Pb2203 | Sb2175 | Zn2138 |
|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 |
| %RSD | 15.1 | 28.8 | 19.8 | 5.05 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **71908.** | **324170.** |
| Stddev | 101. | 9137. |
| %RSD | .14077 | 2.8186 |

Sample Name: CalStd5=10 Acquired: 06/17/2015 13:39:47 Type: Cal
Method: DOD Calibration Updated 060614(v644) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Cd2265 | Cd2288 | Co2286 | Cr2677 | Cu2247 | Mn2576 | Mo2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.001** | **.002** | **.001** | **.001** | **.001** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 9.80 | 9.30 | 21.9 | 7.84 | 4.11 | 1.61 | 2.35 | 2.05 | 29.0 | 6.95 | 5.25 | 2.39 |

| Elem | Ni2316 | Pb2169 | Pb2203 | Sb2068 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 3.57 | 24.6 | 9.10 | 17.4 | 21.2 | 63.8 | 12.6 | 25.0 | 4.16 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **71884.** | **322990.** |
| Stddev | 275. | 11932. |
| %RSD | .38284 | 3.6942 |

Sample Name: CalStd6=20 Acquired: 06/17/2015 13:44:12 Type: Cal
Method: DOD Calibration Updated 060614(v644) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ba4554 | Cr2677 | Cu2247 | Fe2599 | Mn2576 | Mo2020 | Sb2175 | V_2924 |
|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.003** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 6.06 | 21.5 | 5.26 | 11.7 | 4.60 | 5.03 | 7.28 | 10.3 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **71139.** | **323050.** |
| Stddev | 309. | 11559. |
| %RSD | .43380 | 3.5782 |

Sample Name: CalStd7=50 Acquired: 06/17/2015 13:48:32 Type: Cal
Method: DOD Calibration Updated 060614(v644) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Al1670 | As1937 | Ba4554 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cr2835 | Cu2247 | Fe2599 | Mg2802 | Mn2576 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.006** | **.076** | **.003** | **.003** | **.000** | **.000** | **.000** | **.000** | **.001** | **.001** |
| Stddev | .000 | .000 | .000 | .002 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 7.00 | 10.6 | 8.00 | 2.97 | 1.73 | 2.19 | 11.2 | 6.32 | 4.66 | 7.47 | 7.24 | 3.03 |

| Elem | Mo2020 | Mo2045 | Ni2316 | Sb2068 | Se1960 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.002** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 1.94 | 4.40 | 1.88 | 8.20 | 19.3 | 5.05 | 4.61 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **71571.** | **327530.** |
| Stddev | 338. | 11332. |
| %RSD | .47244 | 3.4600 |

Sample Name: CalStd8=100 Acquired: 06/17/2015 13:52:52 Type: Cal
Method: DOD Calibration Updated 060614(v644) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Be2348 | Ca3933 | Cd2265 | Cd2288 | Co2286 | Co2388 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.001** | **.000** | **.000** | **.012** | **.047** | **.023** | **.000** | **.139** | **.006** | **.011** | **.006** | **.000** |
| Stddev | .000 | .000 | .000 | .001 | .002 | .001 | .000 | .005 | .000 | .000 | .000 | .000 |
| %RSD | 6.92 | 3.06 | 35.4 | 5.49 | 3.91 | 3.60 | 5.87 | 3.81 | 2.05 | 1.99 | 2.32 | 8.67 |

| Elem | Cr2677 | Cr2835 | Cu2247 | Cu3247 | Fe2599 | Mg2802 | Mn2576 | Mo2020 | Mo2045 | Ni2316 | Pb2169 | Pb2203 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.002** | **.000** | **.002** | **.002** | **.001** | **.000** | **.004** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 7.25 | 5.50 | 4.92 | 2.62 | 4.68 | 5.56 | 3.36 | 2.34 | 3.86 | 2.25 | 2.76 | 2.00 |

| Elem | Sb2175 | Se1960 | Se2062 | Tl1908 | Tl2767 | V_2908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.001** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 5.87 | 4.77 | 23.0 | 4.57 | 26.2 | 6.52 | 5.14 | 3.97 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **72109.** | **322040.** |
| Stddev | 261. | 7578. |
| %RSD | .36132 | 2.3531 |

Sample Name: CalStd9=1000 Acquired: 06/17/2015 13:57:02 Type: Cal
Method: DOD Calibration Updated 060614(v644) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Al3092 | Al3961 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Be2348 | Ca3158 | Ca3933 | Cd2265 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.004** | **.008** | **.001** | **.001** | **.000** | **.116** | **.498** | **.221** | **.003** | **.004** | **1.18** | **.055** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .008 | .022 | .009 | .000 | .000 | .05 | .001 |
| %RSD | 3.27 | 3.77 | 5.28 | 1.61 | 4.69 | 7.13 | 4.35 | 4.26 | 7.00 | 10.6 | 4.21 | 2.11 |

| Elem | Cd2288 | Co2286 | Co2388 | Cr2677 | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Fe2599 | Mg2025 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.101** | **.057** | **.001** | **.002** | **.002** | **.003** | **.005** | **.000** | **.000** | **.001** | **.000** | **.020** |
| Stddev | .002 | .001 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .001 |
| %RSD | 2.26 | 2.43 | 6.78 | 6.52 | 6.36 | 5.48 | 4.86 | 4.19 | 6.09 | 6.89 | 5.41 | 6.70 |

| Elem | Mn2576 | Mn2593 | Mo2020 | Mo2045 | Ni2316 | Pb2169 | Pb2203 | Sb2068 | Sb2175 | Se1960 | Se2062 | Tl1908 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.022** | **.040** | **.007** | **.001** | **.037** | **.001** | **.001** | **.000** | **.001** | **.001** | **.000** | **.002** |
| Stddev | .001 | .002 | .000 | .000 | .001 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 4.06 | 4.07 | 2.34 | 5.22 | 2.62 | 5.19 | 5.32 | 4.70 | 5.11 | 2.29 | .385 | 1.23 |

| Elem | Tl2767 | V_2908 | V_2924 | Zn2062 | Zn2138 |
|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.002** | **.004** | **.005** | **.007** |
| Stddev | .000 | .000 | .000 | .000 | .000 |
| %RSD | 12.5 | 7.02 | 7.10 | 5.34 | 5.12 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **72657.** | **321880.** |
| Stddev | 134. | 10485. |
| %RSD | .18495 | 3.2575 |

Sample Name: CalStd10=10000 Acquired: 06/17/2015 14:00:48 Type: Cal
Method: DOD Calibration Updated 060614(v644) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Al3092 | Al3961 | As1890 | Ba4934 | Ca3158 | Co2388 | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Fe2599 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.036** | **.088** | **.000** | **5.40** | **.034** | **.007** | **.024** | **.025** | **.030** | **.001** | **.003** | **.014** |
| Stddev | .002 | .005 | .000 | .30 | .002 | .000 | .001 | .000 | .001 | .000 | .000 | .001 |
| %RSD | 5.13 | 5.38 | .361 | 5.48 | 5.42 | 5.19 | 4.75 | .763 | 4.75 | 5.00 | 5.17 | 4.69 |

| Elem | Mg2025 | Mg2802 | Mn2576 | Mn2593 | Mo2045 | Ni2316 | Pb2169 | Sb2068 | Se1960 | Se2062 | Tl2767 | V_2908 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.004** | **.201** | **.235** | **.428** | **.011** | **.375** | **.006** | **.005** | **.007** | **.004** | **.003** | **.024** |
| Stddev | .000 | .010 | .013 | .024 | .000 | .003 | .000 | .000 | .000 | .000 | .000 | .001 |
| %RSD | .858 | 4.94 | 5.67 | 5.66 | .665 | .674 | .906 | .916 | .558 | .197 | 6.65 | 4.89 |

| Elem | Zn2062 | Zn2138 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **.052** | **.065** |
| Stddev | .000 | .000 |
| %RSD | .522 | .542 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **69258.** | **318130.** |
| Stddev | 315. | 2373. |
| %RSD | .45538 | .74603 |

Sample Name: CalStd11-100k    Acquired: 06/17/2015 14:05:07    Type: Cal
Method: DOD Calibration Updated 060614(v644)    Mode: IR    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | Cr2835 | Cu3247 | Mn2593 | Pb2169 | Zn2062 |
|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.220** | **.266** | **3.95** | **.059** | **.398** |
| Stddev | .009 | .011 | .14 | .001 | .006 |
| %RSD | 4.05 | 4.18 | 3.44 | 2.08 | 1.59 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **69692.** | **326800.** |
| Stddev | 383. | 4002. |
| %RSD | .54994 | 1.2247 |

Sample Name: CalStd12-100000 Acquired: 06/17/2015 14:09:16 Type: Cal
Method: DOD Calibration Updated 060614(v644) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Al3092 | Al3961 | Ca3158 | Fe2343 | Fe2395 | Mg2025 |
|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.343** | **.853** | **.329** | **.011** | **.026** | **.031** |
| Stddev | .017 | .043 | .017 | .001 | .001 | .001 |
| %RSD | 4.94 | 5.04 | 5.24 | 5.52 | 5.38 | 2.21 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **67584.** | **322790.** |
| Stddev | 278. | 4463. |
| %RSD | .41081 | 1.3826 |

Sample Name: CalStd13=500000 Acquired: 06/17/2015 14:13:36 Type: Cal
Method: DOD Calibration Updated 060614(v644) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Al3961 | Ca3158 | Fe2343 | Mg2025 |
|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **4.43** | **1.72** | **.049** | **.126** |
| Stddev | .28 | .09 | .002 | .001 |
| %RSD | 6.32 | 5.14 | 3.95 | .553 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **61508.** | **311670.** |
| Stddev | 325. | 1625. |
| %RSD | .52903 | .52132 |

Sample Name: CalStd14-1000k    Acquired: 06/17/2015 14:18:19    Type: Cal
Method: DOD Calibration Updated 060614(v644)    Mode: IR    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | Al3961 | Ca3158 | Fe2343 | Mg2025 |
|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **8.85** | **3.32** | **.089** | **.215** |
| Stddev | .61 | .15 | .004 | .002 |
| %RSD | 6.90 | 4.55 | 5.03 | .719 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **57855.** | **304810.** |
| Stddev | 447. | 1031. |
| %RSD | .77283 | .33815 |

Sample Name: icv      Acquired: 06/17/2015 14:27:36      Type: QC
Method: DOD Calibration Updated 060614(v644)      Mode: CONC      Corr. Factor: 1.000000
User: NAH      ICAP6500:      Prep Batch:      Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al3961 | As1890 | Ba4934 | Be3130 | Ca3158 | Cd2265 | Co2286 | Co2388 | Cr2677 | Cu2247 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **51.2** | **12200.** | **12100.** | **2050.** | **2110.** | **53.0** | **9810.** | **50.6** | **507.** | **488.** | **205.** | **255.** |
| Stddev | 3.4 | 520. | 524. | 56. | 112. | 2.6 | 468. | .7 | 10. | 33. | 14. | 7. |
| %RSD | 6.57 | 4.27 | 4.33 | 2.73 | 5.30 | 4.89 | 4.77 | 1.29 | 1.88 | 6.71 | 6.82 | 2.68 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Fe2343 | Fe2395 | Mg2025 | Mn2576 | Mn2593 | Mo2020 | Mo2045 | Ni2316 | Pb2169 | Pb2203 | Sb2068 | Sb2175 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **5140.** | **4990.** | **9590.** | **499.** | **515.** | **503.** | **493.** | **516.** | **516.** | **495.** | **497.** | **491.** |
| Stddev | 270. | 260. | 332. | 25. | 24. | 7. | 15. | 8. | 13. | 12. | 12. | 12. |
| %RSD | 5.24 | 5.20 | 3.46 | 5.09 | 4.64 | 1.44 | 3.09 | 1.62 | 2.57 | 2.48 | 2.38 | 2.51 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Se1960 | Se2062 | Tl2767 | V_2908 | V_2924 | Zn2062 | Zn2138 |
|---|---|---|---|---|---|---|---|
| Avg | **2060.** | **2070.** | **2040.** | **486.** | **517.** | **497.** | **544.** |
| Stddev | 33. | 26. | 160. | 28. | 29. | 16. | 16. |
| %RSD | 1.62 | 1.24 | 7.87 | 5.77 | 5.61 | 3.14 | 2.97 |
| Check ? | None | None | None | None | None | None | None |
| Value | | | | | | | |
| Range | | | | | | | |

Sample Name: icv Acquired: 06/17/2015 14:27:36 Type: QC
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **70306.** | **324520.** |
| Stddev | 318. | 4755. |
| %RSD | .45277 | 1.4653 |

Sample Name: ICVLL Acquired: 06/17/2015 14:31:49 Type: QC
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3158 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **67.2** | **1190.** | **1160.** | **67.8** | **31.4** | **13.7** | **1450.** | **1670.** | **14.4** | **30.9** | **31.5** | **29.0** |
| Stddev | 4.5 | 23. | 50. | 3.1 | 1.5 | .5 | 56. | 46. | .1 | .5 | 2.8 | 1.6 |
| %RSD | 6.68 | 1.92 | 4.32 | 4.65 | 4.79 | 3.33 | 3.88 | 2.75 | .664 | 1.46 | 8.80 | 5.63 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Fe2343 | Fe2395 | Fe2599 | Mg2802 | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **920.** | **899.** | **907.** | **1500.** | **31.0** | **32.9** | **31.6** | **30.7** | **62.6** | **67.3** | **60.1** | **31.3** |
| Stddev | 64. | 42. | 44. | 77. | .6 | .9 | .6 | 1.8 | 2.7 | 6.5 | 2.1 | 2.5 |
| %RSD | 6.97 | 4.63 | 4.89 | 5.11 | 2.09 | 2.83 | 1.86 | 5.75 | 4.34 | 9.71 | 3.44 | 7.95 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Zn2138 |
|---|---|
| Avg | **33.7** |
| Stddev | 1.2 |
| %RSD | 3.68 |
| Check ? | Chk Pass |
| Value | |
| Range | |

Sample Name: ICVLL Acquired: 06/17/2015 14:31:49 Type: QC
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **70963.** | **329250.** |
| Stddev | 70. | 9431. |
| %RSD | .09802 | 2.8644 |

Sample Name: icb    Acquired: 06/17/2015 14:40:30    Type: QC
Method: DOD Calibration Updated 060614(v644)    Mode: CONC    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **-1.39** | **-.823** | **4.22** | **-.772** | **.023** | **-6.62** | **-1.46** | **.025** | **.812** | **-.314** | **10.6** | **.534** |
| Stddev | 1.75 | 1.67 | .78 | .116 | .026 | 1.14 | .10 | .074 | 2.05 | .338 | 1.3 | .113 |
| %RSD | 126. | 203. | 18.5 | 15.0 | 114. | 17.2 | 6.74 | 301. | 252. | 108. | 11.9 | 21.1 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Avg | **.435** | **-.353** | **-.005** | **.698** | **.632** | **-54.3** | **.183** | **-1.37** | **.263** |
| Stddev | .615 | .824 | .270 | .619 | 1.44 | 526. | 1.55 | 1.59 | .074 |
| %RSD | 141. | 233. | 5300. | 88.8 | 228. | 968. | 846. | 116. | 28.1 |
| Check ? | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | |
| Range | | | | | | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **71150.** | **329690.** |
| Stddev | 227. | 9883. |
| %RSD | .31955 | 2.9975 |

Sample Name: icsa Acquired: 06/17/2015 14:49:14 Type: QC
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3961 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2343 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **.011** | **544000.** | **.161** | **.212** | **-.027** | **499000.** | **.001** | **-.601** | **-.010** | **.001** | **460000.** |
| Stddev | 1.67 | 29000. | 51.4 | .092 | 1.40 | 25000. | 3.29 | .217 | 3.19 | 4.55 | 22700. |
| %RSD | 14900. | 5.33 | 31900. | 43.4 | 5120. | 5.01 | 250000. | 36.1 | 31200. | 342000. | 4.93 |
| Check ? | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None |
| High Limit | | | | | | | | | | | |
| Low Limit | | | | | | | | | | | |

| Elem | Mg2025 | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **468000.** | **-.004** | **.000** | **.000** | **.000** | **.000** | **-.031** | **.412** | **-.362** | **.004** |
| Stddev | 6510. | .612 | 1.12 | 1.08 | 1.22 | 3.07 | 19.9 | 7.14 | 2.54 | 2.35 |
| %RSD | 1.39 | 16300. | 5360000. | 612000. | 3540000. | 1130000. | 63800. | 1730. | 702. | 66700. |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| High Limit | | | | | | | | | | |
| Low Limit | | | | | | | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **60519.** | **306730.** |
| Stddev | 144. | 3089. |
| %RSD | .23743 | 1.0070 |

Sample Name: icsab Acquired: 06/17/2015 14:53:56 Type: QC
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3961 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Be2348 | Ca3158 | Cd2265 | Cd2288 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **573.** | **567000.** | **511.** | **477.** | **559.** | **534.** | **588.** | **516.** | **516000.** | **456.** | **533.** |
| Stddev | 19. | 27100. | 11. | 38. | 17. | 15. | 14. | 14. | 16000. | . | 2. |
| %RSD | 3.38 | 4.77 | 2.17 | 7.93 | 3.07 | 2.87 | 2.44 | 2.64 | 3.10 | .095 | .465 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | |
| Range | | | | | | | | | | | |

| Elem | Co2286 | Co2388 | Cr2677 | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Mg2025 | Mn2576 | Mn2593 | Mo2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **456.** | **459.** | **508.** | **559.** | **406.** | **410.** | **464000.** | **465000.** | **549.** | **548.** | **496.** |
| Stddev | 3. | 13. | 15. | 14. | 3. | 20. | 12000. | 5700. | 15. | 27. | 3. |
| %RSD | .629 | 2.88 | 3.00 | 2.59 | .768 | 4.90 | 2.58 | 1.22 | 2.76 | 4.96 | .697 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | |
| Range | | | | | | | | | | | |

| Elem | Mo2045 | Ni2316 | Pb2169 | Pb2203 | Sb2068 | Sb2175 | Se1960 | Se2062 | Tl1908 | Tl2767 | V_2908 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **420.** | **440.** | **471.** | **485.** | **454.** | **465.** | **502.** | **555.** | **417.** | **495.** | **447.** |
| Stddev | 5. | 2. | 13. | 4. | 10. | 7. | 7. | 65. | 2. | 477. | 9. |
| %RSD | 1.08 | .442 | 2.82 | .872 | 2.13 | 1.57 | 1.40 | 11.8 | .451 | 96.5 | 1.93 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | |
| Range | | | | | | | | | | | |

Sample Name: icsab Acquired: 06/17/2015 14:53:56 Type: QC
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | V_2924 | Zn2062 | Zn2138 |
|---|---|---|---|
| Avg | **534.** | **414.** | **498.** |
| Stddev | 13. | 4. | 4. |
| %RSD | 2.39 | .914 | .850 |
| | | | |
| Check ? | Chk Pass | Chk Pass | Chk Pass |
| Value | | | |
| Range | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **60909.** | **309960.** |
| Stddev | 91. | 2829. |
| %RSD | .14957 | .91274 |

Sample Name: lcsw52893 92 Acquired: 06/17/2015 15:32:52 Type: Unk
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Ca3158 | Cd2265 | Co2286 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **18.4** | **1020.** | **661.** | **816.** | **748.** | **783.** | **849.** | **19.0** | **193000.** | **17.1** | **179.** |
| Stddev | 2.5 | 55. | 13. | 4. | 24. | 44. | 41. | 1.0 | 8810. | .1 | 2. |
| %RSD | 13.4 | 5.38 | 1.99 | .429 | 3.23 | 5.65 | 4.82 | 5.00 | 4.57 | .754 | 1.02 |

| Elem | Cr2677 | Cu2247 | Fe2599 | Mg2025 | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Se2062 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | mg/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **73.8** | **87.6** | **397.** | **88800.** | **199.** | **-1.44** | **185.** | **175.** | **176.** | **784.** | **800.** |
| Stddev | 3.0 | 1.9 | 12. | 1760. | 9. | 1.23 | 2. | 35. | 4. | 5. | 18. |
| %RSD | 4.04 | 2.13 | 3.03 | 1.98 | 4.43 | 85.1 | 1.04 | 19.7 | 2.36 | .698 | 2.21 |

| Elem | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|
| Units | ug/L | ug/L | ug/L |
| Avg | **670.** | **192.** | **193.** |
| Stddev | 2. | 11. | 4. |
| %RSD | .263 | 5.57 | 2.14 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **64442.** | **318060.** |
| Stddev | 114. | 3575. |
| %RSD | .17709 | 1.1239 |

Sample Name: mbw52893 92 Acquired: 06/17/2015 15:37:32 Type: Unk
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-.931** | **-1.50** | **3.05** | **-.738** | **-.026** | **14.3** | **-1.43** | **-.111** | **-3.16** | **-.164** | **9.01** | **7.90** |
| Stddev | 2.71 | 1.51 | 1.66 | .063 | .109 | 6.4 | .13 | .127 | 1.59 | .142 | .98 | 2.43 |
| %RSD | 291. | 100. | 54.3 | 8.47 | 423. | 44.9 | 8.95 | 114. | 50.3 | 86.3 | 10.9 | 30.8 |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **.344** | **-.418** | **.078** | **.823** | **.361** | **14.1** | **.634** | **-.263** | **.065** |
| Stddev | .209 | .373 | .298 | 1.28 | 2.51 | 9.1 | 3.73 | 2.48 | .230 |
| %RSD | 60.7 | 89.3 | 382. | 156. | 693. | 64.5 | 588. | 942. | 355. |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **71785.** | **333030.** |
| Stddev | 448. | 10465. |
| %RSD | .62437 | 3.1424 |

Sample Name: ccv1 Acquired: 06/17/2015 15:41:53 Type: QC
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al3961 | As1890 | Ba4934 | Be3130 | Be2348 | Ca3158 | Cd2265 | Cd2288 | Co2388 | Cr2835 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **511.** | **4980.** | **5090.** | **4900.** | **5130.** | **535.** | **512.** | **4810.** | **510.** | **539.** | **4920.** | **5210.** |
| Stddev | 25. | 227. | 233. | 58. | 257. | 26. | 27. | 304. | 4. | 3. | 245. | 243. |
| %RSD | 4.95 | 4.56 | 4.58 | 1.19 | 5.01 | 4.88 | 5.17 | 6.32 | .779 | .500 | 4.98 | 4.65 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Mg2025 | Mg2802 | Mn2593 | Mo2045 | Ni2316 | Pb2169 | Sb2068 | Sb2175 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **4980.** | **4960.** | **4970.** | **4830.** | **5070.** | **4920.** | **5230.** | **4940.** | **5030.** | **4970.** | **4910.** | **4800.** |
| Stddev | 58. | 253. | 220. | 245. | 60. | 258. | 263. | 57. | 48. | 51. | 60. | 43. |
| %RSD | 1.17 | 5.10 | 4.42 | 5.07 | 1.19 | 5.25 | 5.03 | 1.15 | .946 | 1.03 | 1.22 | .904 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Se1960 | Se2062 | Tl2767 | V_2908 | Zn2062 |
|---|---|---|---|---|---|
| Avg | **5000.** | **4950.** | **4990.** | **4870.** | **4890.** |
| Stddev | 20. | 22. | 244. | 245. | 59. |
| %RSD | .404 | .452 | 4.89 | 5.03 | 1.20 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | |
| Range | | | | | |

Sample Name: ccv1 Acquired: 06/17/2015 15:41:53 Type: QC
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **71256.** | **329570.** |
| Stddev | 286. | 2368. |
| %RSD | .40194 | .71852 |

Sample Name: ccv2    Acquired: 06/17/2015 15:46:23    Type: QC
Method: DOD Calibration Updated 060614(v644)    Mode: CONC    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **50.3** | **527.** | **524.** | **510.** | **52.8** | **548.** | **50.7** | **523.** | **516.** | **522.** | **500.** | **505.** |
| Stddev | 3.3 | 27. | 16. | 37. | 2.2 | 25. | 1.1 | 13. | 37. | 26. | 32. | 34. |
| %RSD | 6.47 | 5.15 | 3.01 | 7.15 | 4.18 | 4.56 | 2.17 | 2.43 | 7.09 | 5.05 | 6.45 | 6.81 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Avg | **497.** | **518.** | **526.** | **507.** | **495.** | **534.** | **528.** | **517.** | **545.** |
| Stddev | 22. | 10. | 13. | 25. | 24. | 14. | 8. | 35. | 27. |
| %RSD | 4.43 | 2.00 | 2.40 | 4.83 | 4.76 | 2.52 | 1.56 | 6.70 | 4.96 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | |
| Range | | | | | | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **71351.** | **329020.** |
| Stddev | 308. | 10513. |
| %RSD | .43199 | 3.1953 |

Sample Name: ccb    Acquired: 06/17/2015 15:50:23    Type: QC
Method: DOD Calibration Updated 060614(v644)    Mode: CONC    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **-2.19** | **-1.78** | **3.79** | **-.588** | **.034** | **-6.43** | **-1.46** | **.106** | **.188** | **-.410** | **8.05** | **.147** |
| Stddev | 2.08 | .99 | 4.95 | .096 | .083 | .57 | .06 | .240 | 2.12 | .284 | 1.80 | .124 |
| %RSD | 94.9 | 55.7 | 130. | 16.4 | 244. | 8.82 | 3.95 | 226. | 1130. | 69.3 | 22.4 | 84.1 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Avg | **.217** | **2.23** | **.102** | **.506** | **-.376** | **5.83** | **-1.52** | **-.750** | **.130** |
| Stddev | .180 | .28 | .369 | 1.59 | .796 | 7.13 | .64 | .714 | .141 |
| %RSD | 83.2 | 12.6 | 362. | 314. | 211. | 122. | 41.7 | 95.2 | 108. |
| Check ? | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | |
| Range | | | | | | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **71949.** | **330860.** |
| Stddev | 258. | 14230. |
| %RSD | .35805 | 4.3008 |

Sample Name: 595902 Acquired: 06/17/2015 15:54:46 Type: Unk
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **.795** | **1.41** | **-.810** | **8.30** | **.037** | **12600.** | **-1.42** | **.011** | **-2.43** | **.238** | **14.2** | **2690.** |
| Stddev | 3.70 | 1.23 | 7.41 | .45 | .197 | 515. | .10 | .093 | 2.38 | .475 | .9 | 122. |
| %RSD | 466. | 86.8 | 916. | 5.37 | 529. | 4.08 | 7.23 | 847. | 97.8 | 200. | 6.21 | 4.53 |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **.999** | **.578** | **.274** | **-.400** | **.722** | **5.24** | **-3.08** | **-.778** | **.324** |
| Stddev | .330 | .590 | .320 | 1.53 | 1.23 | 3.52 | 1.27 | 2.71 | .240 |
| %RSD | 33.0 | 102. | 117. | 384. | 170. | 67.1 | 41.3 | 348. | 74.2 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **70238.** | **330650.** |
| Stddev | 336. | 5152. |
| %RSD | .47889 | 1.5582 |

Sample Name: 595903 Acquired: 06/17/2015 15:59:23 Type: Unk
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-.863** | **.477** | **5.25** | **8.52** | **.227** | **12500.** | **-1.62** | **.167** | **-.631** | **.402** | **11.9** | **2720.** |
| Stddev | .844 | 1.20 | 5.28 | .41 | .196 | 363. | .18 | .105 | 1.08 | .273 | 1.9 | 112. |
| %RSD | 97.8 | 252. | 101. | 4.83 | 86.6 | 2.90 | 11.1 | 62.7 | 171. | 67.9 | 15.7 | 4.12 |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **5.12** | **.601** | **.249** | **-.234** | **.079** | **2.74** | **-1.73** | **.154** | **.630** |
| Stddev | .59 | 1.04 | .493 | 2.08 | 1.94 | 7.79 | 2.43 | 1.90 | .118 |
| %RSD | 11.5 | 173. | 198. | 889. | 2470. | 284. | 140. | 1240. | 18.8 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **70593.** | **326430.** |
| Stddev | 95. | 4530. |
| %RSD | .13515 | 1.3878 |

Sample Name: I595903 Acquired: 06/17/2015 16:04:00 Type: Unk
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-.938** | **-2.97** | **.302** | **1.40** | **-.059** | **2730.** | **-1.53** | **-.061** | **-1.09** | **-.503** | **4.76** | **659.** |
| Stddev | 1.84 | .94 | 6.49 | .26 | .034 | 635. | .04 | .092 | 1.54 | .534 | 3.92 | 69. |
| %RSD | 196. | 31.7 | 2150. | 18.4 | 58.8 | 23.3 | 2.31 | 152. | 142. | 106. | 82.3 | 10.4 |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **1.44** | **.119** | **.126** | **.093** | **-.044** | **-1.19** | **-.992** | **.096** | **-.244** |
| Stddev | .48 | .356 | .368 | .912 | .468 | 7.71 | 1.95 | 2.13 | .079 |
| %RSD | 33.1 | 300. | 293. | 981. | 1060. | 649. | 197. | 2230. | 32.3 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **85149.** | **339830.** |
| Stddev | 27660. | 23627. |
| %RSD | 32.484 | 6.9525 |

Sample Name: dup595903 Acquired: 06/17/2015 16:08:42 Type: Unk
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-1.27** | **.861** | **4.72** | **8.65** | **-.035** | **12700.** | **-1.59** | **.017** | **-2.55** | **.634** | **8.10** | **2750.** |
| Stddev | 3.20 | 1.33 | 2.25 | .52 | .169 | 559. | .09 | .135 | 2.36 | .783 | 2.12 | 118. |
| %RSD | 252. | 154. | 47.7 | 5.95 | 489. | 4.40 | 5.90 | 819. | 92.8 | 123. | 26.2 | 4.30 |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **.316** | **-.009** | **.427** | **-1.01** | **.592** | **3.15** | **-3.22** | **-.901** | **.730** |
| Stddev | .550 | .557 | .451 | 1.57 | 1.16 | 3.58 | 2.58 | 2.01 | .145 |
| %RSD | 174. | 6050. | 106. | 156. | 196. | 114. | 80.3 | 223. | 19.8 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **70481.** | **324960.** |
| Stddev | 199. | 5352. |
| %RSD | .28302 | 1.6470 |

Sample Name: msw595903 Acquired: 06/17/2015 16:13:19 Type: Unk
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Ca3158 | Cd2265 | Co2286 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **18.3** | **1030.** | **641.** | **807.** | **731.** | **765.** | **855.** | **19.5** | **204000.** | **17.4** | **180.** |
| Stddev | 2.8 | 32. | 33. | 6. | 25. | 72. | 41. | .7 | 9500. | .3 | 1. |
| %RSD | 15.2 | 3.06 | 5.14 | .686 | 3.44 | 9.35 | 4.81 | 3.43 | 4.66 | 1.99 | .589 |

| Elem | Cr2677 | Cu2247 | Fe2599 | Mg2025 | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Se2062 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | mg/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **73.4** | **85.6** | **358.** | **88500.** | **197.** | **-.033** | **187.** | **155.** | **173.** | **781.** | **796.** |
| Stddev | 2.1 | 4.2 | 29. | 5570. | 10. | .441 | 1. | 7. | 10. | 3. | 26. |
| %RSD | 2.88 | 4.92 | 8.05 | 6.29 | 4.99 | 1320. | .591 | 4.45 | 6.03 | .410 | 3.24 |

| Elem | Tl1908 | Tl2767 | V_2924 | Zn2138 |
|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L |
| Avg | **668.** | **1070.** | **184.** | **188.** |
| Stddev | 5. | 388. | 14. | 11. |
| %RSD | .740 | 36.1 | 7.71 | 5.71 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **63971.** | **326090.** |
| Stddev | 247. | 17096. |
| %RSD | .38544 | 5.2427 |

Sample Name: msdw595903 Acquired: 06/17/2015 16:17:54 Type: Unk
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Ca3158 | Cd2265 | Co2286 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **17.9** | **1030.** | **661.** | **821.** | **740.** | **794.** | **873.** | **20.1** | **208000.** | **17.5** | **182.** |
| Stddev | 2.8 | 46. | 11. | 15. | 38. | 38. | 45. | .8 | 10000. | .1 | 2. |
| %RSD | 15.6 | 4.46 | 1.69 | 1.82 | 5.16 | 4.84 | 5.20 | 3.74 | 4.81 | .598 | .952 |

| Elem | Cr2677 | Cu2247 | Fe2599 | Mg2025 | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Se2062 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | mg/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **71.4** | **88.4** | **374.** | **90900.** | **202.** | **-.160** | **190.** | **160.** | **177.** | **784.** | **806.** |
| Stddev | 3.5 | 1.7 | 17. | 2000. | 8. | .730 | 2. | 5. | 4. | 7. | 16. |
| %RSD | 4.98 | 1.90 | 4.59 | 2.20 | 4.09 | 457. | .889 | 2.86 | 2.17 | .906 | 1.99 |

| Elem | Tl1908 | Tl2767 | V_2924 | Zn2138 |
|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L |
| Avg | **676.** | **799.** | **195.** | **192.** |
| Stddev | 1. | 488. | 7. | 4. |
| %RSD | .190 | 61.0 | 3.74 | 1.99 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **64083.** | **320540.** |
| Stddev | 80. | 4692. |
| %RSD | .12528 | 1.4638 |

Sample Name: pdsw595903 Acquired: 06/17/2015 16:22:30 Type: Unk
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al3961 | As1890 | Ba4934 | Be3130 | Be2348 | Ca3158 | Cd2265 | Cd2288 | Co2286 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | 104. | 4600. | 4290. | 3620. | 4490. | 104. | 98.9 | 403000. | 91.8 | 132. | 886. |
| Stddev | 7. | 259. | 210. | 106. | 249. | 5. | 5.3 | 19900. | .6 | 1. | 6. |
| %RSD | 6.78 | 5.62 | 4.91 | 2.92 | 5.55 | 4.90 | 5.34 | 4.93 | .634 | .533 | .643 |

| Elem | Co2388 | Cr2677 | Cu2247 | Fe2343 | Fe2395 | Mg2025 | Mn2576 | Mn2593 | Mo2020 | Ni2316 | Pb2169 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | mg/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | 888. | 372. | 414. | 1810. | 1740. | 174000. | 1000. | 818. | -.323 | 914. | 877. |
| Stddev | 63. | 24. | 13. | 102. | 125. | 5920. | 49. | 44. | 1.29 | 6. | 23. |
| %RSD | 7.08 | 6.43 | 3.09 | 5.64 | 7.20 | 3.40 | 4.91 | 5.39 | 401. | .630 | 2.61 |

| Elem | Pb2203 | Sb2068 | Sb2175 | Se1960 | Se2062 | Tl2767 | V_2908 | Zn2062 |
|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | 877. | 893. | 873. | 3920. | 3900. | 3760. | 936. | 801. |
| Stddev | 128. | 22. | 25. | 32. | 9. | 684. | 65. | 23. |
| %RSD | 14.5 | 2.49 | 2.87 | .814 | .225 | 18.2 | 6.95 | 2.83 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | 61729. | 316530. |
| Stddev | 384. | 9361. |
| %RSD | .62278 | 2.9573 |

Sample Name: 595904 Acquired: 06/17/2015 16:27:00 Type: Unk
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-1.51** | **1.26** | **8.01** | **8.62** | **-.055** | **12700.** | **-1.71** | **-.017** | **-1.97** | **1.24** | **13.9** | **2700.** |
| Stddev | .65 | .95 | 5.97 | .33 | .181 | 558. | .14 | .081 | 2.36 | .40 | 1.9 | 134. |
| %RSD | 43.1 | 76.1 | 74.5 | 3.78 | 331. | 4.39 | 8.47 | 489. | 120. | 32.1 | 13.8 | 4.98 |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **1.47** | **-.648** | **.410** | **.465** | **.262** | **14.3** | **-1.87** | **.889** | **1.21** |
| Stddev | .29 | .422 | .397 | .962 | 1.22 | 6.4 | 3.20 | .814 | .02 |
| %RSD | 19.4 | 65.0 | 96.7 | 207. | 465. | 45.0 | 171. | 91.5 | 1.80 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **69560.** | **330900.** |
| Stddev | 544. | 5937. |
| %RSD | .78230 | 1.7941 |

Sample Name: 595905 Acquired: 06/17/2015 16:31:37 Type: Unk
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-.577** | **-.887** | **6.48** | **8.34** | **.037** | **12400.** | **-1.59** | **.052** | **-2.07** | **-.108** | **7.34** | **2660.** |
| Stddev | 3.23 | 1.82 | 5.03 | .62 | .117 | 608. | .06 | .191 | .77 | .279 | 2.94 | 149. |
| %RSD | 560. | 205. | 77.6 | 7.42 | 321. | 4.89 | 3.72 | 368. | 37.4 | 259. | 40.1 | 5.58 |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **.416** | **.249** | **.203** | **-.698** | **.316** | **3.78** | **.119** | **-.401** | **1.55** |
| Stddev | .355 | .720 | .234 | 1.50 | 1.15 | 5.14 | 1.00 | .891 | .23 |
| %RSD | 85.3 | 290. | 115. | 216. | 364. | 136. | 843. | 222. | 15.1 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **69736.** | **329280.** |
| Stddev | 162. | 6194. |
| %RSD | .23211 | 1.8811 |

Sample Name: 595906 Acquired: 06/17/2015 16:36:14 Type: Unk
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-2.43** | **-.461** | **10.9** | **8.02** | **.012** | **12500.** | **-1.57** | **.025** | **-.254** | **.722** | **7.38** | **2610.** |
| Stddev | 1.12 | 1.43 | 3.0 | 1.17 | .317 | 611. | .16 | .090 | 1.71 | .451 | 2.53 | 242. |
| %RSD | 46.1 | 311. | 27.5 | 14.6 | 2670. | 4.88 | 10.0 | 362. | 674. | 62.5 | 34.3 | 9.27 |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **.132** | **-.335** | **.359** | **-.948** | **-1.13** | **1.71** | **-1.70** | **-2.07** | **.297** |
| Stddev | .585 | .156 | .421 | 1.63 | 1.32 | 7.34 | .91 | 1.60 | .070 |
| %RSD | 443. | 46.5 | 117. | 172. | 116. | 429. | 53.4 | 77.1 | 23.5 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **69866.** | **339410.** |
| Stddev | 353. | 18706. |
| %RSD | .50524 | 5.5114 |

Sample Name: ccv1 Acquired: 06/17/2015 16:40:50 Type: QC
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al3961 | As1890 | Ba4934 | Be3130 | Be2348 | Ca3158 | Cd2265 | Cd2288 | Co2388 | Cr2835 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **507.** | **4950.** | **5090.** | **4900.** | **5060.** | **540.** | **514.** | **4740.** | **513.** | **540.** | **4930.** | **5220.** |
| Stddev | 35. | 285. | 300. | 66. | 238. | 32. | 33. | 282. | 4. | 4. | 329. | 335. |
| %RSD | 6.81 | 5.76 | 5.90 | 1.36 | 4.71 | 5.83 | 6.46 | 5.95 | .857 | .740 | 6.67 | 6.42 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Mg2025 | Mg2802 | Mn2593 | Mo2045 | Ni2316 | Pb2169 | Sb2068 | Sb2175 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **5030.** | **5020.** | **4960.** | **4800.** | **5090.** | **4910.** | **5220.** | **4970.** | **5070.** | **5010.** | **4960.** | **4840.** |
| Stddev | 92. | 355. | 342. | 306. | 97. | 329. | 320. | 84. | 39. | 70. | 77. | 68. |
| %RSD | 1.82 | 7.07 | 6.90 | 6.38 | 1.91 | 6.70 | 6.12 | 1.70 | .771 | 1.40 | 1.55 | 1.40 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Se1960 | Se2062 | Tl2767 | V_2908 | Zn2062 |
|---|---|---|---|---|---|
| Avg | **5000.** | **4970.** | **4850.** | **4890.** | **4890.** |
| Stddev | 13. | 23. | 355. | 321. | 105. |
| %RSD | .259 | .456 | 7.32 | 6.56 | 2.16 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | |
| Range | | | | | |

Sample Name: ccv1 Acquired: 06/17/2015 16:40:50 Type: QC
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **70742.** | **326470.** |
| Stddev | 133. | 3646. |
| %RSD | .18828 | 1.1167 |

Sample Name: ccv2 Acquired: 06/17/2015 16:45:14 Type: QC
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **47.8** | **524.** | **522.** | **507.** | **53.1** | **544.** | **50.9** | **522.** | **512.** | **521.** | **497.** | **501.** |
| Stddev | 2.0 | 27. | 12. | 34. | 2.0 | 19. | .9 | 11. | 30. | 26. | 27. | 31. |
| %RSD | 4.26 | 5.23 | 2.27 | 6.71 | 3.72 | 3.45 | 1.76 | 2.19 | 5.95 | 5.05 | 5.36 | 6.20 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Avg | **488.** | **517.** | **529.** | **510.** | **497.** | **527.** | **523.** | **518.** | **539.** |
| Stddev | 18. | 11. | 11. | 21. | 24. | 3. | 7. | 31. | 28. |
| %RSD | 3.70 | 2.14 | 2.10 | 4.20 | 4.90 | .598 | 1.26 | 6.01 | 5.19 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | |
| Range | | | | | | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **71823.** | **331340.** |
| Stddev | 69. | 10936. |
| %RSD | .09542 | 3.3005 |

Sample Name: ccb  Acquired: 06/17/2015 16:49:14  Type: QC
Method: DOD Calibration Updated 060614(v644)  Mode: CONC  Corr. Factor: 1.000000
User: NAH  ICAP6500:  Prep Batch:  Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **-.636** | **-2.50** | **4.47** | **-.609** | **.014** | **-7.87** | **-1.55** | **-.045** | **.948** | **-.374** | **4.82** | **-.184** |
| Stddev | 2.90 | .94 | 2.28 | .100 | .131 | 1.11 | .16 | .121 | .622 | .533 | 3.41 | .175 |
| %RSD | 456. | 37.7 | 51.0 | 16.5 | 923. | 14.1 | 9.97 | 271. | 65.6 | 143. | 70.7 | 95.5 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Avg | **-.003** | **2.84** | **.131** | **.186** | **2.11** | **-35.2** | **-.565** | **-1.50** | **.205** |
| Stddev | .568 | .43 | .064 | 1.46 | 1.78 | 203. | 2.18 | 1.28 | .222 |
| %RSD | 17300. | 15.2 | 48.7 | 783. | 84.6 | 577. | 386. | 85.4 | 108. |
| Check ? | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | |
| Range | | | | | | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **72428.** | **334370.** |
| Stddev | 23. | 9255. |
| %RSD | .03175 | 2.7678 |

Sample Name: 595907 Acquired: 06/17/2015 16:53:38 Type: Unk
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-1.40** | **.547** | **4.35** | **8.37** | **.030** | **12600.** | **-1.60** | **.040** | **-1.67** | **.311** | **8.66** | **2670.** |
| Stddev | 2.51 | 1.03 | 2.57 | .29 | .136 | 473. | .14 | .102 | 1.19 | .695 | 2.82 | 99. |
| %RSD | 180. | 189. | 59.1 | 3.50 | 454. | 3.75 | 8.99 | 256. | 71.4 | 223. | 32.6 | 3.69 |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **1.16** | **.668** | **.578** | **.225** | **.642** | **6.63** | **.315** | **-.058** | **1.64** |
| Stddev | .22 | .381 | .250 | 1.78 | 1.33 | 5.71 | 2.38 | 2.74 | .19 |
| %RSD | 18.9 | 57.0 | 43.3 | 792. | 208. | 86.1 | 755. | 4740. | 11.8 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **70416.** | **333050.** |
| Stddev | 220. | 2974. |
| %RSD | .31182 | .89294 |

Sample Name: ccv1 Acquired: 06/17/2015 17:38:04 Type: QC
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al3961 | As1890 | Ba4934 | Be3130 | Be2348 | Ca3158 | Cd2265 | Cd2288 | Co2388 | Cr2835 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **507.** | **4960.** | **5090.** | **4900.** | **5110.** | **540.** | **506.** | **4770.** | **512.** | **540.** | **4860.** | **5190.** |
| Stddev | 32. | 291. | 321. | 57. | 263. | 34. | 28. | 266. | 4. | 5. | 282. | 289. |
| %RSD | 6.23 | 5.86 | 6.30 | 1.16 | 5.15 | 6.33 | 5.56 | 5.58 | .742 | 1.00 | 5.81 | 5.56 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Mg2025 | Mg2802 | Mn2593 | Mo2045 | Ni2316 | Pb2169 | Sb2068 | Sb2175 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **5010.** | **4990.** | **4940.** | **4790.** | **5050.** | **4890.** | **5210.** | **4960.** | **5080.** | **5000.** | **4960.** | **4840.** |
| Stddev | 45. | 323. | 274. | 279. | 73. | 295. | 316. | 42. | 41. | 45. | 36. | 40. |
| %RSD | .889 | 6.46 | 5.55 | 5.84 | 1.45 | 6.04 | 6.07 | .854 | .798 | .896 | .731 | .832 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Se1960 | Se2062 | Tl2767 | V_2908 | Zn2062 |
|---|---|---|---|---|---|
| Avg | **5020.** | **4940.** | **4940.** | **4860.** | **4830.** |
| Stddev | 40. | 58. | 400. | 299. | 33. |
| %RSD | .801 | 1.18 | 8.10 | 6.16 | .674 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | |
| Range | | | | | |

Sample Name: ccv1 Acquired: 06/17/2015 17:38:04 Type: QC
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **70440.** | **327180.** |
| Stddev | 269. | 1621. |
| %RSD | .38204 | .49546 |

Sample Name: ccv2 Acquired: 06/17/2015 17:42:28 Type: QC
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **50.7** | **516.** | **521.** | **500.** | **52.3** | **541.** | **50.4** | **519.** | **501.** | **512.** | **483.** | **491.** |
| Stddev | 2.8 | 37. | 10. | 39. | 2.0 | 21. | 1.2 | 12. | 36. | 34. | 37. | 37. |
| %RSD | 5.61 | 7.11 | 1.99 | 7.88 | 3.84 | 3.94 | 2.41 | 2.29 | 7.17 | 6.60 | 7.74 | 7.57 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Avg | **489.** | **514.** | **526.** | **497.** | **489.** | **520.** | **517.** | **506.** | **528.** |
| Stddev | 18. | 8. | 11. | 29. | 30. | 8. | 8. | 34. | 34. |
| %RSD | 3.74 | 1.63 | 2.05 | 5.90 | 6.10 | 1.56 | 1.51 | 6.71 | 6.44 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | |
| Range | | | | | | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **72182.** | **337570.** |
| Stddev | 348. | 15553. |
| %RSD | .48174 | 4.6073 |

Sample Name: ccb    Acquired: 06/17/2015 17:46:29    Type: QC
Method: DOD Calibration Updated 060614(v644)    Mode: CONC    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **-1.22** | **-2.08** | **7.67** | **-.641** | **.052** | **-8.25** | **-1.58** | **.108** | **-1.54** | **-.395** | **5.16** | **-.068** |
| Stddev | 2.79 | .20 | 2.44 | .045 | .209 | .74 | .07 | .078 | .16 | .099 | 3.30 | .020 |
| %RSD | 229. | 9.47 | 31.9 | 6.95 | 399. | 8.96 | 4.27 | 71.9 | 10.6 | 24.9 | 64.0 | 29.7 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Avg | **-.299** | **2.67** | **.182** | **1.13** | **.810** | **-.969** | **-2.82** | **1.08** | **.162** |
| Stddev | .615 | .51 | .181 | 1.10 | 1.12 | 52.0 | 2.76 | .22 | .154 |
| %RSD | 205. | 19.0 | 99.2 | 97.4 | 138. | 5360. | 97.9 | 20.3 | 94.5 |
| Check ? | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | |
| Range | | | | | | | | | |

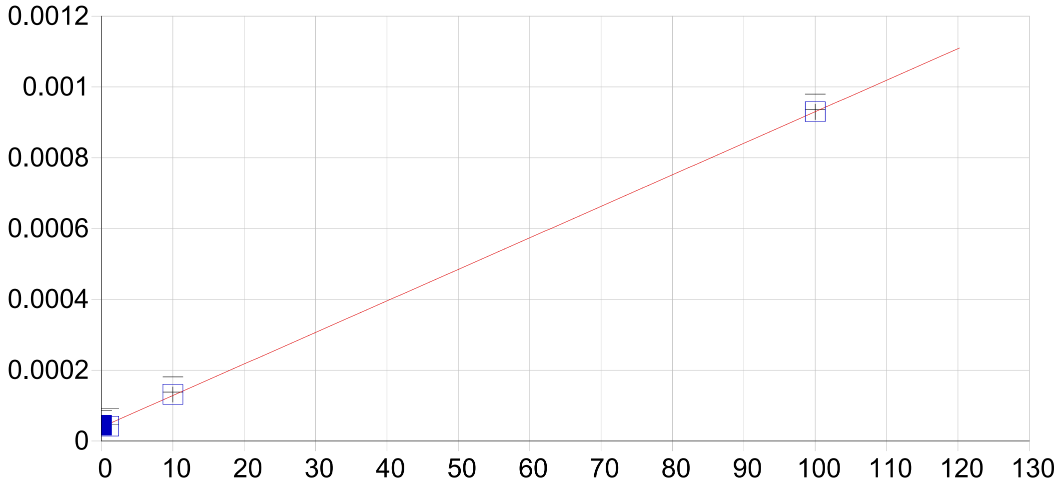
| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **72069.** | **327280.** |
| Stddev | 304. | 543. |
| %RSD | .42244 | .16578 |

| Element, Wavelength and Order | Date of Fit | Date of Cal. | Type of Fit | Weighting | A0 | A1 | A2 | n (Exponent) | Correlation | Std Error of Est | Predicted MDL | Predicted MQL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ag 328.068 {103} | 06/22/2015 07:49:37 | 06/19/2015 15:00:51 | Linear | None | 0.000039 | 0.000009 | 0.000000 | 1.000000 | 0.999929 | 0.000006 | 2.683911 | 8.946370 |
| Ag 338.289 {100} | 06/22/2015 07:49:37 | 06/19/2015 15:04:50 | Linear | None | 0.000021 | 0.000001 | 0.000000 | 1.000000 | 0.999040 | 0.000034 | 6.863312 | 22.877705 |
| Al 308.215 {109} | 06/22/2015 07:49:37 | 06/19/2015 15:28:55 | Linear | 1/Conc | 0.000049 | 0.000000 | 0.000000 | 1.000000 | 0.999914 | 0.000008 | 15.932325 | 53.107750 |
| Al 309.271 {109} | 06/22/2015 07:49:37 | 06/19/2015 15:18:38 | Linear | 1/Conc | 0.001089 | 0.000004 | 0.000000 | 1.000000 | 0.999961 | 0.000015 | 11.864989 | 39.549963 |
| Al 396.152 { 85} | 06/22/2015 07:49:37 | 06/19/2015 15:28:55 | Linear | 1/Var | 0.000003 | 0.000009 | 0.000000 | 1.000000 | 0.999397 | 0.000079 | 6.954057 | 23.180188 |
| Al 167.079 {502} | 06/22/2015 07:49:37 | 06/19/2015 15:04:50 | Linear | None | 0.000002 | 0.000000 | 0.000000 | 1.000000 | 0.999992 | 0.000001 | 1.824970 | 6.083234 |
| As 193.759 {474} | 06/22/2015 07:49:37 | 06/19/2015 15:04:50 | Linear | 1/Var | 0.000003 | 0.000001 | 0.000000 | 1.000000 | 0.999872 | 0.000002 | 6.543100 | 21.810333 |
| As 189.042 {479} | 06/22/2015 07:49:37 | 06/19/2015 15:09:25 | Linear | None | 0.000000 | 0.000000 | 0.000000 | 1.000000 | 0.999997 | 0.000000 | 21.285617 | 70.952056 |
| Ba 455.403 { 74} | 06/22/2015 07:49:37 | 06/19/2015 15:04:50 | Linear | None | 0.000056 | 0.000117 | 0.000000 | 1.000000 | 0.999999 | 0.000042 | 0.150391 | 0.501303 |
| Ba 493.409 { 68} | 06/22/2015 07:49:37 | 06/19/2015 15:09:25 | Linear | 1/Var | -0.005869 | 0.000565 | 0.000000 | 1.000000 | 0.999932 | 0.000055 | 0.473754 | 1.579181 |
| Be 313.042 {108} | 06/22/2015 07:49:37 | 06/19/2015 15:04:50 | Linear | 1/Conc | 0.000001 | 0.000243 | 0.000000 | 1.000000 | 0.999918 | 0.000002 | 0.079422 | 0.264741 |
| Be 234.861 {144} | 06/22/2015 07:49:37 | 06/19/2015 15:04:50 | Linear | 1/Conc | 0.000002 | 0.000003 | 0.000000 | 1.000000 | 0.999968 | 0.000000 | 0.928182 | 3.093940 |
| Ca 315.887 {107} | 06/22/2015 07:49:37 | 06/19/2015 15:28:55 | Curvilin | 1/Conc | 0.000399 | 0.000004 | 0.000000 | 1.000000 | 0.999892 | 0.000093 | 7.496616 | 24.988719 |
| Ca 317.933 {106} | 06/22/2015 07:49:37 | 06/19/2015 15:28:55 | Linear | 1/Var | 0.003427 | 0.000001 | 0.000000 | 1.000000 | 0.998554 | 0.000211 | 3.756752 | 12.522506 |
| Ca 393.366 { 86} | 06/22/2015 07:49:37 | 06/19/2015 15:04:50 | Linear | None | 0.026618 | 0.001302 | 0.000000 | 1.000000 | 0.999949 | 0.007682 | 0.038540 | 0.128466 |
| Ca 396.847 { 85} | 06/22/2015 07:49:37 | 06/19/2015 15:09:25 | Linear | None | 0.002473 | 0.000126 | 0.000000 | 1.000000 | 0.999999 | 0.000845 | 0.066907 | 0.223023 |
| Cd 214.438 {457} | 06/22/2015 07:49:37 | 06/19/2015 15:04:50 | Linear | None | 0.000139 | 0.000103 | 0.000000 | 1.000000 | 0.999979 | 0.000250 | 0.073957 | 0.246523 |
| Cd 226.502 {149} | 06/22/2015 07:49:37 | 06/19/2015 15:04:51 | Linear | None | 0.000003 | 0.000003 | 0.000000 | 1.000000 | 0.999960 | 0.000015 | 4.354860 | 14.516199 |
| Cd 226.502 {449} | 06/22/2015 07:49:37 | 06/19/2015 15:04:51 | Linear | None | 0.000056 | 0.000054 | 0.000000 | 1.000000 | 0.999981 | 0.000125 | 0.155048 | 0.516826 |
| Cd 228.802 {447} | 06/22/2015 07:49:37 | 06/19/2015 15:04:51 | Linear | None | 0.000189 | 0.000100 | 0.000000 | 1.000000 | 0.999981 | 0.000280 | 0.116929 | 0.389763 |
| Co 228.616 {147} | 06/22/2015 07:49:37 | 06/19/2015 15:04:51 | Linear | None | 0.000006 | 0.000003 | 0.000000 | 1.000000 | 0.999995 | 0.000005 | 4.220299 | 14.067665 |
| Co 228.616 {447} | 06/22/2015 07:49:37 | 06/19/2015 15:04:51 | Linear | 1/Conc | -0.000019 | 0.000058 | 0.000000 | 1.000000 | 0.999930 | 0.000001 | 0.182933 | 0.609778 |
| Co 238.892 {141} | 06/22/2015 07:49:37 | 06/19/2015 15:09:25 | Linear | 1/Var | 0.000001 | 0.000001 | 0.000000 | 1.000000 | 0.999863 | 0.000005 | 4.502736 | 15.009120 |
| Cr 267.716 {126} | 06/22/2015 07:49:37 | 06/19/2015 15:04:51 | Linear | None | 0.000001 | 0.000002 | 0.000000 | 1.000000 | 0.999995 | 0.000002 | 2.361163 | 7.870545 |
| Cr 283.563 {119} | 06/22/2015 07:49:37 | 06/19/2015 15:14:02 | Linear | 1/Conc | 0.000012 | 0.000002 | 0.000000 | 1.000000 | 0.999966 | 0.000002 | 2.188436 | 7.294785 |
| Cu 224.700 {450} | 06/22/2015 07:49:37 | 06/19/2015 15:09:25 | Linear | 1/Conc | -0.000008 | 0.000002 | 0.000000 | 1.000000 | 0.999924 | 0.000000 | 0.436799 | 1.455997 |
| Cu 324.754 {104} | 06/22/2015 07:49:37 | 06/19/2015 15:14:02 | Linear | None | 0.002183 | 0.000003 | 0.000000 | 1.000000 | 1.000000 | 0.000056 | 2.428788 | 8.095961 |
| Cu 327.396 {103} | 06/22/2015 07:49:37 | 06/19/2015 15:14:02 | Linear | 1/Conc | -0.000036 | 0.000001 | 0.000000 | 1.000000 | 0.999974 | 0.000001 | 6.806962 | 22.689873 |
| Fe 234.349 {144} | 06/22/2015 07:49:37 | 06/19/2015 15:28:55 | Full Fit | 1/Var | 0.000003 | 0.000000 | 0.000000 | 1.000000 | 0.999874 | 0.000001 | 15.462173 | 51.540577 |
| Fe 239.562 {141} | 06/22/2015 07:49:37 | 06/19/2015 15:18:38 | Curvilin | 1/Conc | 0.000003 | 0.000000 | 0.000000 | 1.000000 | 0.999996 | 0.000000 | 6.872940 | 22.909799 |
| Fe 259.940 {130} | 06/22/2015 07:49:37 | 06/19/2015 15:09:26 | Linear | None | 0.000005 | 0.000001 | 0.000000 | 1.000000 | 0.999994 | 0.000022 | 2.725370 | 9.084567 |
| Mg 202.582 {466} | 06/22/2015 07:49:37 | 06/19/2015 15:28:55 | Full Fit | 1/Conc | -0.000005 | 0.000001 | 0.000000 | 0.920000 | 0.999959 | 0.000004 | 1.693632 | 5.645439 |
| Mg 279.079 {121} | 06/22/2015 07:49:37 | 06/19/2015 15:28:55 | Full Fit | None | -0.000014 | 0.000000 | 0.000000 | 1.040000 | 1.000000 | 0.000034 | 42.875749 | 142.919164 |
| Mg 280.270 {120} | 06/22/2015 07:49:37 | 06/19/2015 15:09:26 | Linear | 1/Conc | 0.000119 | 0.000019 | 0.000000 | 1.000000 | 0.999993 | 0.000002 | 0.125658 | 0.418860 |
| Mn 257.610 {131} | 06/22/2015 07:49:37 | 06/19/2015 15:09:26 | Linear | 1/Conc | 0.000002 | 0.000025 | 0.000000 | 1.000000 | 0.999930 | 0.000003 | 0.471165 | 1.570549 |
| Mn 259.373 {130} | 06/22/2015 07:49:37 | 06/19/2015 15:14:02 | Linear | 1/Conc | 0.000017 | 0.000041 | 0.000000 | 1.000000 | 0.999713 | 0.000466 | 0.500449 | 1.668164 |
| Mn 293.930 {115} | 06/22/2015 07:49:37 | 06/19/2015 15:09:26 | Linear | 1/Conc | -0.000002 | 0.000002 | 0.000000 | 1.000000 | 0.999915 | 0.000000 | 2.667439 | 8.891463 |
| Mo 203.844 {465} | 06/22/2015 07:49:37 | 06/19/2015 15:04:52 | Linear | 1/Conc | 0.000128 | 0.000007 | 0.000000 | 1.000000 | 0.896173 | 0.000005 | 0.949628 | 3.165427 |
| Mo 202.030 {467} | 06/22/2015 07:49:37 | 06/19/2015 15:04:52 | Linear | 1/Var | 0.000013 | 0.000006 | 0.000000 | 1.000000 | 0.996036 | 0.000019 | 0.792520 | 2.641734 |
| Mo 204.598 {465} | 06/22/2015 07:49:37 | 06/19/2015 15:09:26 | Linear | None | 0.000008 | 0.000001 | 0.000000 | 1.000000 | 0.999999 | 0.000006 | 1.220119 | 4.067062 |
| Ni 221.647 {452} | 06/22/2015 07:49:37 | 06/19/2015 15:09:26 | Linear | 1/Conc | 0.000013 | 0.000030 | 0.000000 | 1.000000 | 0.999945 | 0.000015 | 0.395835 | 1.319449 |
| Ni 231.604 {146} | 06/22/2015 07:49:37 | 06/19/2015 15:09:26 | Linear | None | 0.000005 | 0.000000 | 0.000000 | 1.000000 | 0.999993 | 0.000011 | 31.304584 | 104.348613 |
| Ni 231.604 {445} | 06/22/2015 07:49:37 | 06/19/2015 15:09:26 | Linear | 1/Conc | 0.000016 | 0.000036 | 0.000000 | 1.000000 | 0.999964 | 0.000001 | 0.421876 | 1.406252 |
| Pb 216.999 {455} | 06/22/2015 07:49:37 | 06/19/2015 15:14:02 | Curvilin | 1/Conc | 0.000005 | 0.000001 | 0.000000 | 1.000000 | 0.999936 | 0.000000 | 3.424791 | 11.415971 |

| Element, Wavelength and Order | Date of Fit | Date of Cal. | Type of Fit | Weighting | A0 | A1 | A2 | n (Exponent) | Correlation | Std Error of Est | Predicted MDL | Predicted MQL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pb 220.353 153 | 06/22/2015 07:49:37 | 06/19/2015 15:14:03 | Linear | 1/Var | -0.000001 | 0.000000 | 0.000000 | 1.000000 | 0.999583 | 0.000001 | 57.298341 | 190.994469 |
| Pb 220.353 453 | 06/22/2015 07:49:37 | 06/19/2015 15:04:52 | Linear | 1/Conc | 0.000001 | 0.000001 | 0.000000 | 1.000000 | 0.999735 | 0.000000 | 1.933812 | 6.446040 |
| Pb 283.306 119 | 06/22/2015 07:49:37 | 06/19/2015 15:14:03 | Linear | 1/Conc | 0.000004 | 0.000000 | 0.000000 | 1.000000 | 0.999966 | 0.000000 | 68.853709 | 229.512365 |
| Sb 206.833 463 | 06/22/2015 07:49:37 | 06/19/2015 15:09:26 | Linear | 1/Conc | 0.000000 | 0.000000 | 0.000000 | 1.000000 | 0.999979 | 0.000000 | 2.607872 | 8.692906 |
| Sb 217.581 455 | 06/22/2015 07:49:37 | 06/19/2015 15:04:52 | Linear | 1/Conc | -0.000000 | 0.000001 | 0.000000 | 1.000000 | 0.999745 | 0.000000 | 1.840931 | 6.136436 |
| Se 196.090 172 | 06/22/2015 07:49:37 | 06/19/2015 15:09:26 | Linear | None | 0.000019 | 0.000000 | 0.000000 | 1.000000 | 0.999796 | 0.000003 | 378.430635 | 1261.43545 |
| Se 196.090 472 | 06/22/2015 07:49:37 | 06/19/2015 15:09:26 | Linear | 1/Var | 0.000001 | 0.000001 | 0.000000 | 1.000000 | 0.999981 | 0.000002 | 7.041208 | 23.470694 |
| Se 206.279 463 | 06/22/2015 07:49:37 | 06/19/2015 15:09:27 | Linear | None | 0.000001 | 0.000000 | 0.000000 | 1.000000 | 0.999999 | 0.000004 | 19.503331 | 65.011102 |
| Tl 190.856 476 | 06/22/2015 07:49:37 | 06/19/2015 15:04:52 | Linear | 1/Var | -0.000002 | 0.000002 | 0.000000 | 1.000000 | 0.999655 | 0.000004 | 2.698838 | 8.996126 |
| Tl 190.856 477 | 06/22/2015 07:49:37 | 06/19/2015 15:04:53 | Linear | 1/Var | -0.000001 | 0.000001 | 0.000000 | 1.000000 | 0.999932 | 0.000002 | 7.783688 | 25.945627 |
| Tl 276.787 122 | 06/22/2015 07:49:37 | 06/19/2015 15:09:27 | Linear | None | 0.000004 | 0.000000 | 0.000000 | 1.000000 | 0.999961 | 0.000015 | 71.549420 | 238.498067 |
| V 290.882 116 | 06/22/2015 07:49:37 | 06/19/2015 15:09:27 | Linear | 1/Conc | 0.000017 | 0.000002 | 0.000000 | 1.000000 | 0.999931 | 0.000001 | 2.569042 | 8.563474 |
| V 292.402 115 | 06/22/2015 07:49:37 | 06/19/2015 15:04:53 | Linear | 1/Conc | -0.000002 | 0.000004 | 0.000000 | 1.000000 | 0.997231 | 0.000000 | 2.116776 | 7.055920 |
| Zn 206.200 463 | 06/22/2015 07:49:37 | 06/19/2015 15:14:03 | Full Fit | 1/Conc | 0.000001 | 0.000005 | -0.000000 | 0.990000 | 1.000000 | 0.000000 | 0.271475 | 0.904917 |
| Zn 213.856 457 | 06/22/2015 07:49:37 | 06/19/2015 15:14:03 | Curvilin | 1/Conc | 0.000052 | 0.000070 | -0.000000 | 1.000000 | 0.999995 | 0.000017 | 0.117521 | 0.391735 |
| Zn 213.856 458 | 06/22/2015 07:49:37 | 06/19/2015 15:09:27 | Linear | 1/Var | 0.000005 | 0.000003 | 0.000000 | 1.000000 | 0.998929 | 0.000006 | 0.504760 | 1.682532 |
| Y 224.306 450 | 06/22/2015 07:49:37 | 06/19/2015 14:24:05 | Linear | 1/Conc | 0.000000 | 0.000000 | 0.000000 | 1.000000 | 0.000000 | 0.000000 | -1.000000 | -1.000000 |
| Y 371.030  91 | 06/22/2015 07:49:37 | 06/19/2015 14:24:05 | Linear | 1/Conc | 0.000000 | 0.000000 | 0.000000 | 1.000000 | 0.000000 | 0.000000 | -1.000000 | -1.000000 |
| Na 330.298 102 | 06/22/2015 07:49:37 | 06/19/2015 15:09:27 | Linear | 1/Conc | -0.000006 | 0.000000 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 449.548403 | 1498.49467 |
| Na 588.995  57 | 06/22/2015 07:49:37 | 06/19/2015 15:09:27 | Linear | 1/Conc | -0.002194 | 0.000013 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 3.190485 | 10.634951 |
| Si 251.611 134 | 06/22/2015 07:49:37 | 06/19/2015 15:09:27 | Linear | None | 0.000002 | 0.000001 | 0.000000 | 1.000000 | 0.999982 | 0.000027 | 6.656363 | 22.187877 |
| Ti 334.941 101 | 06/22/2015 07:49:37 | 06/19/2015 15:09:27 | Linear | 1/Conc | 0.000004 | 0.000008 | 0.000000 | 1.000000 | 0.999903 | 0.000001 | 0.796950 | 2.656500 |
| Ti 337.280 100 | 06/22/2015 07:49:37 | 06/19/2015 15:09:27 | Linear | 1/Conc | -0.000004 | 0.000008 | 0.000000 | 1.000000 | 0.999894 | 0.000001 | 1.115439 | 3.718130 |
| Sr 407.771  83 | 06/22/2015 07:49:37 | 06/19/2015 15:09:27 | Linear | 1/Conc | -0.000906 | 0.000163 | 0.000000 | 1.000000 | 0.999994 | 0.000002 | 0.080881 | 0.269603 |
| Sr 421.552  80 | 06/22/2015 07:49:37 | 06/19/2015 15:09:27 | Linear | 1/Conc | -0.000004 | 0.000157 | 0.000000 | 1.000000 | 0.999991 | 0.000003 | 0.076866 | 0.256222 |
| Sn 189.989 477 | 06/22/2015 07:49:37 | 06/19/2015 15:09:27 | Curvilin | 1/Conc | 0.000010 | 0.000003 | -0.000000 | 1.000000 | 0.999975 | 0.000000 | 1.277374 | 4.257915 |
| Sn 189.989 478 | 06/22/2015 07:49:37 | 06/19/2015 15:09:27 | Curvilin | 1/Conc | 0.000002 | 0.000001 | -0.000000 | 1.000000 | 0.999985 | 0.000000 | 4.138420 | 13.794732 |
| Sn 283.999 119 | 06/22/2015 07:49:37 | 06/19/2015 15:09:27 | Linear | 1/Conc | -0.000003 | 0.000000 | 0.000000 | 1.000000 | 0.999931 | 0.000000 | 29.754030 | 99.180102 |
| B 249.678 135 | 06/22/2015 07:49:37 | 06/19/2015 15:09:27 | Linear | None | -0.000000 | 0.000001 | 0.000000 | 1.000000 | 0.999952 | 0.000042 | 4.669306 | 15.564355 |
| B 249.773 135 | 06/22/2015 07:49:37 | 06/19/2015 15:09:27 | Linear | 1/Conc | 0.000067 | 0.000001 | 0.000000 | 1.000000 | 0.987071 | 0.000003 | 3.171921 | 10.573071 |
| Li 670.784  50 | 06/22/2015 07:49:37 | 06/19/2015 15:09:27 | Linear | 1/Conc | 0.000198 | 0.000034 | 0.000000 | 1.000000 | 0.999885 | 0.000007 | 0.828614 | 2.762048 |
|  766.490  44 | 06/22/2015 07:49:37 | 06/19/2015 15:09:28 | Linear | 1/Conc | 0.000056 | 0.000001 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 16.973591 | 56.578638 |
|  769.896  44 | 06/22/2015 07:49:37 | 06/19/2015 15:09:28 | Linear | 1/Conc | 0.000132 | 0.000001 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 39.855994 | 132.853314 |
| P 177.495 489 | 06/22/2015 07:49:37 | 06/19/2015 15:09:28 | Linear | 1/Conc | -0.000022 | 0.000001 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 4.156371 | 13.854571 |
| P 213.618 158 | 06/22/2015 07:49:37 | 06/19/2015 15:09:28 | Linear | 1/Conc | 0.000010 | 0.000000 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 105.730240 | 352.434133 |
| P 213.618 457 | 06/22/2015 07:49:37 | 06/19/2015 15:09:28 | Linear | 1/Conc | -0.000019 | 0.000001 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 5.316896 | 17.722988 |
| S 180.731 486 | 06/22/2015 07:49:37 | 06/19/2015 15:18:38 | Linear | 1/Conc | -0.000014 | 0.000002 | 0.000000 | 1.000000 | 0.955530 | 0.000847 | 3.164688 | 10.548959 |
| S 182.034 485 | 06/22/2015 07:49:37 | 06/19/2015 15:18:38 | Linear | 1/Conc | -0.000000 | 0.000001 | 0.000000 | 1.000000 | 0.953553 | 0.000494 | 5.282500 | 17.608334 |
| S 182.624 484 | 06/22/2015 07:49:37 | 06/19/2015 15:18:38 | Linear | None | -0.008196 | 0.000000 | 0.000000 | 1.000000 | 0.934386 | 0.012240 | 12.088742 | 40.295806 |
|  239.709 140 | 06/22/2015 07:49:37 | 06/19/2015 15:04:54 | Linear | 1/Conc | -0.000000 | 0.000000 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 28.181532 | 93.938439 |
|  245.148 137 | 06/22/2015 07:49:37 | 06/19/2015 15:04:54 | Linear | 1/Conc | -0.000000 | 0.000000 | 0.000000 | 1.000000 | 1.000000 | 0.000000 | 134.795241 | 449.317468 |

| Element, Wavelength and Order | Status | Reslope | | QC Norm | |
|---|---|---|---|---|---|
| | | Slope | Y-int | Slope factor | Offset |
| Ag 328.068 ▯103▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ag 338.289 ▯100▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Al 308.215 ▯109▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Al 309.271 ▯109▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Al 396.152 ▯ 85▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Al 167.079 ▯502▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| As 193.759 ▯474▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| As 189.042 ▯479▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ba 455.403 ▯ 74▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ba 493.409 ▯ 68▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Be 313.042 ▯108▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Be 234.861 ▯144▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ca 315.887 ▯107▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ca 317.933 ▯106▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ca 393.366 ▯ 86▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ca 396.847 ▯ 85▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cd 214.438 ▯457▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cd 226.502 ▯149▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cd 226.502 ▯449▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cd 228.802 ▯447▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Co 228.616 ▯147▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Co 228.616 ▯447▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Co 238.892 ▯141▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cr 267.716 ▯126▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cr 283.563 ▯119▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cu 224.700 ▯450▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cu 324.754 ▯104▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Cu 327.396 ▯103▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Fe 234.349 ▯144▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Fe 239.562 ▯141▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Fe 259.940 ▯130▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mg 202.582 ▯466▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mg 279.079 ▯121▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mg 280.270 ▯120▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mn 257.610 ▯131▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mn 259.373 ▯130▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mn 293.930 ▯115▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mo 203.844 ▯465▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mo 202.030 ▯467▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Mo 204.598 ▯465▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ni 221.647 ▯452▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ni 231.604 ▯146▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Ni 231.604 ▯445▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |
| Pb 216.999 ▯455▯ | O▯ . | 1.000000 | 0.000000 | 1 | 0 |

| Element, Wavelength and Order | Status | Reslope | | QC Norm | |
|---|---|---|---|---|---|
| | | Slope | Y-int | Slope factor | Offset |
| Pb 220.353 □153□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Pb 220.353 □453□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Pb 283.306 □119□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sb 206.833 □463□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sb 217.581 □455□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Se 196.090 □172□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Se 196.090 □472□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Se 206.279 □463□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Tl 190.856 □476□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Tl 190.856 □477□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Tl 276.787 □122□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| V 290.882 □116□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| V 292.402 □115□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Zn 206.200 □463□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Zn 213.856 □457□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Zn 213.856 □458□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Y 224.306 □450□□ | □ arnin | 1.000000 | 0.000000 | 1 | 0 |
| Y 371.030 □ 91□□ | □ arnin | 1.000000 | 0.000000 | 1 | 0 |
| Na 330.298 □102□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Na 588.995 □ 57□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Si 251.611 □134□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Ti 334.941 □101□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Ti 337.280 □100□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sr 407.771 □ 83□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sr 421.552 □ 80□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sn 189.989 □477□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sn 189.989 □478□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Sn 283.999 □119□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| B 249.678 □135□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| B 249.773 □135□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| Li 670.784 □ 50□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| □ 766.490 □ 44□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| □ 769.896 □ 44□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| P 177.495 □489□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| P 213.618 □158□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| P 213.618 □457□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| S 180.731 □486□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| S 182.034 □485□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| S 182.624 □484□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| □ 239.709 □140□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |
| □ 245.148 □137□ | O□ . | 1.000000 | 0.000000 | 1 | 0 |

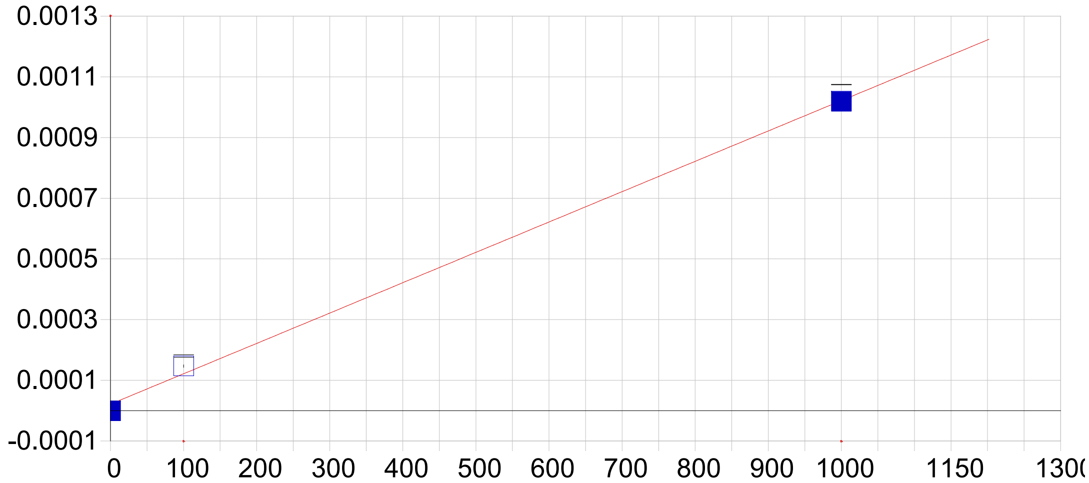



**Ag 328.068 {103}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000039 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000009 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999929 | Status: | OK. |
| Std Error of Est: | 0.000006 | | |
| Predicted MDL: | 2.683911 | | |
| Predicted MQL: | 8.946370 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .52435 | .524 | .000 | .00004 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.296 | .296 | 2.96 | .00013 | .000 | 1 |
| CalStd8=100 | 100.00 | 99.978 | -.022 | -.022 | .00093 | .000 | 1 |
| CalStd3=1 | 1.0000 | .20147 | -.799 | -79.9 | .00004 | .000 | 1 |

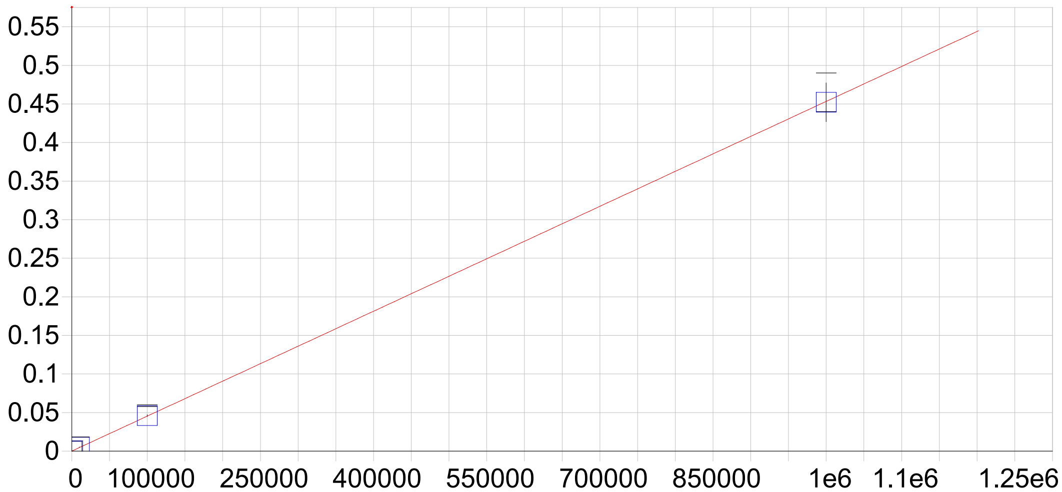



**Ag 338.289 {100}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000021 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999040 | Status: | OK. |
| Std Error of Est: | 0.000034 | | |
| Predicted MDL: | 6.863312 | | |
| Predicted MQL: | 22.877705 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -22.827 | -22.8 | .000 | .00000 | .000 | 1 |
| CalStd8=100 | 100.00 | 125.36 | 25.4 | 25.4 | .00015 | .000 | 1 |
| CalStd9=100 | 1000.0 | 997.47 | -2.53 | -.253 | .00102 | .000 | 1 |

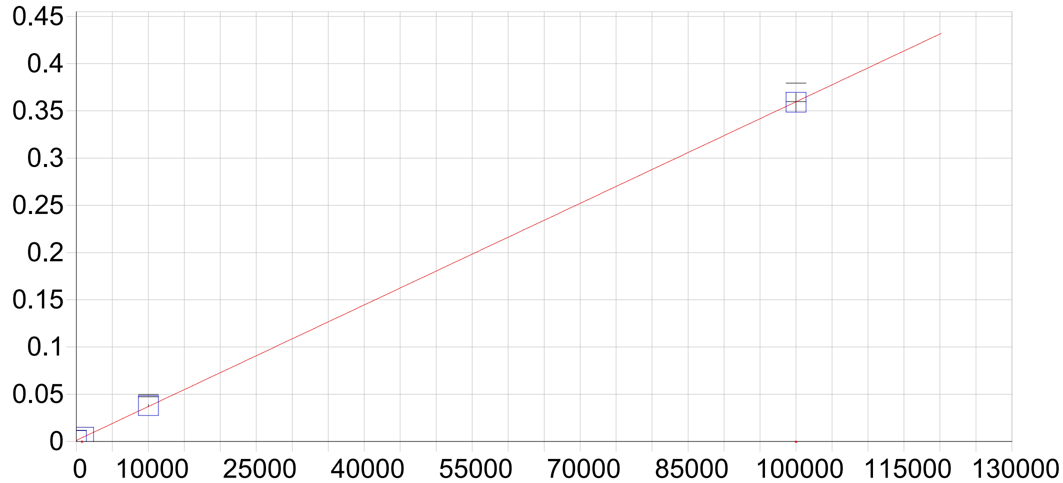



**Al 308.215 {109}**

Date o Fit: 06/22/2015 07:49:37 Type o Fit: Linear  eighting: 1/Conc

A0 (Oset): 0.000049 Re-Slope: 1.000000
A1 ( ain): 0.000000 Y-int: 0.000000
A2 (Curvature): 0.000000
n (Eponent): 1.000000
Correlation: 0.999914 Status: O .
Std Error o Est: 0.000008
Predicted MDL: 15.932325
Predicted MQL: 53.107750

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.22082 | -.221 | .000 | .00005 | .000 | 1 |
| CalStd10=10 | 10000. | 11283. | 1280. | 12.8 | .00516 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1083.6 | 83.6 | 8.36 | .00054 | .000 | 1 |
| CalStd12-100 | 100000. | 101140. | 1140. | 1.14 | .04589 | .001 | 1 |
| CalStd14-100 | 1000000. | 997490. | -2510. | -.251 | .45212 | .025 | 1 |

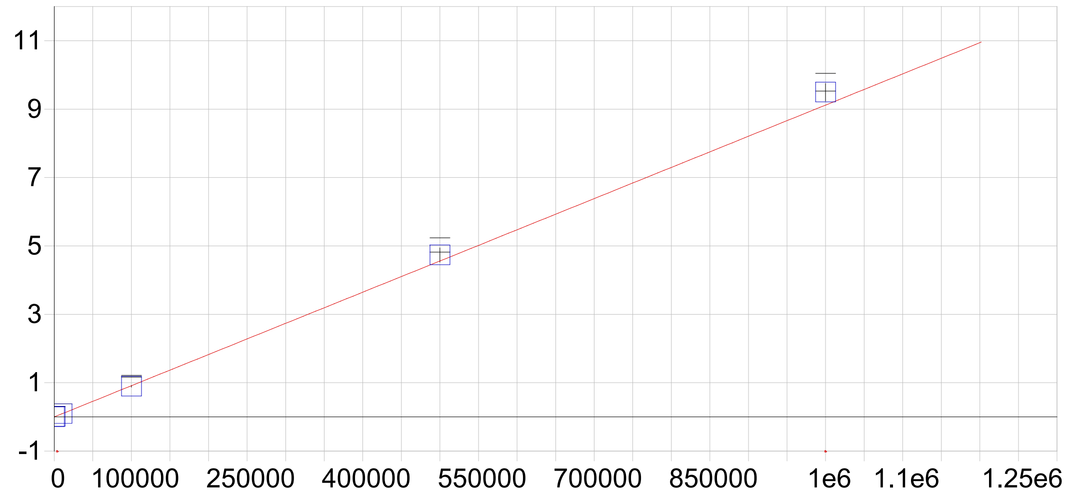



**Al 309.271 {109}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.001089 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000004 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999961 | Status: | OK. |
| Std Error of Est: | 0.000015 | | |
| Predicted MDL: | 11.864989 | | |
| Predicted MQL: | 39.549963 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .02721 | .027 | .000 | .00109 | .000 | 1 |
| CalStd10=10 | 10000. | 10242. | 242. | 2.42 | .03781 | .001 | 1 |
| CalStd9=100 | 1000.0 | 950.49 | -49.5 | -4.95 | .00450 | .000 | 1 |
| CalStd12-100 | 100000. | 99807. | -193. | -.193 | .35896 | .010 | 1 |

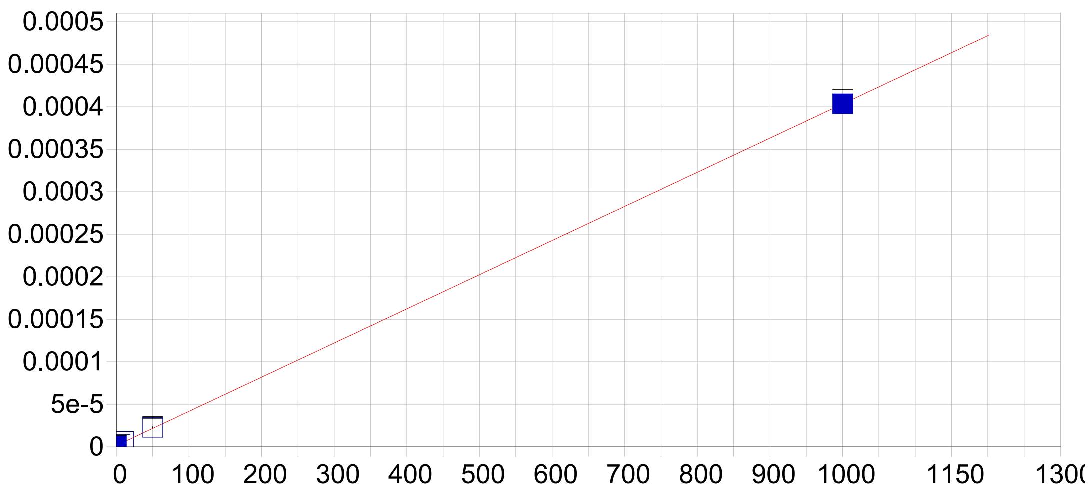



**Al 396.152 { 85}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000003 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000009 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999397 | Status: | O . |
| Std Error o Est: | 0.000079 | | |
| Predicted MDL: | 6.954057 | | |
| Predicted MQL: | 23.180188 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .46174 | .462 | .000 | .00001 | .000 | 1 |
| CalStd14-100 | 1000000. | 1041200. | 41200. | 4.12 | 9.4944 | .259 | 1 |
| CalStd13=50 | 500000. | 519150. | 19100. | 3.83 | 4.7340 | .209 | 1 |
| CalStd10=10 | 10000. | 10178. | 178. | 1.78 | .09281 | .003 | 1 |
| CalStd12-100 | 100000. | 98293. | -1710. | -1.71 | .89631 | .024 | 1 |
| CalStd9=100 | 1000.0 | 952.82 | -47.2 | -4.72 | .00869 | .000 | 1 |

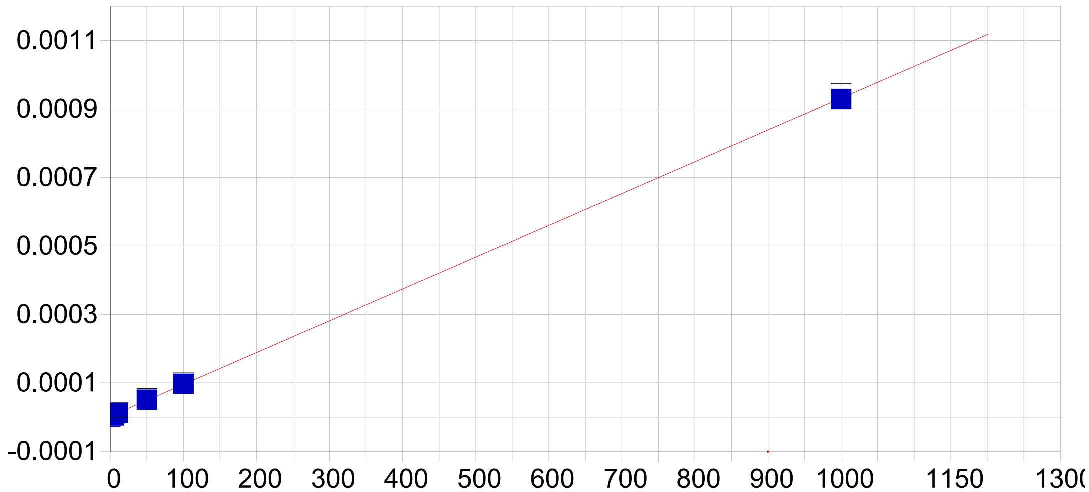



**Al 167.079 {502}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000002 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999992 | Status: | O . |
| Std Error o Est: | 0.000001 | | |
| Predicted MDL: | 1.824970 | | |
| Predicted MQL: | 6.083234 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -2.1446 | -2.14 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.87 | -.134 | -.013 | .00040 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.561 | .561 | 5.61 | .00001 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.0443 | -.956 | -19.1 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 52.674 | 2.67 | 5.35 | .00002 | .000 | 1 |

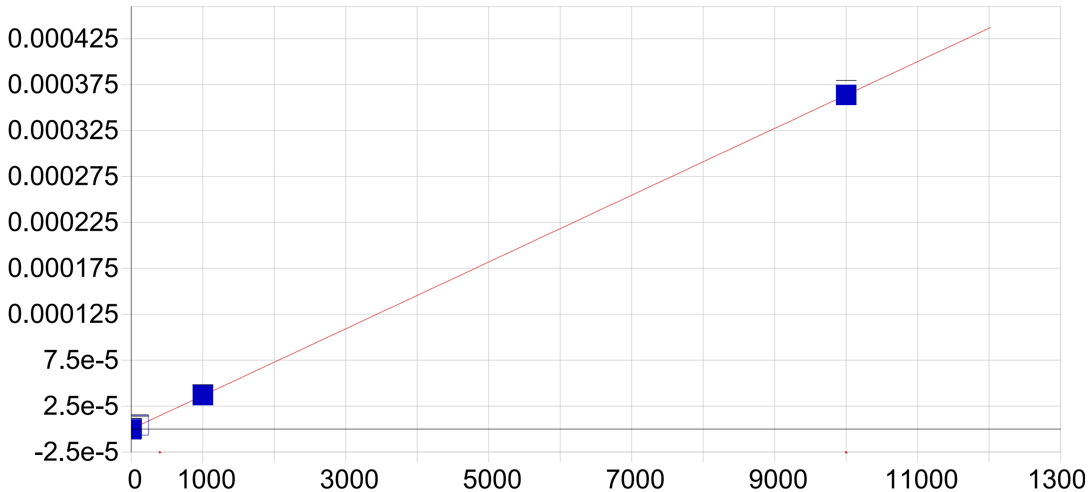



**As 193.759 {474}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000003 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Eponent): | 1.000000 | | |
| Correlation: | 0.999872 | Status: | O . |
| Std Error o Est: | 0.000002 | | |
| Predicted MDL: | 6.543100 | | |
| Predicted MQL: | 21.810333 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -2.7760 | -2.78 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 996.12 | -3.88 | -.388 | .00093 | .000 | 1 |
| CalStd7=50 | 50.000 | 51.577 | 1.58 | 3.15 | .00005 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.1555 | -.845 | -8.45 | .00001 | .000 | 1 |
| CalStd8=100 | 100.00 | 101.73 | 1.73 | 1.73 | .00010 | .000 | 1 |
| CalStd4=5 | 5.0000 | 2.0291 | -2.97 | -59.4 | .00000 | .000 | 1 |

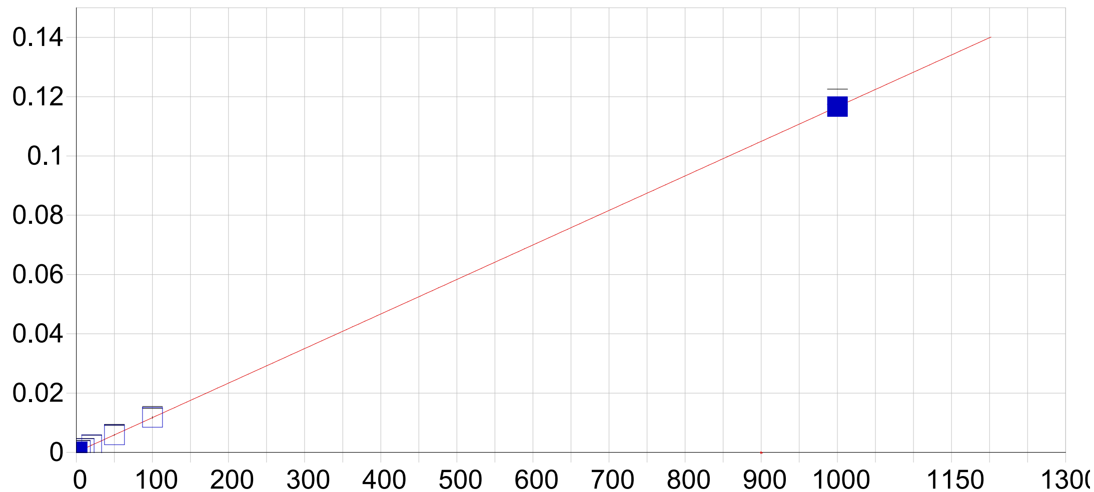



**As 189.042 {479}**

Date of Fit: 06/22/2015 07:49:37 Type of Fit: Linear Weighting: None

A0 (Offset): 0.000000 Re-Slope: 1.000000
A1 (Gain): 0.000000 Y-int: 0.000000
A2 (Curvature): 0.000000
n (Exponent): 1.000000
Correlation: 0.999997 Status: OK.
Std Error of Est: 0.000000
Predicted MDL: 21.285617
Predicted MQL: 70.952056

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -15.290 | -15.3 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1009.6 | 9.63 | .963 | .00004 | .000 | 1 |
| CalStd10=10 | 10000. | 9999.0 | -1.04 | -.010 | .00036 | .000 | 1 |
| CalStd8=100 | 100.00 | 107.44 | 7.44 | 7.44 | .00000 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.2599 | -.740 | -14.8 | .00000 | .000 | 1 |

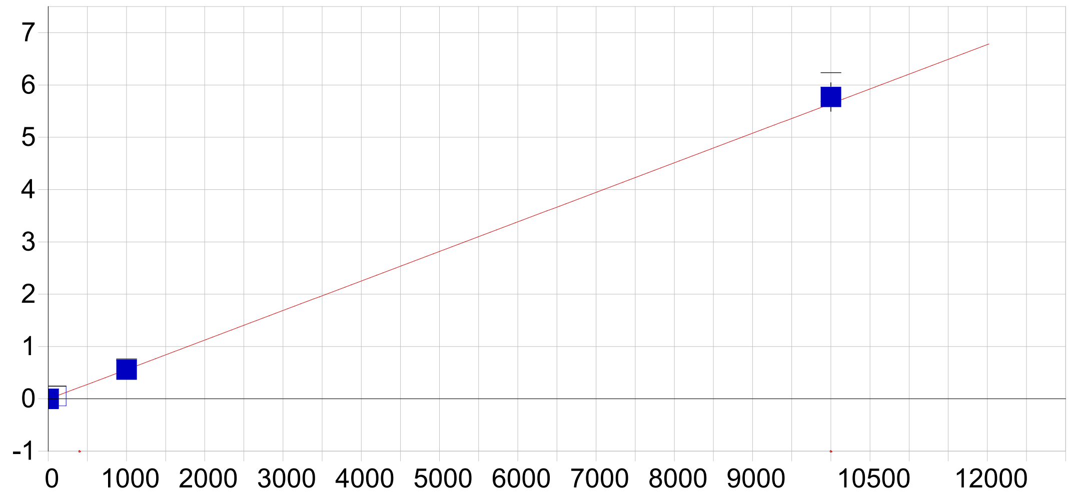



**Ba 455.403 { 74}**

Date o Fit: 06/22/2015 07:49:37 Type o Fit: Linear  eighting: None

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000056 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000117 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999999 | Status: | O . |
| Std Error o Est: | 0.000042 | | |
| Predicted MDL: | 0.150391 | | |
| Predicted MQL: | 0.501303 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.31849 | -.318 | .000 | .00002 | .000 | 1 |
| CalStd7=50 | 50.000 | 49.968 | -.032 | -.064 | .00588 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.236 | .236 | 2.36 | .00125 | .000 | 1 |
| CalStd6=20 | 20.000 | 20.546 | .546 | 2.73 | .00245 | .000 | 1 |
| CalStd8=100 | 100.00 | 100.47 | .467 | .467 | .01176 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.7989 | -.201 | -4.02 | .00062 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.94 | -.057 | -.006 | .11659 | .003 | 1 |
| CalStd3=1 | 1.0000 | .69277 | -.307 | -30.7 | .00014 | .000 | 1 |
| CalStd2=0.5 | .50000 | .16682 | -.333 | -66.6 | .00008 | .000 | 1 |

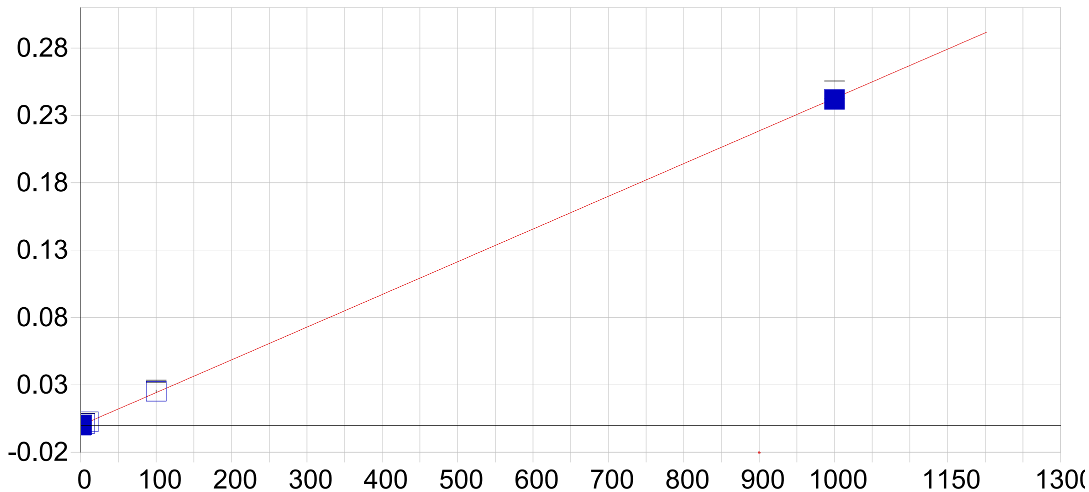



**Ba 493.409 { 68}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.005869 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000565 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999932 | Status: | O . |
| Std Error o Est: | 0.000055 | | |
| Predicted MDL: | 0.473754 | | |
| Predicted MQL: | 1.579181 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .02993 | .030 | .000 | -.00585 | .000 | 1 |
| CalStd9=100 | 1000.0 | 992.75 | -7.25 | -.725 | .55503 | .016 | 1 |
| CalStd10=10 | 10000. | 10224. | 224. | 2.24 | 5.7704 | .274 | 1 |
| CalStd8=100 | 100.00 | 100.74 | .740 | .740 | .05104 | .002 | 1 |
| CalStd4=5 | 5.0000 | 4.9724 | -.028 | -.552 | -.00306 | .000 | 1 |

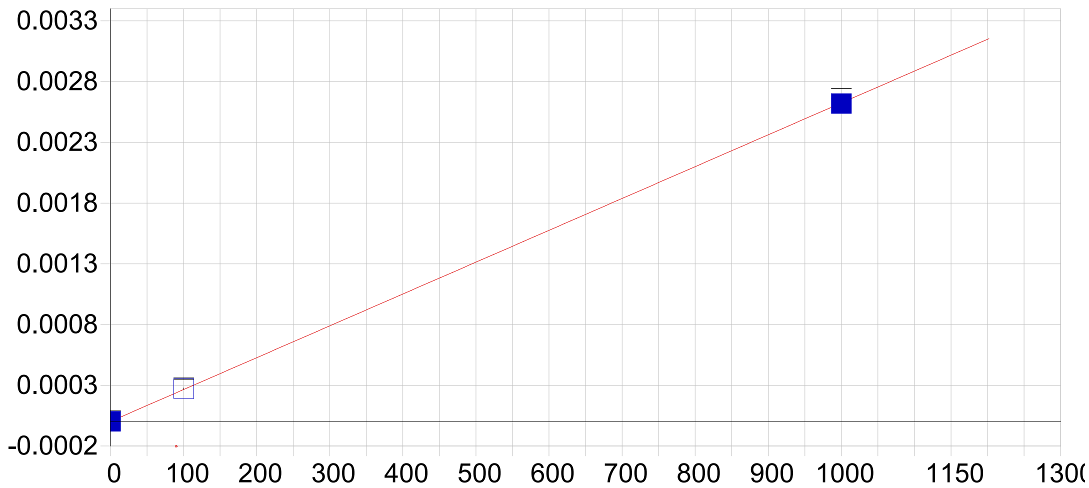



**Be 313.042 {108}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear |  eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000001 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000243 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Eponent): | 1.000000 | | |
| Correlation: | 0.999918 | Status: | O . |
| Std Error o Est: | 0.000002 | | |
| Predicted MDL: | 0.079422 | | |
| Predicted MQL: | 0.264741 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00011 | .000 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.481 | .481 | 4.81 | .00255 | .000 | 1 |
| CalStd8=100 | 100.00 | 103.44 | 3.44 | 3.44 | .02511 | .001 | 1 |
| CalStd2=0.5 | .50000 | .58096 | .081 | 16.2 | .00014 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.1159 | .116 | 2.32 | .00124 | .000 | 1 |
| CalStd1=0.25 | .25000 | .27891 | .029 | 11.6 | .00007 | .000 | 1 |
| CalStd9=100 | 1000.0 | 995.79 | -4.21 | -.421 | .24174 | .006 | 1 |
| CalStd3=1 | 1.0000 | 1.0611 | .061 | 6.11 | .00026 | .000 | 1 |

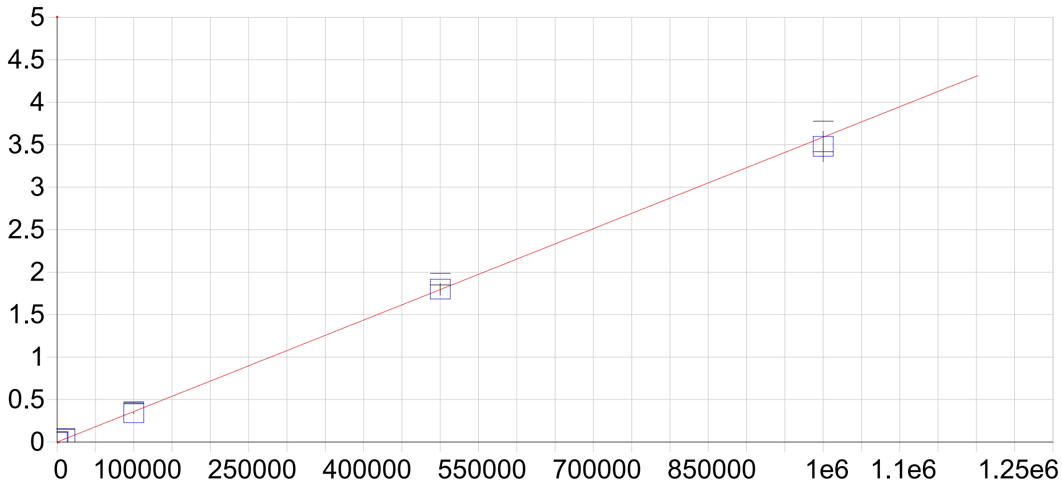



**Be 234.861 {144}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000002 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999968 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 0.928182 | | |
| Predicted MQL: | 3.093940 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00229 | -.002 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 997.46 | -2.54 | -.254 | .00262 | .000 | 1 |
| CalStd8=100 | 100.00 | 102.54 | 2.54 | 2.54 | .00027 | .000 | 1 |

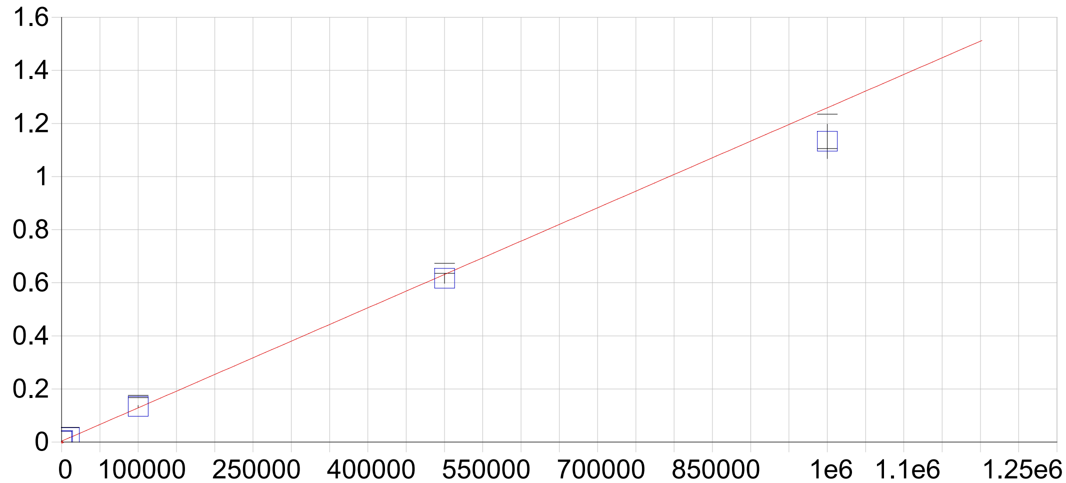



**Ca 315.887 {107}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Curvilinear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000399 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000004 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999892 | Status: | OK. |
| Std Error of Est: | 0.000093 | | |
| Predicted MDL: | 7.496616 | | |
| Predicted MQL: | 24.988719 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .18754 | .188 | .000 | .00040 | .000 | 1 |
| CalStd10=10 | 10000. | 9762.8 | -237. | -2.37 | .03543 | .001 | 1 |
| CalStd13=50 | 500000. | 501380. | 1380. | .276 | 1.7995 | .069 | 1 |
| CalStd14-100 | 1000000. | 969640. | -30400. | -3.04 | 3.4797 | .180 | 1 |
| CalStd9=100 | 1000.0 | 864.09 | -136. | -13.6 | .00350 | .000 | 1 |
| CalStd12-100 | 100000. | 95662. | -4340. | -4.34 | .34365 | .012 | 1 |

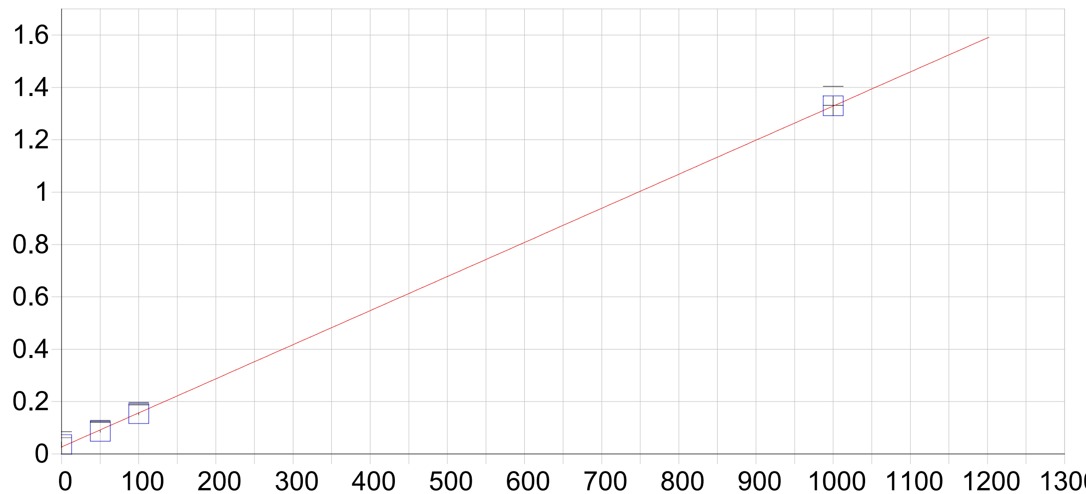



**Ca 317.933 {106}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.003427 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.998554 | Status: | O . |
| Std Error o Est: | 0.000211 | | |
| Predicted MDL: | 3.756752 | | |
| Predicted MQL: | 12.522506 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -8.0151 | -8.02 | .000 | .00342 | .000 | 1 |
| CalStd10=10 | 10000. | 10715. | 715. | 7.15 | .01688 | .001 | 1 |
| CalStd13=50 | 500000. | 488200. | -11800. | -2.36 | .61641 | .019 | 1 |
| CalStd14-100 | 1000000. | 899300. | -101000. | -10.1 | 1.1326 | .065 | 1 |
| CalStd9=100 | 1000.0 | 991.34 | -8.66 | -.866 | .00467 | .000 | 1 |
| CalStd12-100 | 100000. | 103940. | 3940. | 3.94 | .13394 | .004 | 1 |

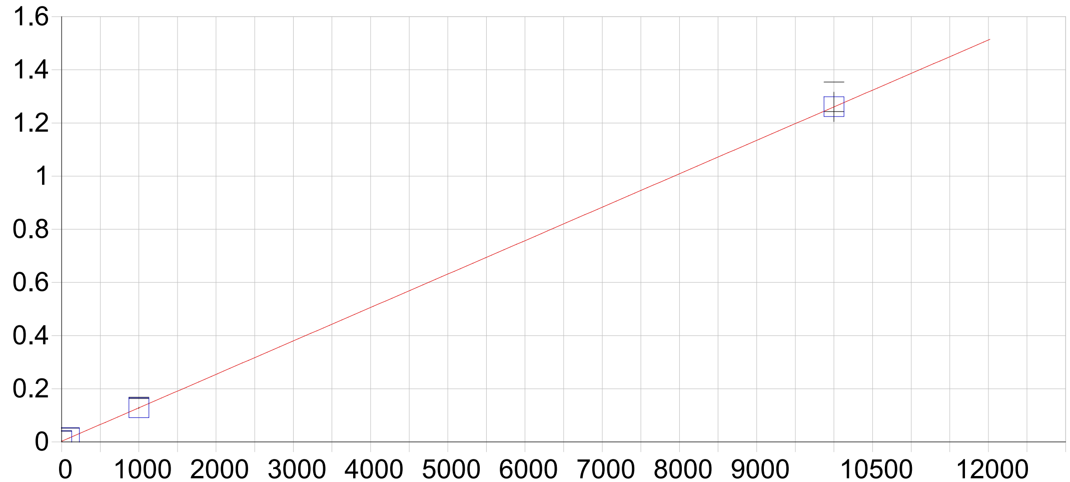



**Ca 393.366 { 86}**

| | | | | | |
|---|---|---|---|---|---|
| Date o▯ Fit: | 06/22/2015 07:49:37 | Type o▯ Fit: | Linear | ▯ eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O▯▯set): | 0.026618 | Re-Slope: | 1.000000 |
| A1 (▯ ain): | 0.001302 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E▯ ponent): | 1.000000 | | |
| Correlation: | 0.999949 | Status: | O▯ . |
| Std Error o▯ Est: | 0.007682 | | |
| Predicted MDL: | 0.038540 | | |
| Predicted MQL: | 0.128466 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 6.5501 | 6.55 | .000 | .03515 | .011 | 1 |
| CalStd7=50 | 50.000 | 45.551 | -4.45 | -8.90 | .08594 | .003 | 1 |
| CalStd9=100 | 1000.0 | 1000.5 | .481 | .048 | 1.3296 | .036 | 1 |
| CalStd8=100 | 100.00 | 97.418 | -2.58 | -2.58 | .15349 | .005 | 1 |

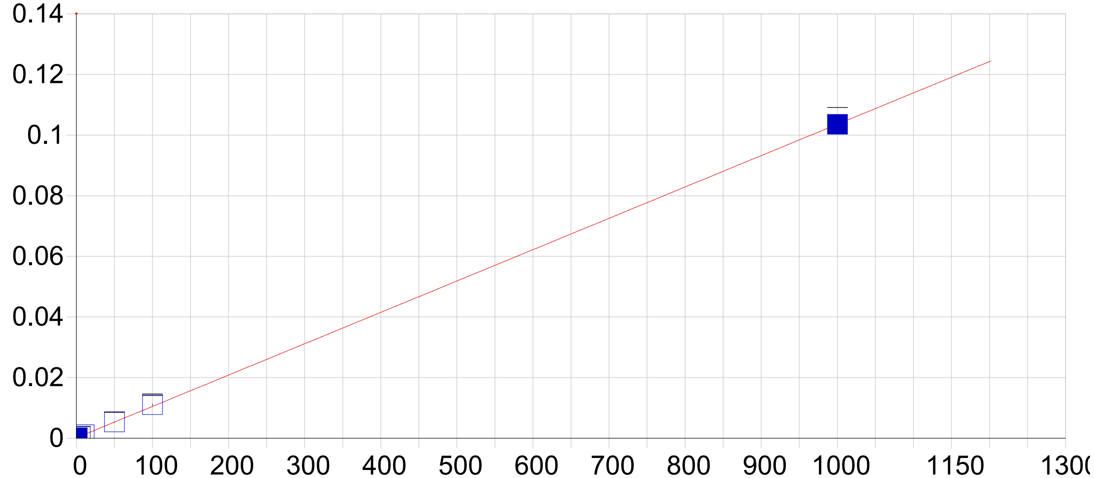



**Ca 396.847 { 85}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.002473 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000126 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999999 | Status: | OK. |
| Std Error of Est: | 0.000845 | | |
| Predicted MDL: | 0.066907 | | |
| Predicted MQL: | 0.223023 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 7.4223 | 7.42 | .000 | .00341 | .001 | 1 |
| CalStd10=10 | 10000. | 10001. | .550 | .006 | 1.2606 | .055 | 1 |
| CalStd8=100 | 100.00 | 97.258 | -2.74 | -2.74 | .01471 | .000 | 1 |
| CalStd9=100 | 1000.0 | 994.77 | -5.23 | -.523 | .12762 | .002 | 1 |

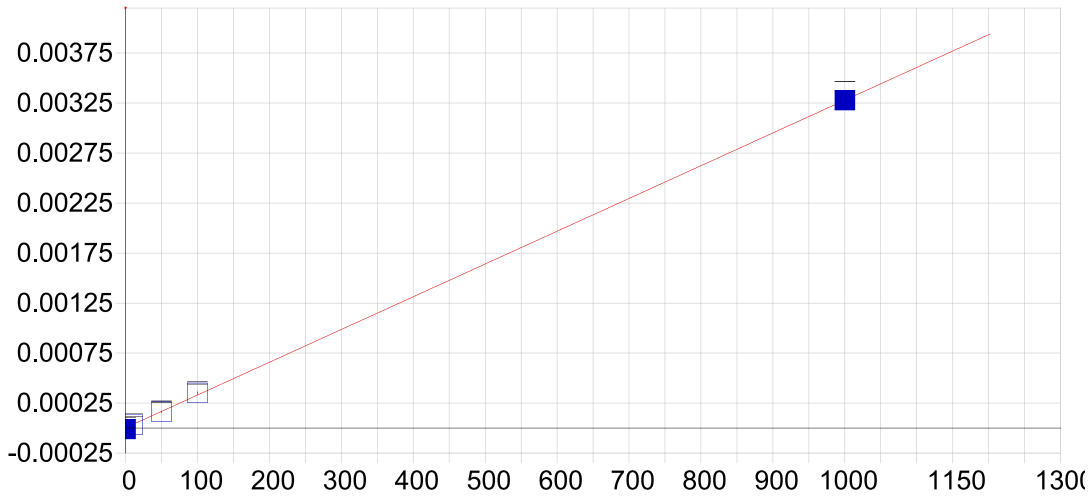



**Cd 214.438 {457}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000139 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000103 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999979 | Status: | O . |
| Std Error o Est: | 0.000250 | | |
| Predicted MDL: | 0.073957 | | |
| Predicted MQL: | 0.246523 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -1.1409 | -1.14 | .000 | .00002 | .000 | 1 |
| CalStd7=50 | 50.000 | 49.894 | -.106 | -.211 | .00530 | .000 | 1 |
| CalStd3=1 | 1.0000 | -.11532 | -1.12 | -112. | .00013 | .000 | 1 |
| CalStd2=0.5 | .50000 | -.64169 | -1.14 | -228. | .00007 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.0121 | -.988 | -19.8 | .00055 | .000 | 1 |
| CalStd8=100 | 100.00 | 105.45 | 5.45 | 5.45 | .01105 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.5685 | -.431 | -4.31 | .00113 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.47 | -.529 | -.053 | .10353 | .002 | 1 |

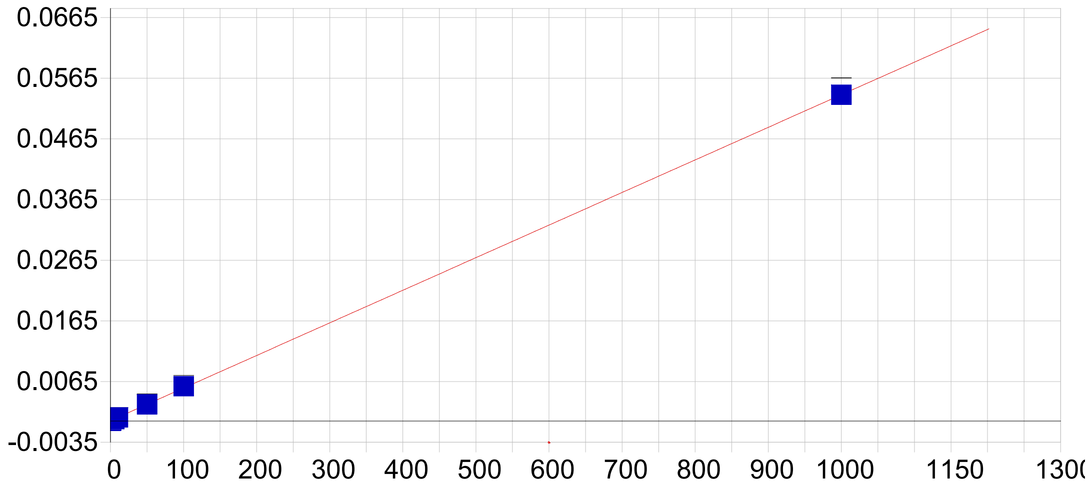



**Cd 226.502 {149}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000003 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999960 | Status: | O . |
| Std Error o Est: | 0.000015 | | |
| Predicted MDL: | 4.354860 | | |
| Predicted MQL: | 14.516199 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -4.1469 | -4.15 | .000 | -.00001 | .000 | 1 |
| CalStd7=50 | 50.000 | 48.815 | -1.18 | -2.37 | .00016 | .000 | 1 |
| CalStd8=100 | 100.00 | 106.39 | 6.39 | 6.39 | .00035 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.5203 | -.480 | -4.80 | .00003 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.43 | -.574 | -.057 | .00328 | .000 | 1 |

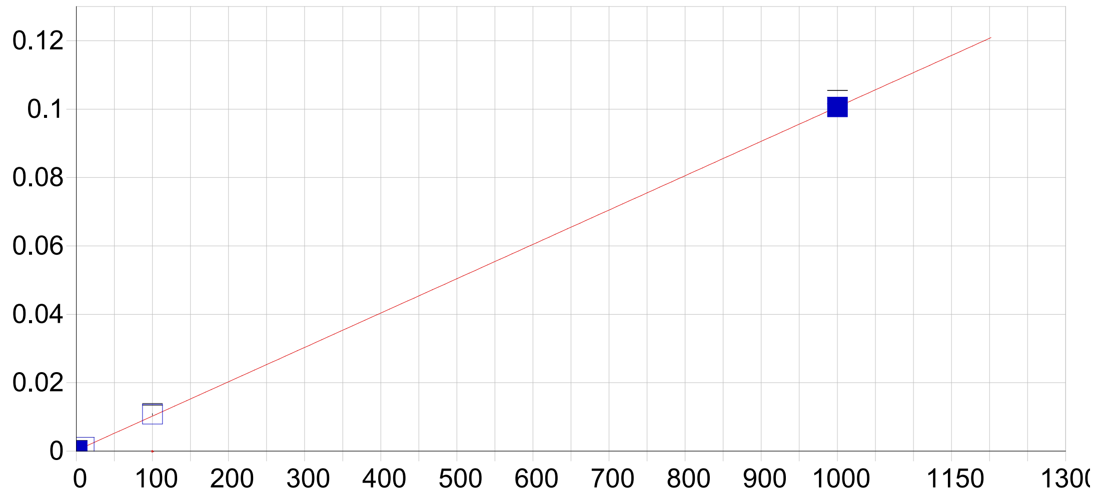



**Cd 226.502 {449}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000056 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000054 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999981 | Status: | O . |
| Std Error o Est: | 0.000125 | | |
| Predicted MDL: | 0.155048 | | |
| Predicted MQL: | 0.516826 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -1.0275 | -1.03 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 49.804 | -.196 | -.392 | .00273 | .000 | 1 |
| CalStd3=1 | 1.0000 | -.02223 | -1.02 | -102. | .00005 | .000 | 1 |
| CalStd2=0.5 | .50000 | -.51877 | -1.02 | -204. | .00003 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.0367 | -.963 | -19.3 | .00027 | .000 | 1 |
| CalStd8=100 | 100.00 | 105.28 | 5.28 | 5.28 | .00571 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.4584 | -.542 | -5.42 | .00056 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.49 | -.506 | -.051 | .05376 | .001 | 1 |

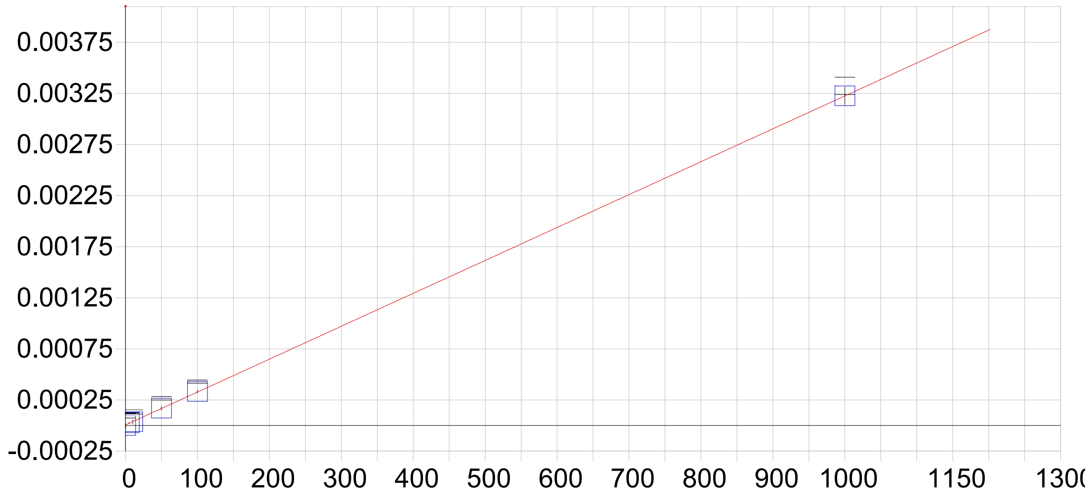



**Cd 228.802 {447}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000189 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000100 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999981 | Status: | O . |
| Std Error o Est: | 0.000280 | | |
| Predicted MDL: | 0.116929 | | |
| Predicted MQL: | 0.389763 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -1.3541 | -1.35 | .000 | .00005 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.51 | -.494 | -.049 | .10057 | .002 | 1 |
| CalStd8=100 | 100.00 | 105.03 | 5.03 | 5.03 | .01074 | .000 | 1 |
| CalStd2=0.5 | .50000 | -.77314 | -1.27 | -255. | .00011 | .000 | 1 |
| CalStd3=1 | 1.0000 | -.27504 | -1.28 | -128. | .00016 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.3697 | -.630 | -6.30 | .00113 | .000 | 1 |

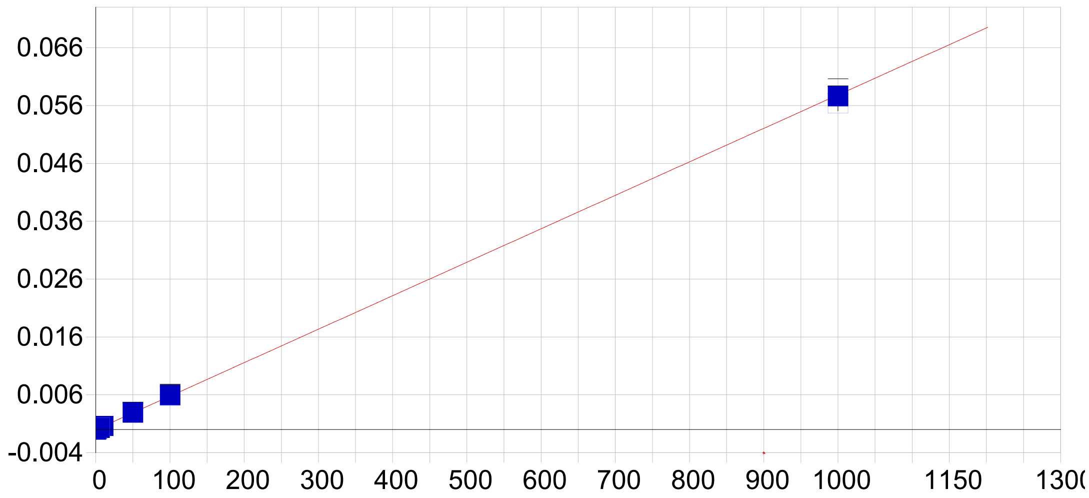



**Co 228.616 {147}**

Date o Fit: 06/22/2015 07:49:37 Type o Fit: Linear  eighting: None

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000006 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999995 | Status: | O . |
| Std Error o Est: | 0.000005 | | |
| Predicted MDL: | 4.220299 | | |
| Predicted MQL: | 14.067665 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -2.2256 | -2.23 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 50.517 | .517 | 1.03 | .00017 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.5208 | -.479 | -4.79 | .00004 | .000 | 1 |
| CalStd4=5 | 5.0000 | 6.0667 | 1.07 | 21.3 | .00003 | .000 | 1 |
| CalStd8=100 | 100.00 | 101.28 | 1.28 | 1.28 | .00033 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.85 | -.154 | -.015 | .00323 | .000 | 1 |

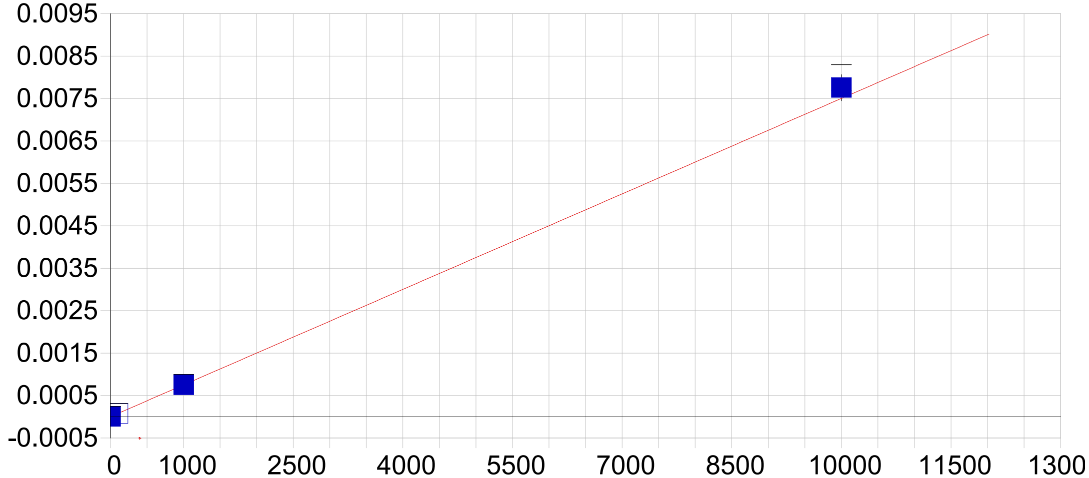



**Co 228.616 {447}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O set): | -0.000019 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000058 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999930 | Status: | O . |
| Std Error o Est: | 0.000001 | | |
| Predicted MDL: | 0.182933 | | |
| Predicted MQL: | 0.609778 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00017 | .000 | .000 | -.00002 | .000 | 1 |
| CalStd7=50 | 50.000 | 50.768 | .768 | 1.54 | .00286 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.679 | .679 | 6.79 | .00059 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.1854 | .185 | 3.71 | .00027 | .000 | 1 |
| CalStd8=100 | 100.00 | 102.68 | 2.68 | 2.68 | .00580 | .000 | 1 |
| CalStd9=100 | 1000.0 | 995.67 | -4.33 | -.433 | .05637 | .001 | 1 |
| CalStd3=1 | 1.0000 | 1.0234 | .023 | 2.34 | .00004 | .000 | 1 |

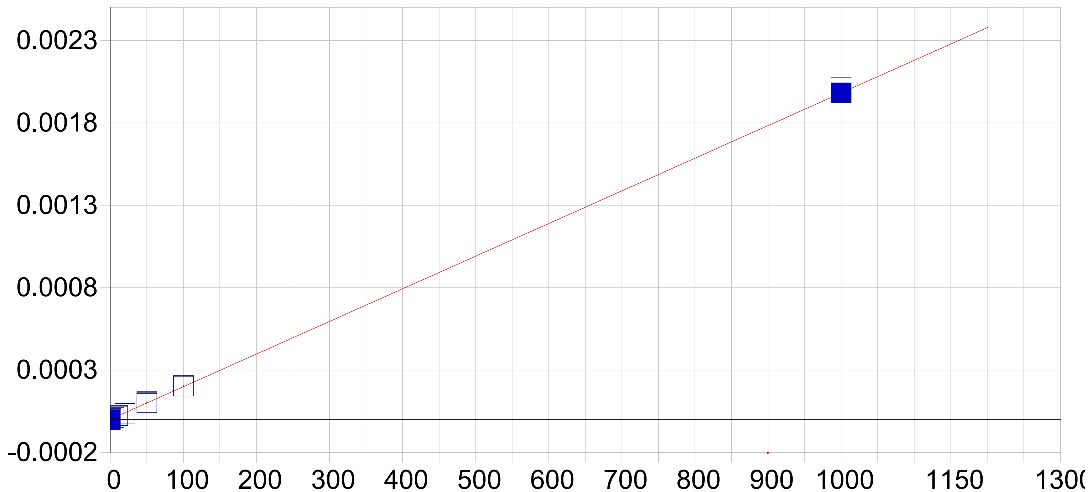



**Co 238.892 {141}**

Date o Fit: 06/22/2015 07:49:37 Type o Fit: Linear  eighting: 1/Var

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000001 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999863 | Status: | O . |
| Std Error o Est: | 0.000005 | | |
| Predicted MDL: | 4.502736 | | |
| Predicted MQL: | 15.009120 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 4.1278 | 4.13 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 996.48 | -3.52 | -.352 | .00075 | .000 | 1 |
| CalStd10=10 | 10000. | 10336. | 336. | 3.36 | .00776 | .000 | 1 |
| CalStd8=100 | 100.00 | 98.460 | -1.54 | -1.54 | .00008 | .000 | 1 |

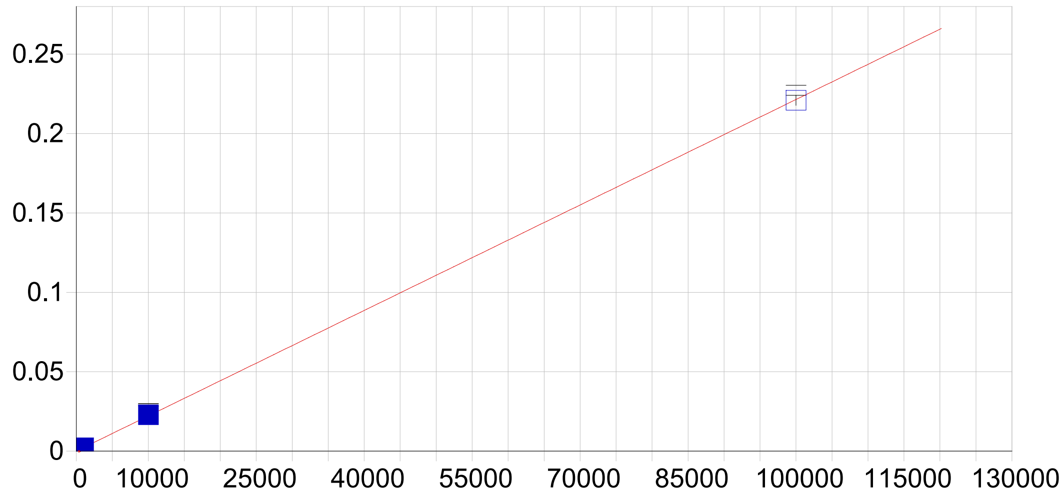



**Cr 267.716 {126}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000001 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000002 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999995 | Status: | O . |
| Std Error o Est: | 0.000002 | | |
| Predicted MDL: | 2.361163 | | |
| Predicted MQL: | 7.870545 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -1.0096 | -1.01 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.909 | .909 | 9.09 | .00002 | .000 | 1 |
| CalStd7=50 | 50.000 | 51.170 | 1.17 | 2.34 | .00010 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.83 | -.168 | -.017 | .00198 | .000 | 1 |
| CalStd6=20 | 20.000 | 18.324 | -1.68 | -8.38 | .00004 | .000 | 1 |
| CalStd8=100 | 100.00 | 101.33 | 1.33 | 1.33 | .00020 | .000 | 1 |
| CalStd3=1 | 1.0000 | .18448 | -.816 | -81.6 | .00000 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.2543 | .254 | 5.09 | .00001 | .000 | 1 |

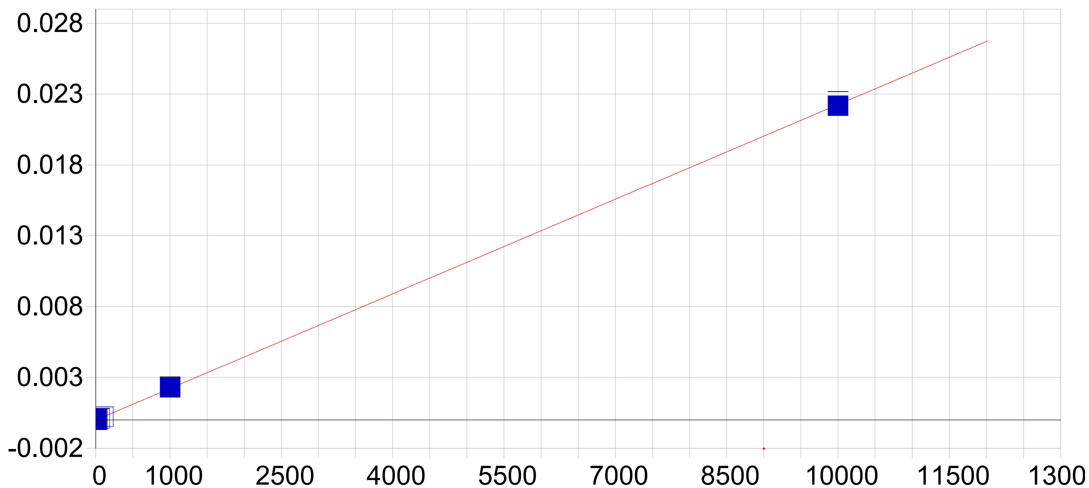



**Cr 283.563 {119}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000012 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000002 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999966 | Status: | OK . |
| Std Error of Est: | 0.000002 | | |
| Predicted MDL: | 2.188436 | | |
| Predicted MQL: | 7.294785 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00188 | -.002 | .000 | .00001 | .000 | 1 |
| CalStd7=50 | 50.000 | 49.751 | -.249 | -.499 | .00012 | .000 | 1 |
| CalStd8=100 | 100.00 | 102.17 | 2.17 | 2.17 | .00024 | .000 | 1 |
| CalStd9=100 | 1000.0 | 997.33 | -2.67 | -.267 | .00222 | .000 | 1 |
| CalStd10=10 | 10000. | 10261. | 261. | 2.61 | .02276 | .001 | 1 |
| CalStd11-100 | 100000. | 99739. | -261. | -.261 | .22087 | .003 | 1 |

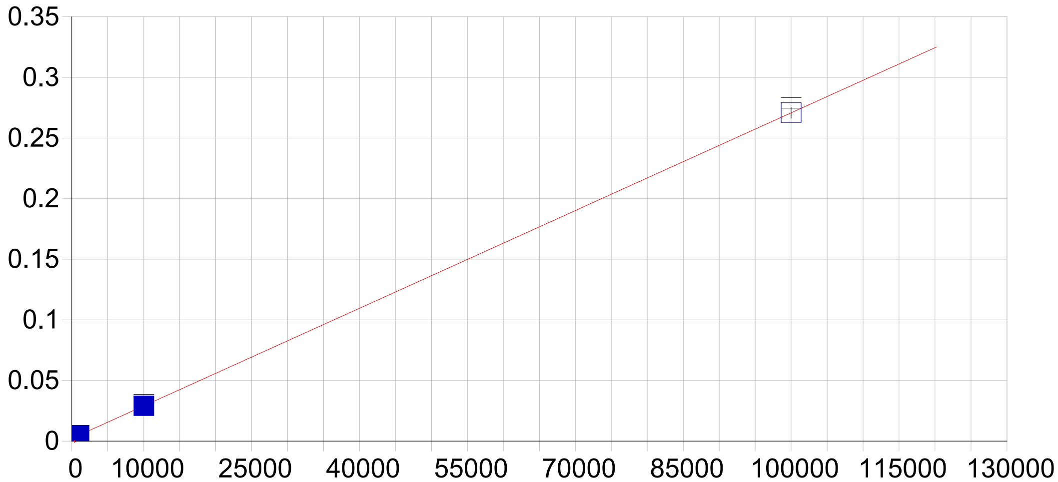



**Cu 224.700 {450}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000008 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000002 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999924 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 0.436799 | | |
| Predicted MQL: | 1.455997 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00006 | .000 | .000 | -.00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1036.2 | 36.2 | 3.62 | .00230 | .000 | 1 |
| CalStd7=50 | 50.000 | 51.061 | 1.06 | 2.12 | .00011 | .000 | 1 |
| CalStd8=100 | 100.00 | 103.61 | 3.61 | 3.61 | .00022 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.5973 | -.403 | -4.03 | .00001 | .000 | 1 |
| CalStd10=10 | 10000. | 9960.5 | -39.5 | -.395 | .02218 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.7033 | -.297 | -5.93 | .00000 | .000 | 1 |
| CalStd6=20 | 20.000 | 19.129 | -.871 | -4.35 | .00003 | .000 | 1 |
| CalStd3=1 | 1.0000 | 1.1116 | .112 | 11.2 | -.00001 | .000 | 1 |

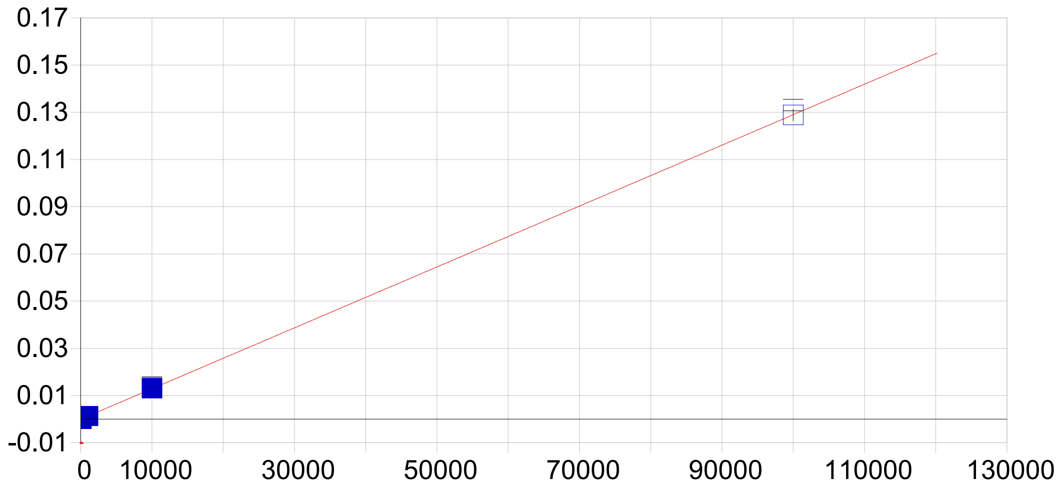



**Cu 324.754 {104}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.002183 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | OK. |
| Std Error of Est: | 0.000056 | | |
| Predicted MDL: | 2.428788 | | |
| Predicted MQL: | 8.095961 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 22.660 | 22.7 | .000 | .00224 | .000 | 1 |
| CalStd9=100 | 1000.0 | 979.91 | -20.1 | -2.01 | .00481 | .000 | 1 |
| CalStd8=100 | 100.00 | 111.49 | 11.5 | 11.5 | .00248 | .000 | 1 |
| CalStd10=10 | 10000. | 9984.2 | -15.8 | -.158 | .02900 | .001 | 1 |
| CalStd11-100 | 100000. | 100000. | 1.77 | .002 | .27079 | .004 | 1 |

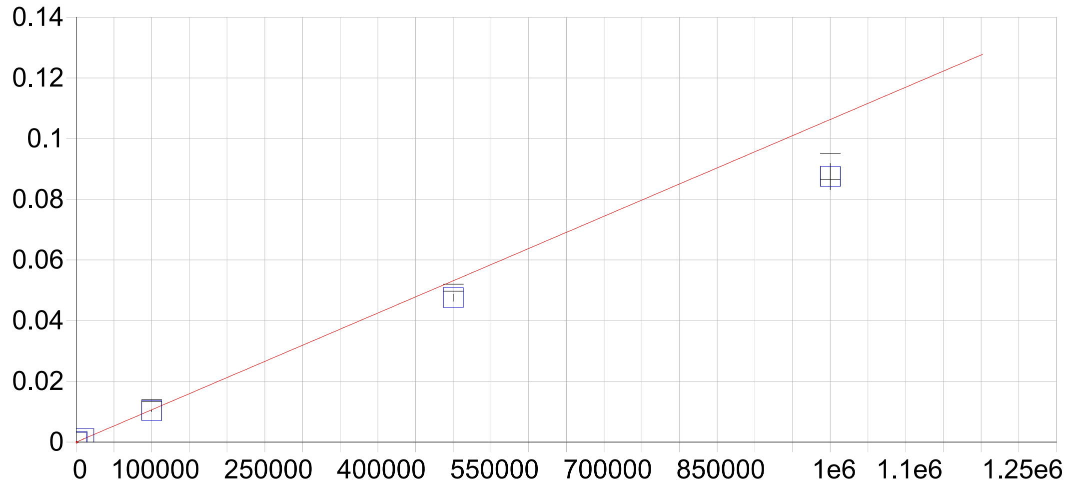



**Cu 327.396 {103}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000036 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999974 | Status: | OK. |
| Std Error of Est: | 0.000001 | | |
| Predicted MDL: | 6.806962 | | |
| Predicted MQL: | 22.689873 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.01176 | -.012 | .000 | -.00004 | .000 | 1 |
| CalStd6=20 | 20.000 | 26.199 | 6.20 | 31.0 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 59.580 | 9.58 | 19.2 | .00004 | .000 | 1 |
| CalStd8=100 | 100.00 | 107.49 | 7.49 | 7.49 | .00010 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1001.5 | 1.47 | .147 | .00126 | .000 | 1 |
| CalStd10=10 | 10000. | 10115. | 115. | 1.15 | .01302 | .001 | 1 |
| CalStd11-100 | 100000. | 99860. | -140. | -.140 | .12881 | .002 | 1 |

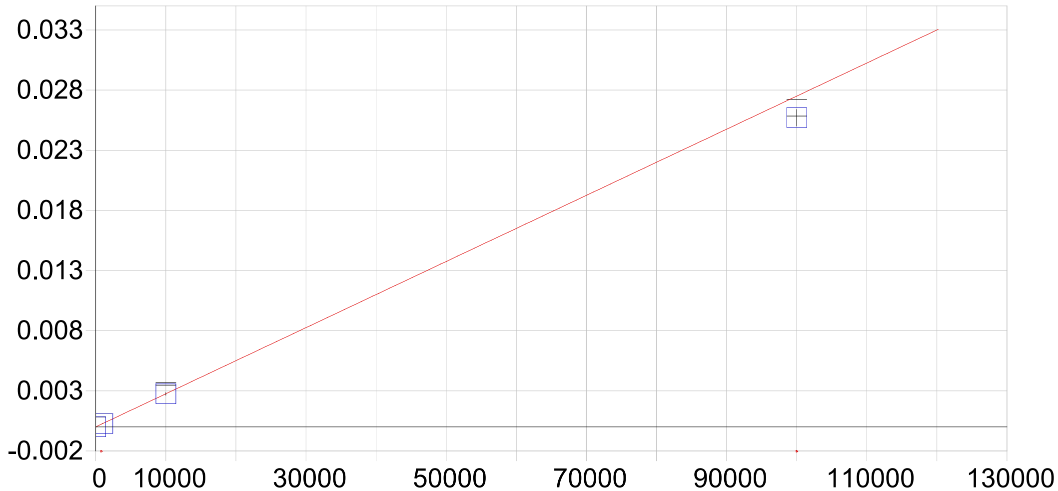



**Fe 234.349 {144}**

Date of Fit: 06/22/2015 07:49:37 Type of Fit: Full Fit Weighting: 1/Var

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000003 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999874 | Status: | OK . |
| Std Error of Est: | 0.000001 | | |
| Predicted MDL: | 15.462173 | | |
| Predicted MQL: | 51.540577 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 2.8908 | 2.89 | .000 | .00000 | .000 | 1 |
| CalStd10=10 | 10000. | 10350. | 350. | 3.50 | .00110 | .000 | 1 |
| CalStd13=50 | 500000. | 447540. | -52500. | -10.5 | .04758 | .001 | 1 |
| CalStd14-100 | 1000000. | 823080. | -177000. | -17.7 | .08751 | .004 | 1 |
| CalStd9=100 | 1000.0 | 999.44 | -.561 | -.056 | .00011 | .000 | 1 |
| CalStd12-100 | 100000. | 97236. | -2760. | -2.76 | .01034 | .000 | 1 |

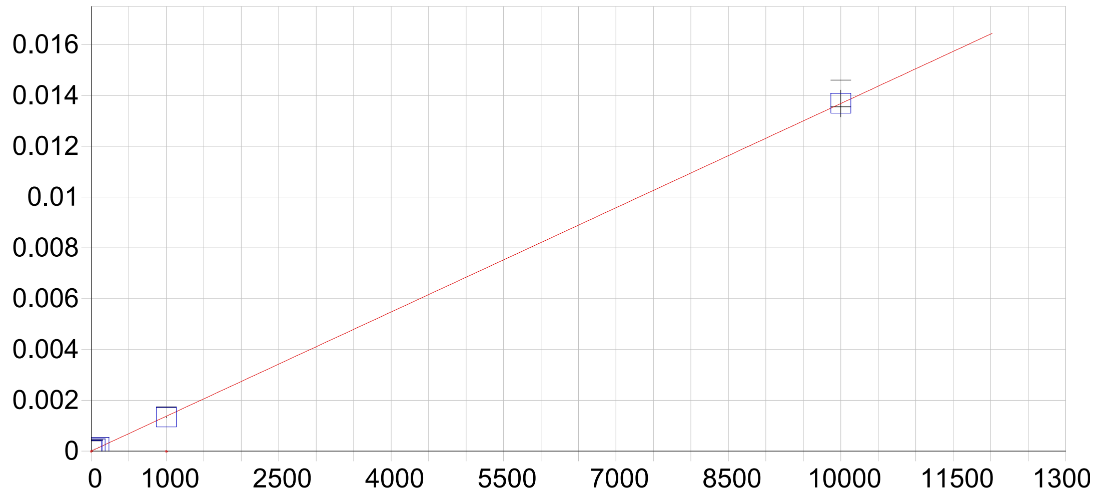



**Fe 239.562 {141}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Curvilinear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000003 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999996 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 6.872940 | | |
| Predicted MQL: | 22.909799 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .02395 | .024 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 972.47 | -27.5 | -2.75 | .00027 | .000 | 1 |
| CalStd10=10 | 10000. | 9964.3 | -35.7 | -.357 | .00274 | .000 | 1 |
| CalStd12-100 | 100000. | 93470. | -6530. | -6.53 | .02570 | .001 | 1 |

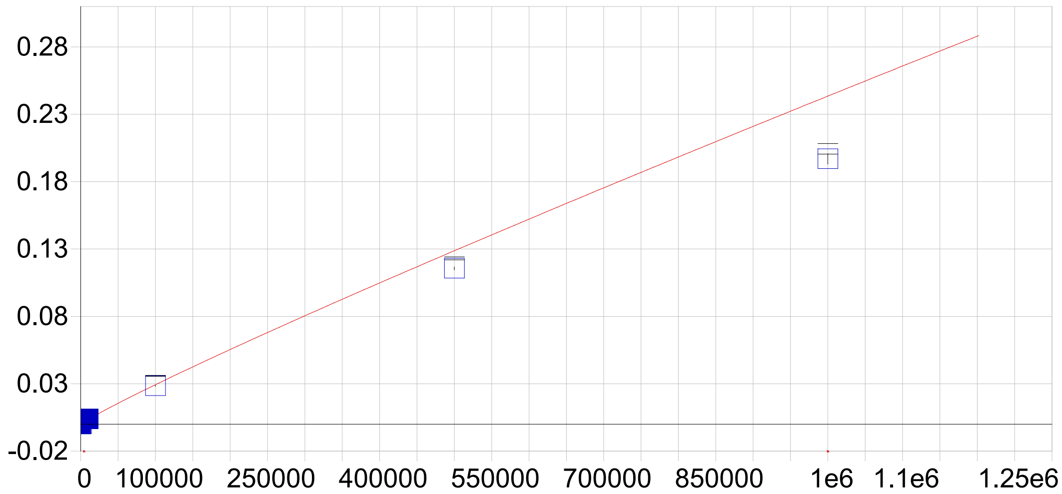



**Fe 259.940 {130}**

Date of Fit: 06/22/2015 07:49:37 Type of Fit: Linear Weighting: None

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000005 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999994 | Status: | OK . |
| Std Error of Est: | 0.000022 | | |
| Predicted MDL: | 2.725370 | | |
| Predicted MQL: | 9.084567 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 5.7013 | 5.70 | .000 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 970.93 | -29.1 | -2.91 | .00133 | .000 | 1 |
| CalStd7=50 | 50.000 | 58.871 | 8.87 | 17.7 | .00009 | .000 | 1 |
| CalStd8=100 | 100.00 | 105.16 | 5.16 | 5.16 | .00015 | .000 | 1 |
| CalStd6=20 | 20.000 | 26.534 | 6.53 | 32.7 | .00004 | .000 | 1 |
| CalStd10=10 | 10000. | 10003. | 2.80 | .028 | .01369 | .001 | 1 |

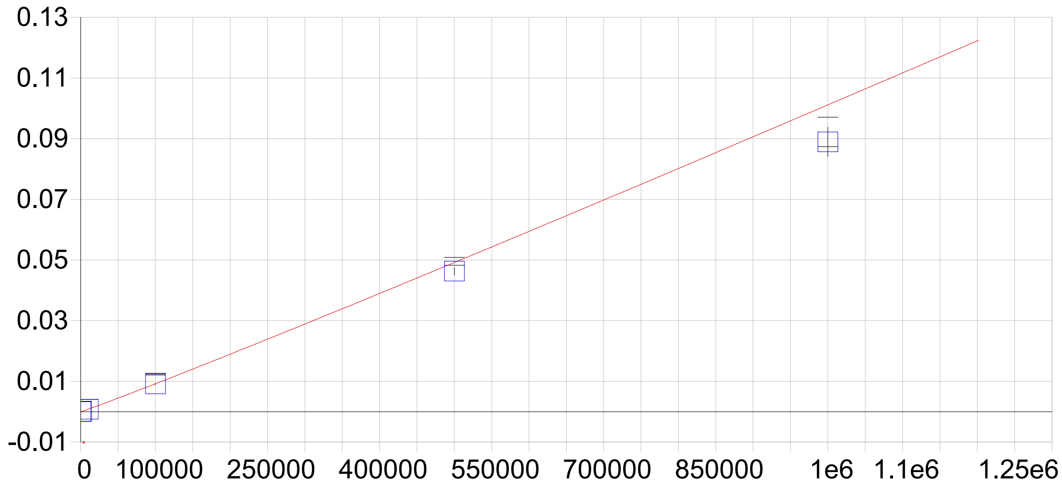



**Mg 202.582 {466}**

Date of Fit: 06/22/2015 07:49:37 Type of Fit: Full Fit Weighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000005 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 0.920000 | | |
| Correlation: | 0.999959 | Status: | OK . |
| Std Error of Est: | 0.000004 | | |
| Predicted MDL: | 1.693632 | | |
| Predicted MQL: | 5.645439 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .02003 | .020 | .000 | -.00001 | .000 | 1 |
| CalStd13=50 | 500000. | 445100. | -54900. | -11.0 | .11564 | .001 | 1 |
| CalStd10=10 | 10000. | 10608. | 608. | 6.08 | .00371 | .000 | 1 |
| CalStd14-100 | 1000000. | 793830. | -206000. | -20.6 | .19691 | .004 | 1 |
| CalStd12-100 | 100000. | 96763. | -3240. | -3.24 | .02840 | .000 | 1 |
| CalStd9=100 | 1000.0 | 900.51 | -99.5 | -9.95 | .00038 | .000 | 1 |

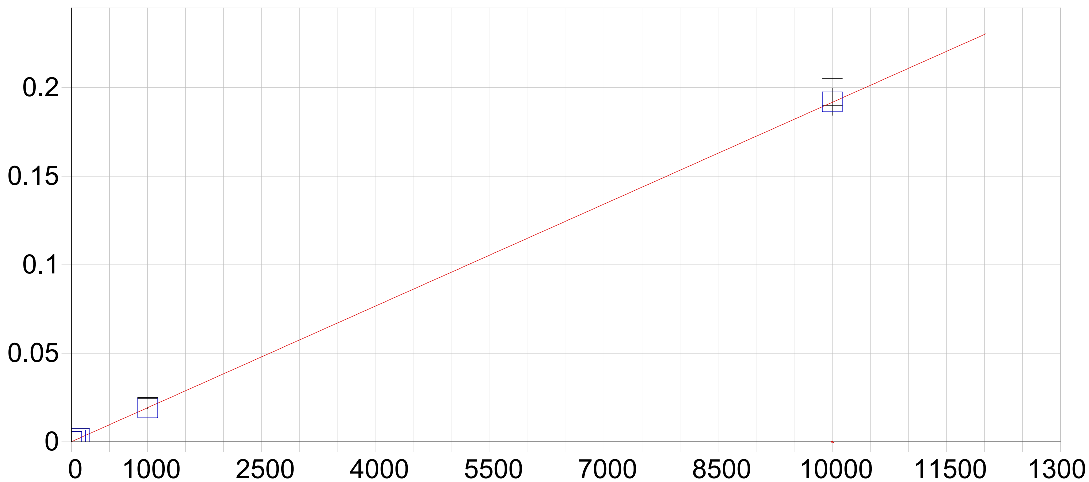



**Mg 279.079 {121}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Full Fit | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000014 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.040000 | | |
| Correlation: | 1.000000 | Status: | OK . |
| Std Error of Est: | 0.000034 | | |
| Predicted MDL: | 42.875749 | | |
| Predicted MQL: | 142.919164 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 205.77 | 206. | .000 | .00000 | .000 | 1 |
| CalStd13=50 | 500000. | 471730. | -28300. | -5.65 | .04628 | .001 | 1 |
| CalStd10=10 | 10000. | 9556.1 | -444. | -4.44 | .00079 | .000 | 1 |
| CalStd14-100 | 1000000. | 883480. | -117000. | -11.7 | .08889 | .005 | 1 |
| CalStd12-100 | 100000. | 98892. | -1110. | -1.11 | .00910 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1319.2 | 319. | 31.9 | .00009 | .000 | 1 |

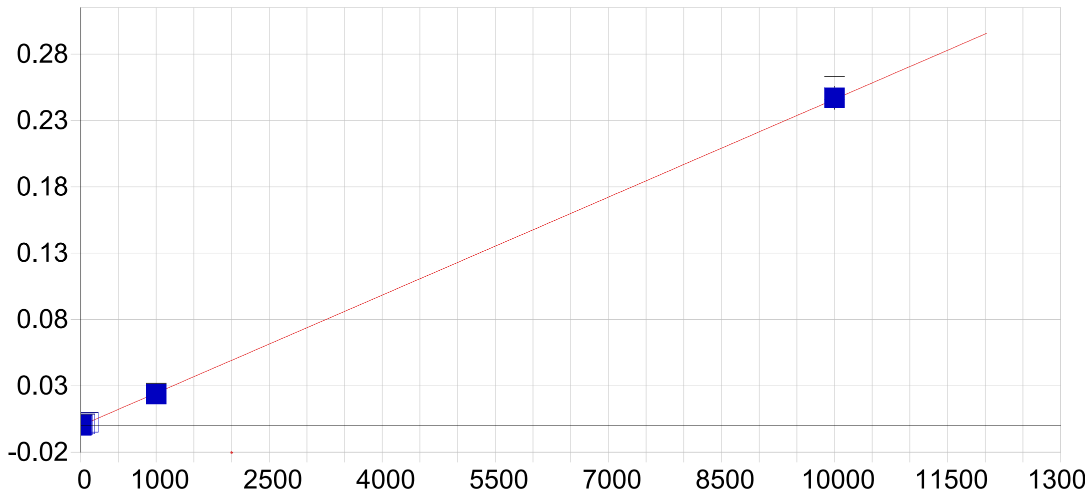



**Mg 280.270 {120}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000119 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000019 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999993 | Status: | OK. |
| Std Error of Est: | 0.000002 | | |
| Predicted MDL: | 0.125658 | | |
| Predicted MQL: | 0.418860 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00158 | .002 | .000 | .00012 | .000 | 1 |
| CalStd9=100 | 1000.0 | 988.82 | -11.2 | -1.12 | .01906 | .000 | 1 |
| CalStd10=10 | 10000. | 10013. | 13.0 | .130 | .19195 | .008 | 1 |
| CalStd8=100 | 100.00 | 98.595 | -1.40 | -1.40 | .00201 | .000 | 1 |
| CalStd7=50 | 50.000 | 49.612 | -.388 | -.777 | .00107 | .000 | 1 |

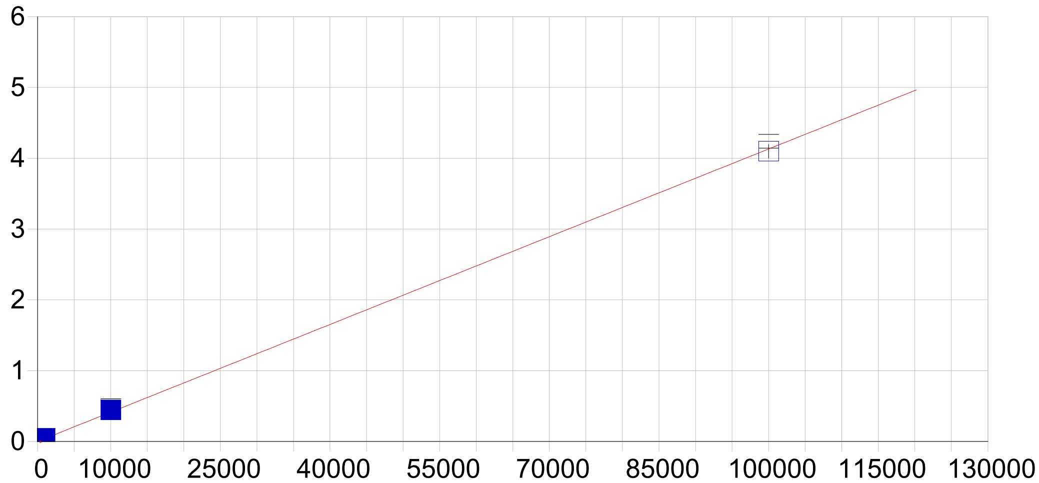



**Mn 257.610 {131}**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | | Type o Fit: | Linear | eighting: | 1/Conc | |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000002 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000025 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999930 | Status: | O . |
| Std Error o Est: | 0.000003 | | |
| Predicted MDL: | 0.471165 | | |
| Predicted MQL: | 1.570549 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00034 | .000 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.484 | .484 | 4.84 | .00026 | .000 | 1 |
| CalStd7=50 | 50.000 | 49.064 | -.936 | -1.87 | .00121 | .000 | 1 |
| CalStd6=20 | 20.000 | 19.904 | -.096 | -.480 | .00049 | .000 | 1 |
| CalStd8=100 | 100.00 | 97.925 | -2.07 | -2.07 | .00241 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.8048 | -.195 | -3.90 | .00012 | .000 | 1 |
| CalStd9=100 | 1000.0 | 963.63 | -36.4 | -3.64 | .02371 | .001 | 1 |
| CalStd10=10 | 10000. | 10039. | 39.2 | .392 | .24695 | .009 | 1 |

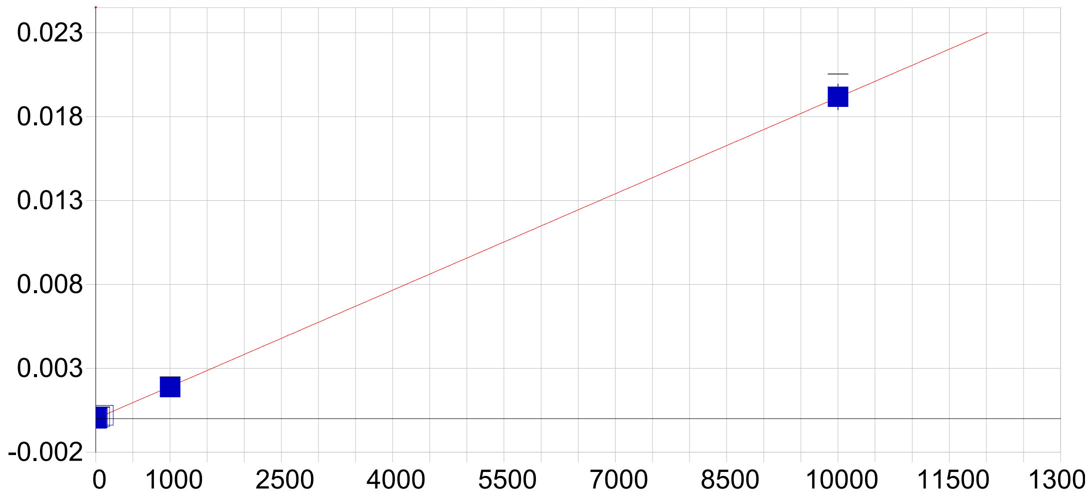



**Mn 259.373 {130}**

Date of Fit: 06/22/2015 07:49:37 Type of Fit: Linear Weighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000017 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000041 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999713 | Status: | OK . |
| Std Error of Est: | 0.000466 | | |
| Predicted MDL: | 0.500449 | | |
| Predicted MQL: | 1.668164 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.09619 | -.096 | .000 | .00001 | .000 | 1 |
| CalStd10=10 | 10000. | 10754. | 754. | 7.54 | .44483 | .016 | 1 |
| CalStd11-100 | 100000. | 99217. | -783. | -.783 | 4.0984 | .097 | 1 |
| CalStd9=100 | 1000.0 | 1028.6 | 28.6 | 2.86 | .04257 | .001 | 1 |

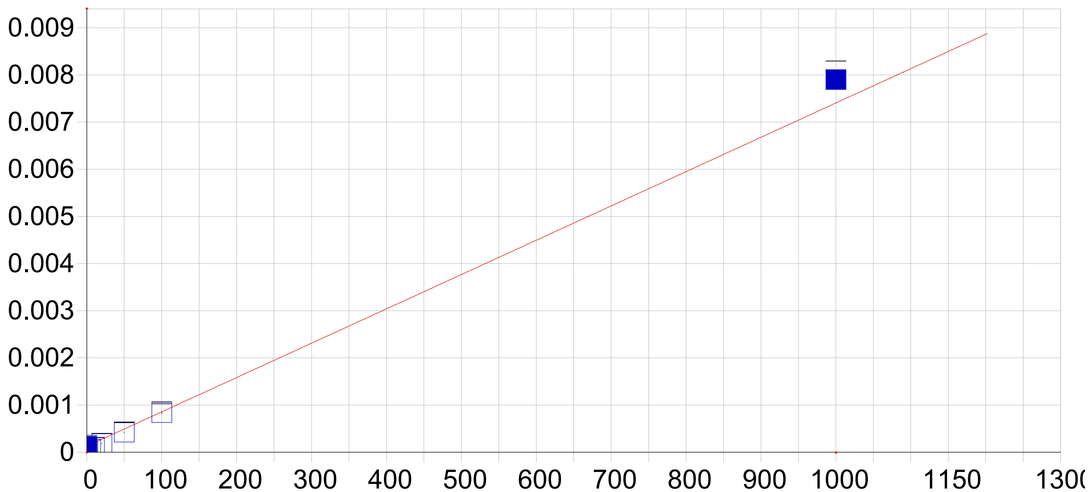



**Mn 293.930 {115}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O set): | -0.000002 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000002 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999915 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 2.667439 | | |
| Predicted MQL: | 8.891463 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00339 | -.003 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.984 | .984 | 9.84 | .00002 | .000 | 1 |
| CalStd7=50 | 50.000 | 51.522 | 1.52 | 3.04 | .00010 | .000 | 1 |
| CalStd6=20 | 20.000 | 21.939 | 1.94 | 9.69 | .00004 | .000 | 1 |
| CalStd8=100 | 100.00 | 101.77 | 1.77 | 1.77 | .00019 | .000 | 1 |
| CalStd4=5 | 5.0000 | 7.2790 | 2.28 | 45.6 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 978.20 | -21.8 | -2.18 | .00187 | .000 | 1 |
| CalStd10=10 | 10000. | 10013. | 13.3 | .133 | .01918 | .001 | 1 |

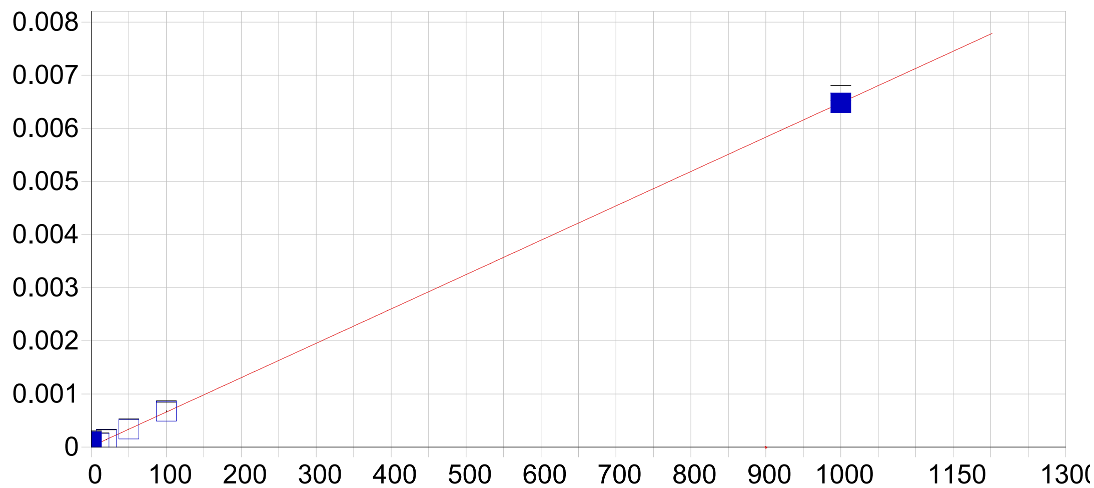



**Mo 203.844 {465}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000128 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000007 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.896173 | Status: | O . |
| Std Error o Est: | 0.000005 | | |
| Predicted MDL: | 0.949628 | | |
| Predicted MQL: | 3.165427 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .01972 | .020 | .000 | .00013 | .000 | 1 |
| CalStd7=50 | 50.000 | 40.187 | -9.81 | -19.6 | .00042 | .000 | 1 |
| CalStd3=1 | 1.0000 | -13.730 | -14.7 | -1470. | .00003 | .000 | 1 |
| CalStd6=20 | 20.000 | 7.7838 | -12.2 | -61.1 | .00018 | .000 | 1 |
| CalStd5=10 | 10.000 | -3.8965 | -13.9 | -139. | .00010 | .000 | 1 |
| CalStd8=100 | 100.00 | 97.355 | -2.64 | -2.64 | .00084 | .000 | 1 |
| CalStd4=5 | 5.0000 | -9.1505 | -14.2 | -283. | .00006 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1067.5 | 67.5 | 6.75 | .00790 | .000 | 1 |

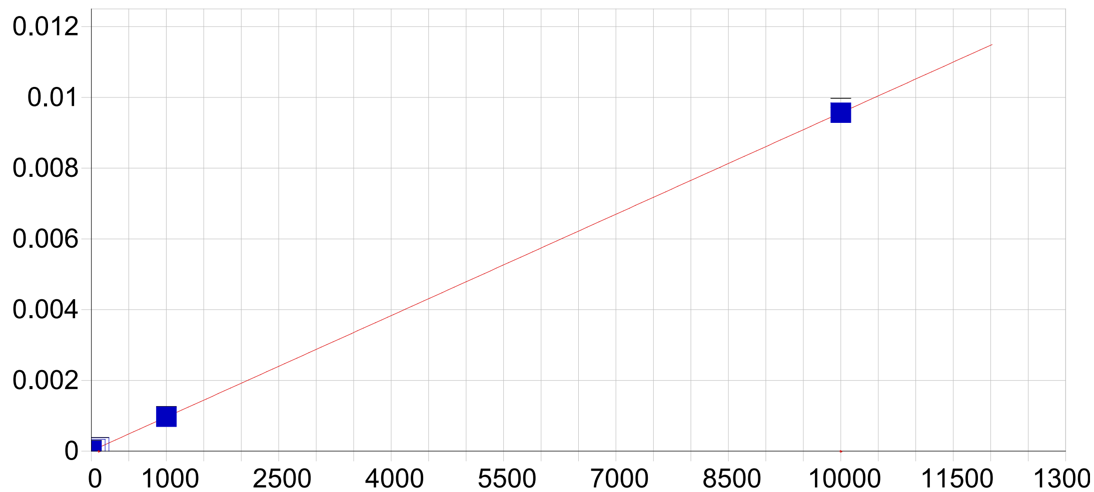



**Mo 202.030 {467}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000013 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000006 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.996036 | Status: | OK . |
| Std Error of Est: | 0.000019 | | |
| Predicted MDL: | 0.792520 | | |
| Predicted MQL: | 2.641734 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 13.148 | 13.1 | .000 | .00010 | .000 | 1 |
| CalStd7=50 | 50.000 | 49.996 | -.004 | -.008 | .00034 | .000 | 1 |
| CalStd6=20 | 20.000 | 19.577 | -.423 | -2.11 | .00014 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.3510 | -.649 | -6.49 | .00007 | .000 | 1 |
| CalStd8=100 | 100.00 | 101.86 | 1.86 | 1.86 | .00067 | .000 | 1 |
| CalStd9=100 | 1000.0 | 999.33 | -.674 | -.067 | .00648 | .000 | 1 |

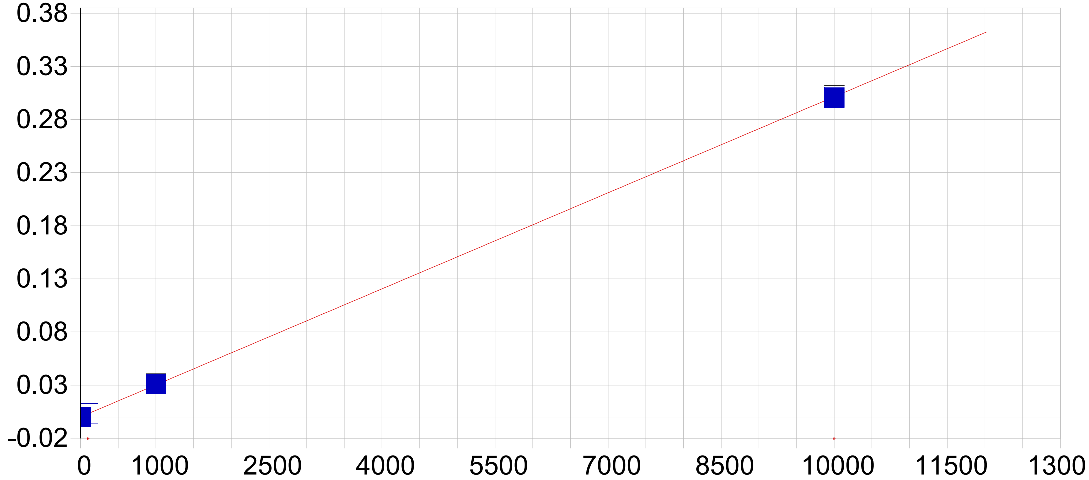



**Mo 204.598 {465}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000008 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999999 | Status: | O . |
| Std Error o Est: | 0.000006 | | |
| Predicted MDL: | 1.220119 | | |
| Predicted MQL: | 4.067062 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 7.4150 | 7.42 | .000 | .00002 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1002.3 | 2.29 | .229 | .00097 | .000 | 1 |
| CalStd10=10 | 10000. | 9999.8 | -.160 | -.002 | .00956 | .000 | 1 |
| CalStd7=50 | 50.000 | 44.610 | -5.39 | -10.8 | .00005 | .000 | 1 |
| CalStd8=100 | 100.00 | 95.848 | -4.15 | -4.15 | .00010 | .000 | 1 |

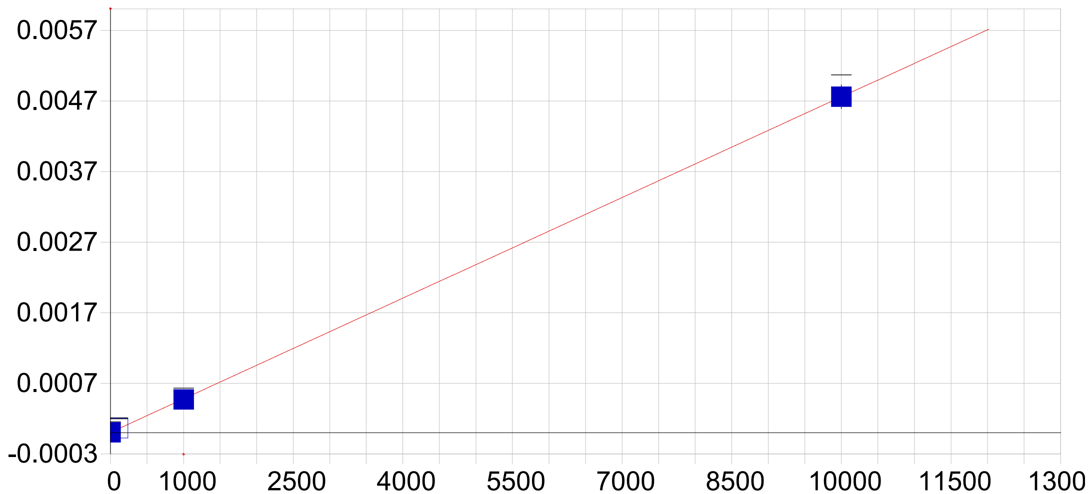



**Ni 221.647 {452}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000013 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000030 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999945 | Status: | O . |
| Std Error o Est: | 0.000015 | | |
| Predicted MDL: | 0.395835 | | |
| Predicted MQL: | 1.319449 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00874 | -.009 | .000 | .00001 | .000 | 1 |
| CalStd10=10 | 10000. | 9967.0 | -33.0 | -.330 | .30049 | .002 | 1 |
| CalStd8=100 | 100.00 | 106.41 | 6.41 | 6.41 | .00322 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1026.5 | 26.5 | 2.65 | .03096 | .001 | 1 |

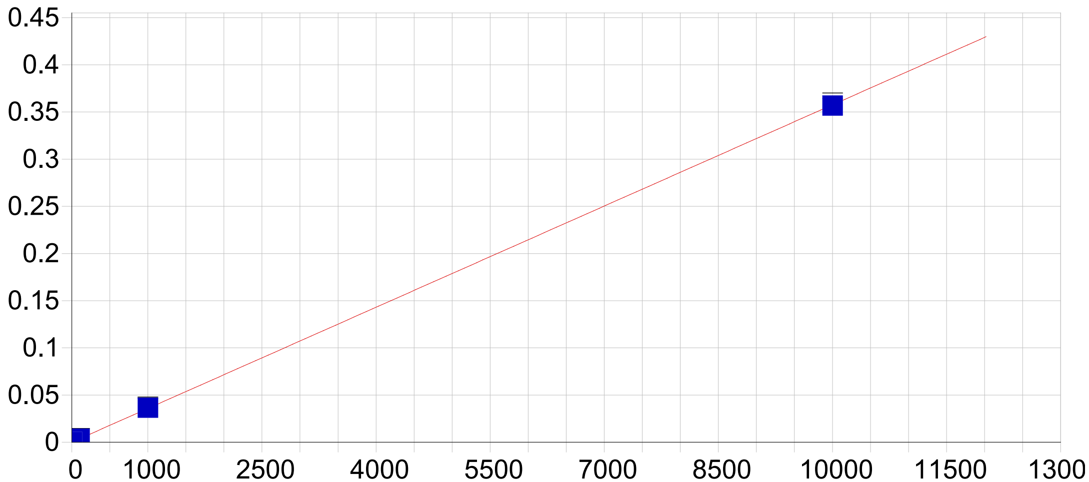



**Ni 231.604 {146}**

Date o Fit: 06/22/2015 07:49:37 Type o Fit: Linear  eighting: None

A0 (Oset): 0.000005 Re-Slope: 1.000000
A1 ( ain): 0.000000 Y-int: 0.000000
A2 (Curvature): 0.000000
n (Eponent): 1.000000
Correlation: 0.999993 Status: O .
Std Error o Est: 0.000011
Predicted MDL: 31.304584
Predicted MQL: 104.348613

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .62173 | .622 | .000 | .00001 | .000 | 1 |
| CalStd10=10 | 10000. | 10002. | 2.15 | .021 | .00476 | .000 | 1 |
| CalStd8=100 | 100.00 | 120.77 | 20.8 | 20.8 | .00006 | .000 | 1 |
| CalStd9=100 | 1000.0 | 976.47 | -23.5 | -2.35 | .00047 | .000 | 1 |

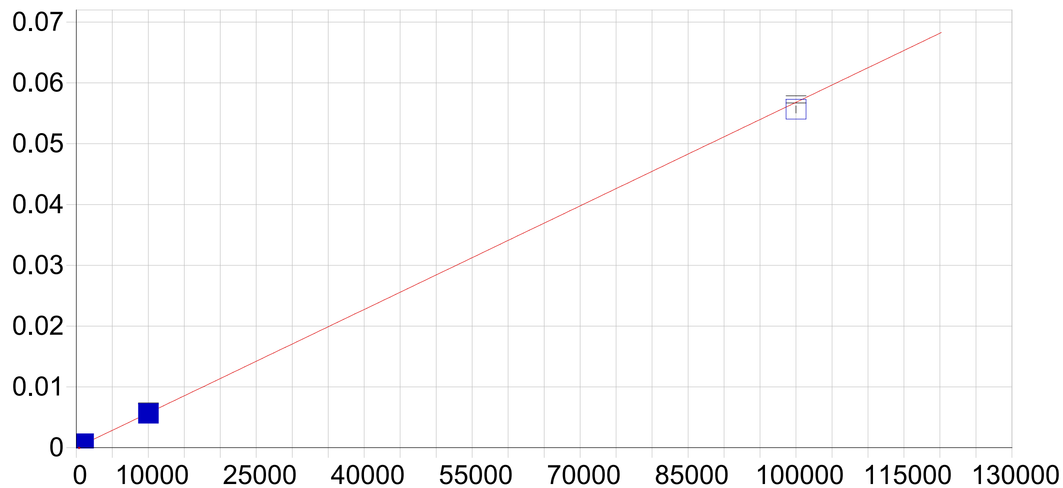



**Ni 231.604 {445}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000016 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000036 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999964 | Status: | O . |
| Std Error o Est: | 0.000001 | | |
| Predicted MDL: | 0.421876 | | |
| Predicted MQL: | 1.406252 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00045 | .000 | .000 | .00002 | .000 | 1 |
| CalStd7=50 | 50.000 | 52.342 | 2.34 | 4.68 | .00189 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.715 | .715 | 7.15 | .00040 | .000 | 1 |
| CalStd8=100 | 100.00 | 104.80 | 4.80 | 4.80 | .00376 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.2666 | .267 | 5.33 | .00020 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1017.1 | 17.1 | 1.71 | .03638 | .001 | 1 |
| CalStd3=1 | 1.0000 | 1.2161 | .216 | 21.6 | .00006 | .000 | 1 |
| CalStd10=10 | 10000. | 9974.6 | -25.4 | -.254 | .35669 | .003 | 1 |

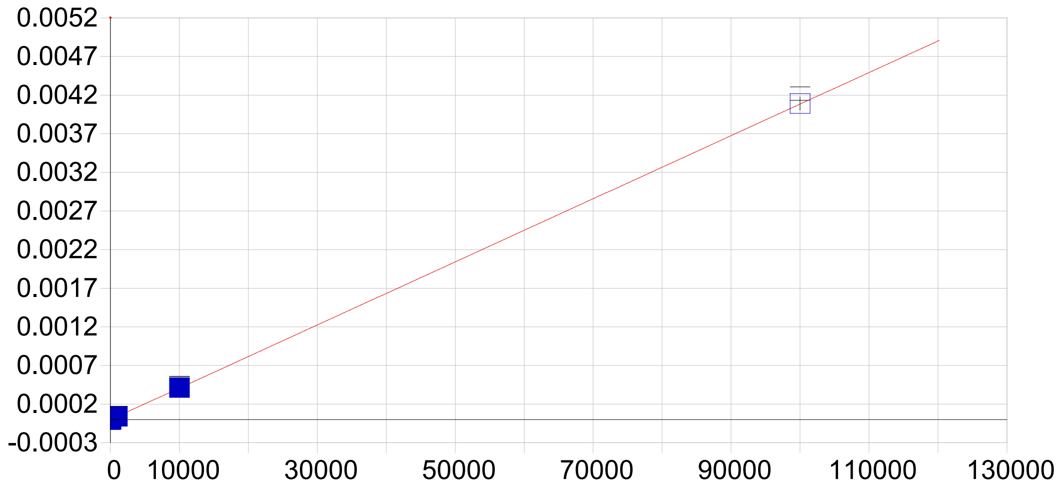



**Pb 216.999 {455}**

| | | | | | |
|---|---|---|---|---|---|
| Date o□ Fit: | 06/22/2015 07:49:37 | Type o□ Fit: | Curvilinear | □ eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O□□set): | 0.000005 | Re-Slope: | 1.000000 |
| A1 (□ ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E□ ponent): | 1.000000 | | |
| Correlation: | 0.999936 | Status: | O□ . |
| Std Error o□ Est: | 0.000000 | | |
| Predicted MDL: | 3.424791 | | |
| Predicted MQL: | 11.415971 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00349 | .003 | .000 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1095.7 | 95.7 | 9.57 | .00063 | .000 | 1 |
| CalStd10=10 | 10000. | 9870.2 | -130. | -1.30 | .00562 | .000 | 1 |
| CalStd11-100 | 100000. | 97927. | -2070. | -2.07 | .05564 | .001 | 1 |
| CalStd8=100 | 100.00 | 108.69 | 8.69 | 8.69 | .00007 | .000 | 1 |
| CalStd4=5 | 5.0000 | 1.8561 | -3.14 | -62.9 | .00001 | .000 | 1 |
| CalStd5=10 | 10.000 | 7.5963 | -2.40 | -24.0 | .00001 | .000 | 1 |

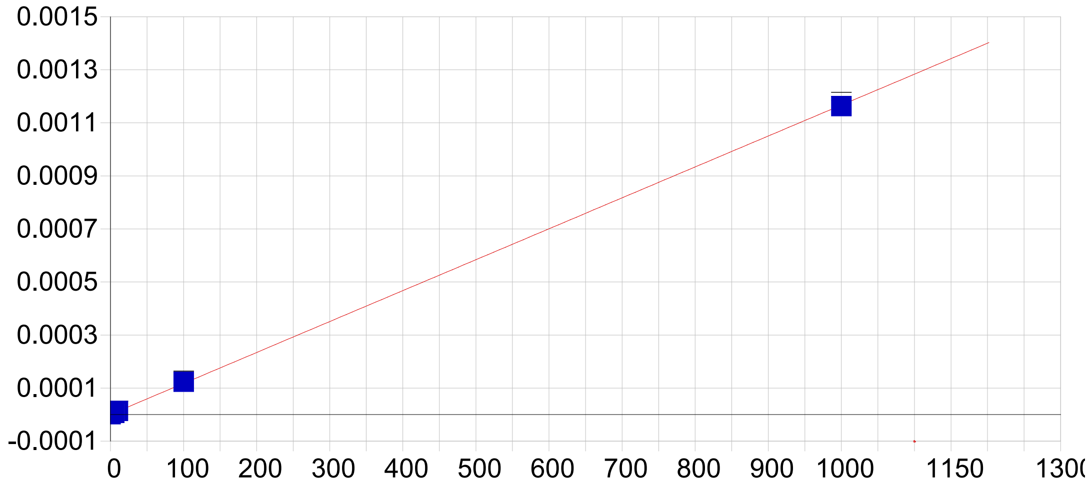



**Pb 220.353 {153}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000001 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999583 | Status: | OK . |
| Std Error of Est: | 0.000001 | | |
| Predicted MDL: | 57.298341 | | |
| Predicted MQL: | 190.994469 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -23.005 | -23.0 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 986.27 | -13.7 | -1.37 | .00004 | .000 | 1 |
| CalStd10=10 | 10000. | 10122. | 122. | 1.22 | .00041 | .000 | 1 |
| CalStd8=100 | 100.00 | 52.893 | -47.1 | -47.1 | .00000 | .000 | 1 |
| CalStd4=5 | 5.0000 | 10.707 | 5.71 | 114. | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | -18.481 | -28.5 | -285. | .00000 | .000 | 1 |
| CalStd11-100 | 100000. | 100120. | 123. | .123 | .00409 | .000 | 1 |

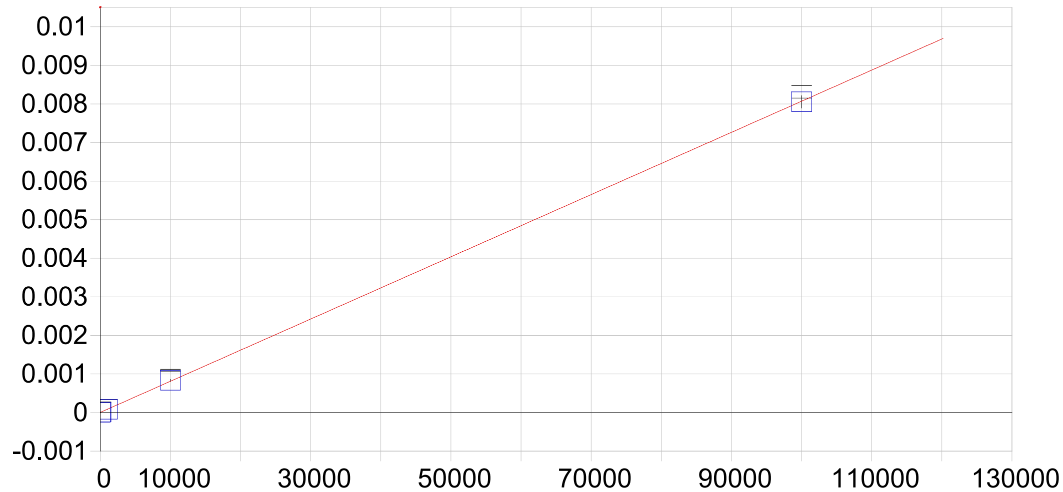



**Pb 220.353 {453}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000001 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999735 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 1.933812 | | |
| Predicted MQL: | 6.446040 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00082 | .001 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.470 | .470 | 4.70 | .00001 | .000 | 1 |
| CalStd8=100 | 100.00 | 104.78 | 4.78 | 4.78 | .00012 | .000 | 1 |
| CalStd4=5 | 5.0000 | 3.7274 | -1.27 | -25.5 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 996.02 | -3.98 | -.398 | .00116 | .000 | 1 |

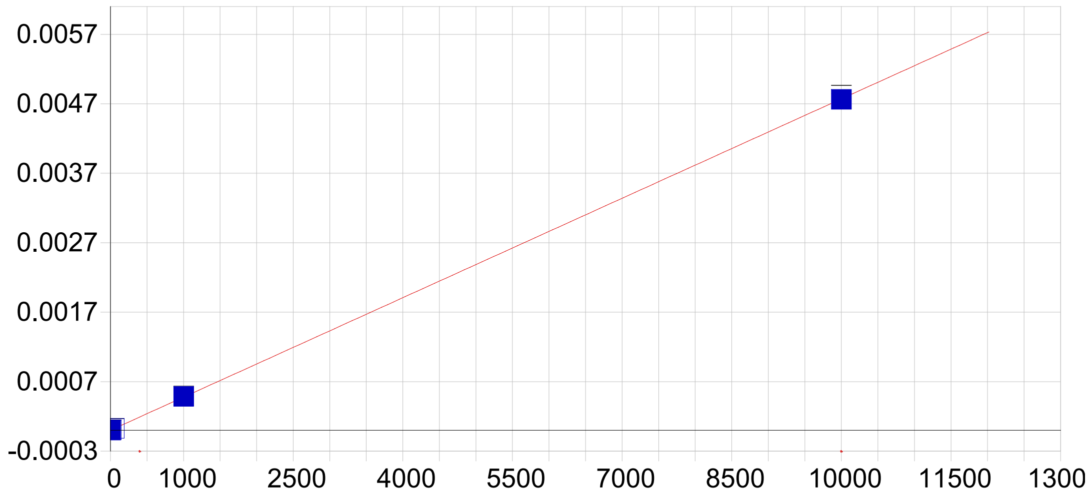



**Pb 283.306 {119}**

| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Conc |
|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000004 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999966 | Status: | OK. |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 68.853709 | | |
| Predicted MQL: | 229.512365 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00555 | -.006 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 969.54 | -30.5 | -3.05 | .00008 | .000 | 1 |
| CalStd10=10 | 10000. | 10242. | 242. | 2.42 | .00083 | .000 | 1 |
| CalStd11-100 | 100000. | 99782. | -218. | -.218 | .00805 | .000 | 1 |
| CalStd8=100 | 100.00 | 106.40 | 6.40 | 6.40 | .00001 | .000 | 1 |

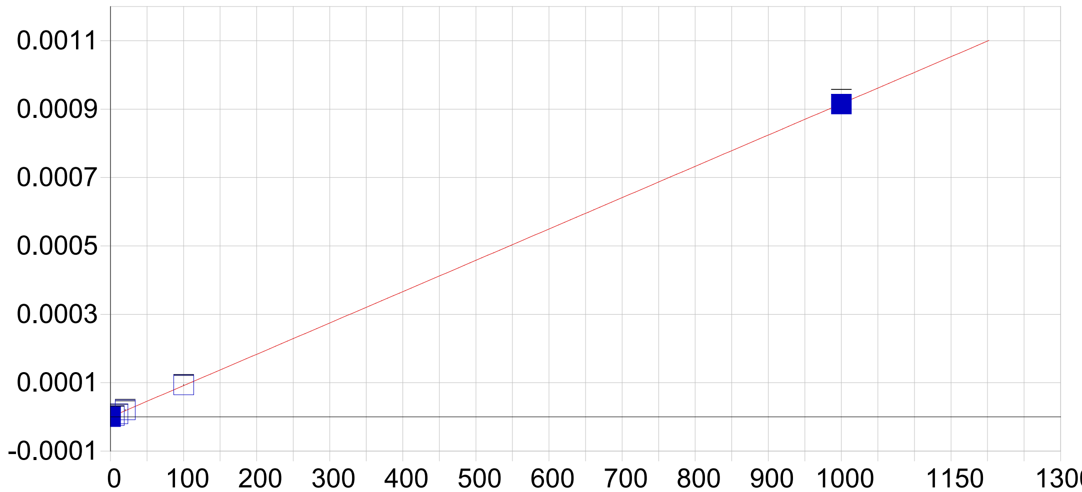



**Sb 206.833 {463}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000000 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999979 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 2.607872 | | |
| Predicted MQL: | 8.692906 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00117 | -.001 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1017.2 | 17.2 | 1.72 | .00049 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.601 | .601 | 6.01 | .00001 | .000 | 1 |
| CalStd7=50 | 50.000 | 52.093 | 2.09 | 4.19 | .00003 | .000 | 1 |
| CalStd10=10 | 10000. | 9980.1 | -19.9 | -.199 | .00476 | .000 | 1 |

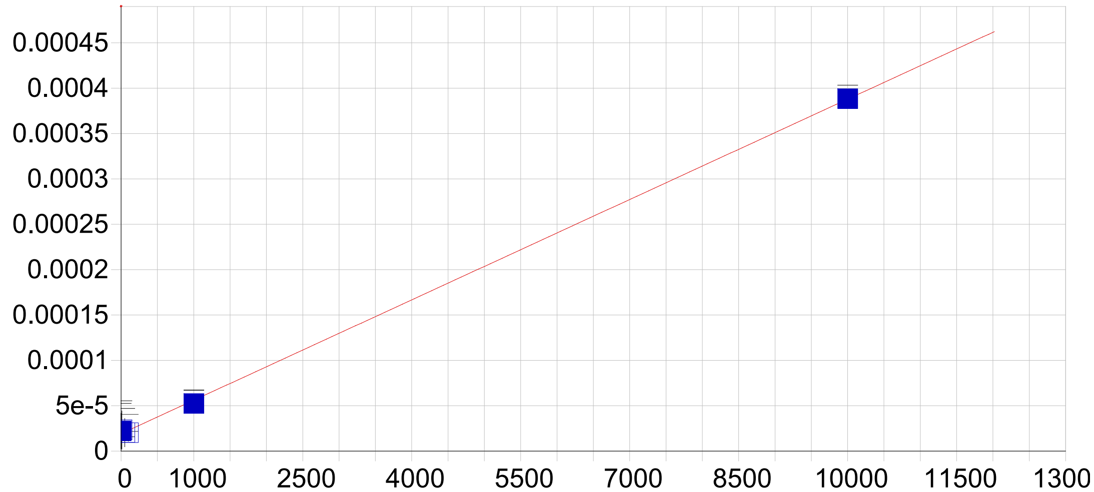



**Sb 217.581 {455}**

| | | | | | |
|---|---|---|---|---|---|
| Date o□ Fit: | 06/22/2015 07:49:37 | Type o□ Fit: | Linear | □ eighting: | 1/Conc |

A0 (O□□set): -0.000000    Re-Slope: 1.000000
A1 (□ ain): 0.000001    Y-int: 0.000000
A2 (Curvature): 0.000000
n (E□ ponent): 1.000000
Correlation: 0.999745    Status: O□ .
Std Error o□ Est: 0.000000
Predicted MDL: 1.840931
Predicted MQL: 6.136436

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00111 | .001 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 998.32 | -1.68 | -.168 | .00091 | .000 | 1 |
| CalStd6=20 | 20.000 | 21.815 | 1.82 | 9.08 | .00002 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.1265 | -.873 | -8.73 | .00001 | .000 | 1 |
| CalStd8=100 | 100.00 | 101.95 | 1.95 | 1.95 | .00009 | .000 | 1 |
| CalStd4=5 | 5.0000 | 3.7835 | -1.22 | -24.3 | .00000 | .000 | 1 |

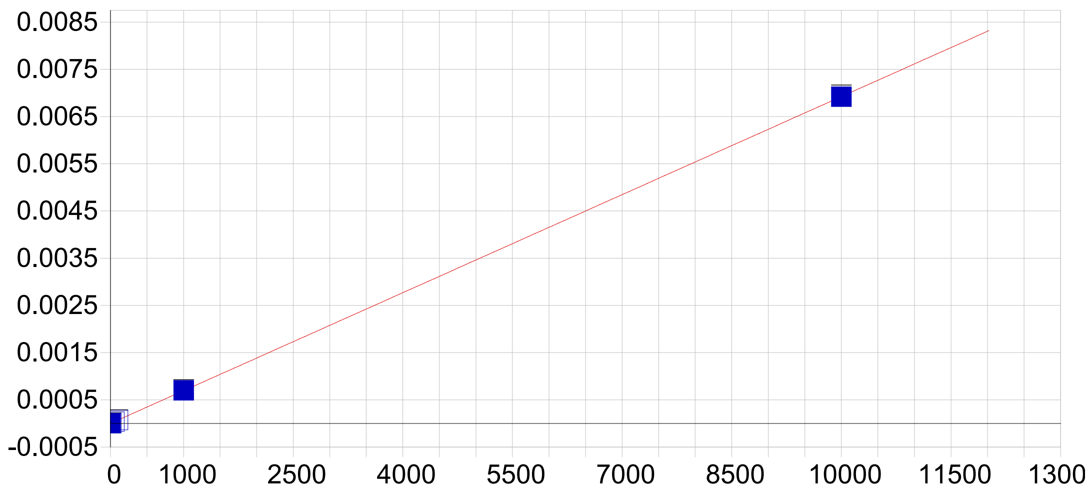



**Se 196.090 {172}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000019 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999796 | Status: | OK . |
| Std Error of Est: | 0.000003 | | |
| Predicted MDL: | 378.430635 | | |
| Predicted MQL: | 1261.435451 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 80.704 | 80.7 | .000 | .00002 | .000 | 1 |
| CalStd7=50 | 50.000 | 31.638 | -18.4 | -36.7 | .00002 | .000 | 1 |
| CalStd9=100 | 1000.0 | 897.41 | -103. | -10.3 | .00005 | .000 | 1 |
| CalStd5=10 | 10.000 | 110.70 | 101. | 1010. | .00002 | .000 | 1 |
| CalStd8=100 | 100.00 | 28.584 | -71.4 | -71.4 | .00002 | .000 | 1 |
| CalStd10=10 | 10000. | 10011. | 11.0 | .110 | .00039 | .000 | 1 |

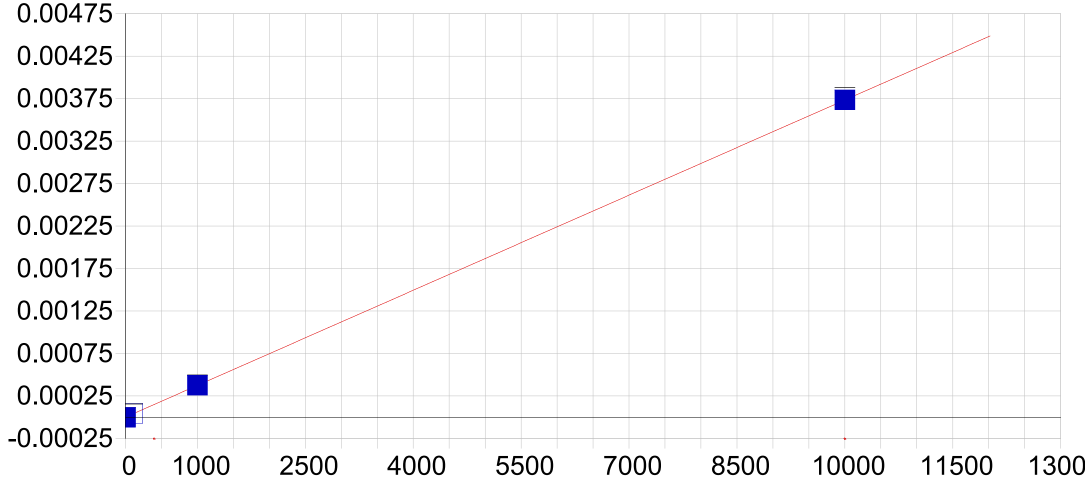



**Se 196.090 {472}**

Date of Fit: 06/22/2015 07:49:37 Type of Fit: Linear Weighting: 1/Var

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000001 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999981 | Status: | OK . |
| Std Error of Est: | 0.000002 | | |
| Predicted MDL: | 7.041208 | | |
| Predicted MQL: | 23.470694 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 3.3152 | 3.32 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 50.072 | .072 | .143 | .00004 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1009.5 | 9.53 | .953 | .00070 | .000 | 1 |
| CalStd5=10 | 10.000 | 5.5699 | -4.43 | -44.3 | .00000 | .000 | 1 |
| CalStd8=100 | 100.00 | 102.20 | 2.20 | 2.20 | .00007 | .000 | 1 |
| CalStd10=10 | 10000. | 9991.4 | -8.65 | -.086 | .00692 | .000 | 1 |

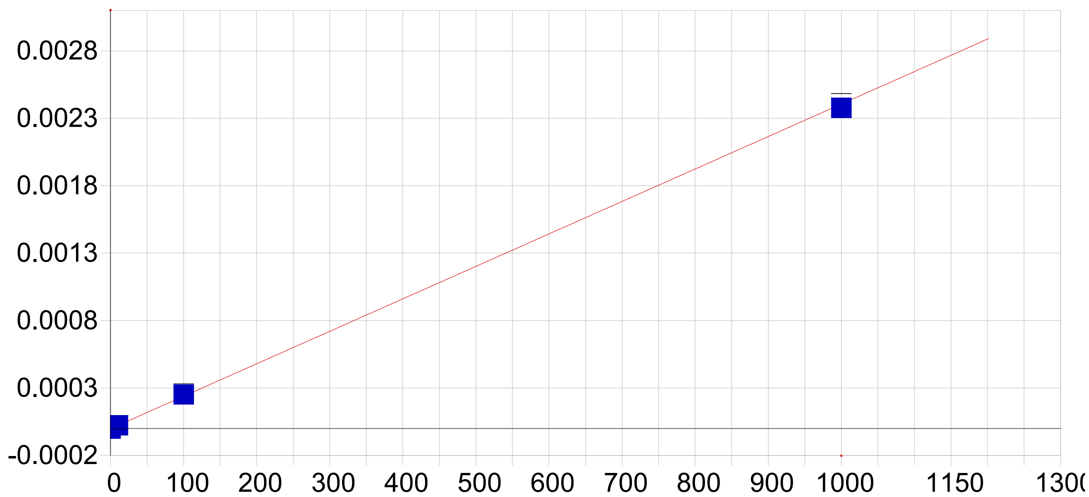



**Se 206.279 {463}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000001 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999999 | Status: | OK . |
| Std Error of Est: | 0.000004 | | |
| Predicted MDL: | 19.503331 | | |
| Predicted MQL: | 65.011102 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -9.7580 | -9.76 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1000.5 | .499 | .050 | .00037 | .000 | 1 |
| CalStd10=10 | 10000. | 9999.9 | -.144 | -.001 | .00374 | .000 | 1 |
| CalStd8=100 | 100.00 | 109.40 | 9.40 | 9.40 | .00004 | .000 | 1 |

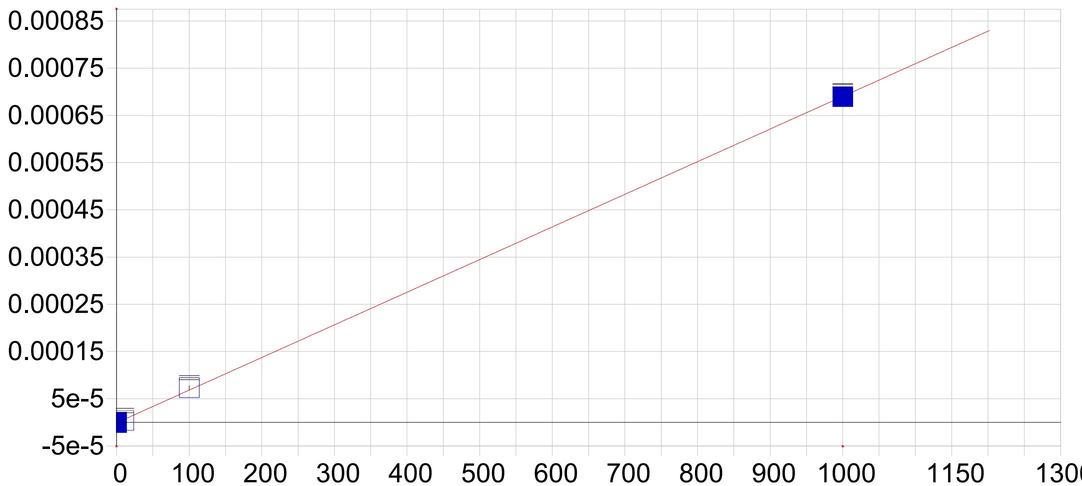



**Tl 190.856 {476}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000002 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000002 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999655 | Status: | O . |
| Std Error o Est: | 0.000004 | | |
| Predicted MDL: | 2.698838 | | |
| Predicted MQL: | 8.996126 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.57407 | -.574 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 987.81 | -12.2 | -1.22 | .00238 | .000 | 1 |
| CalStd8=100 | 100.00 | 105.03 | 5.03 | 5.03 | .00025 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.018 | .018 | .183 | .00002 | .000 | 1 |

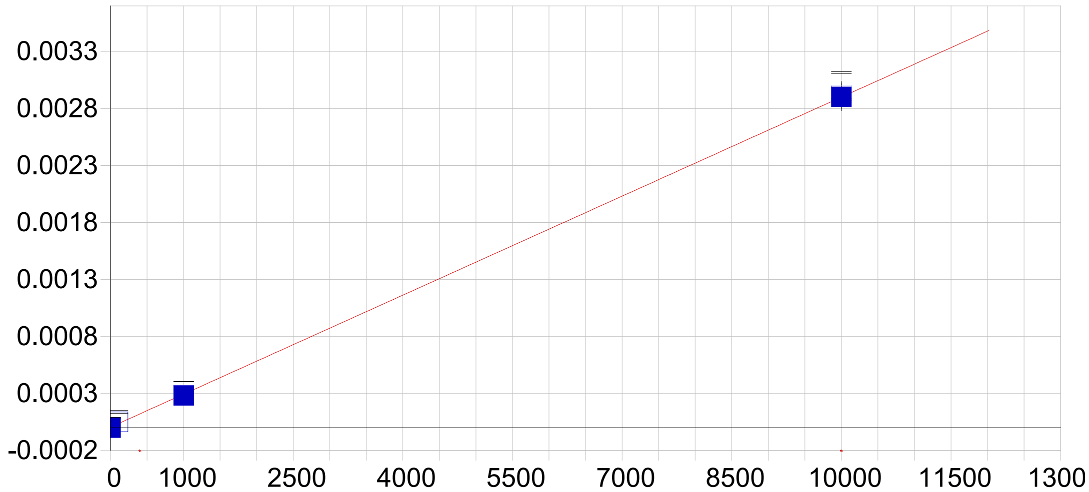



**Tl 190.856 {477}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000001 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999932 | Status: | OK. |
| Std Error of Est: | 0.000002 | | |
| Predicted MDL: | 7.783688 | | |
| Predicted MQL: | 25.945627 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.25520 | -.255 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 998.56 | -1.44 | -.144 | .00069 | .000 | 1 |
| CalStd8=100 | 100.00 | 107.38 | 7.38 | 7.38 | .00007 | .000 | 1 |
| CalStd5=10 | 10.000 | 6.7021 | -3.30 | -33.0 | .00000 | .000 | 1 |

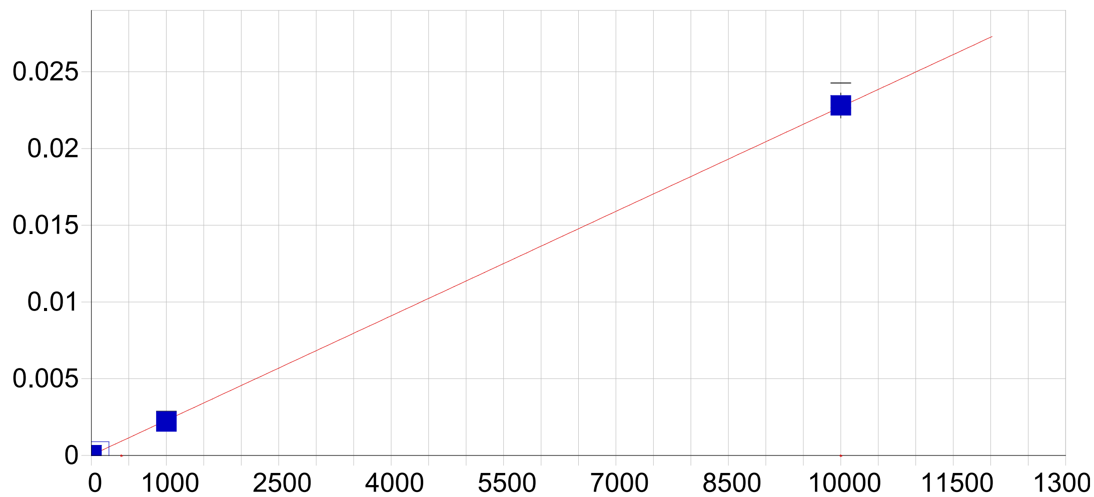



**Tl 276.787 {122}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000004 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999961 | Status: | OK . |
| Std Error of Est: | 0.000015 | | |
| Predicted MDL: | 71.549420 | | |
| Predicted MQL: | 238.498067 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -19.439 | -19.4 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 957.88 | -42.1 | -4.21 | .00028 | .000 | 1 |
| CalStd10=10 | 10000. | 10004. | 3.64 | .036 | .00292 | .000 | 1 |
| CalStd8=100 | 100.00 | 157.93 | 57.9 | 57.9 | .00005 | .000 | 1 |

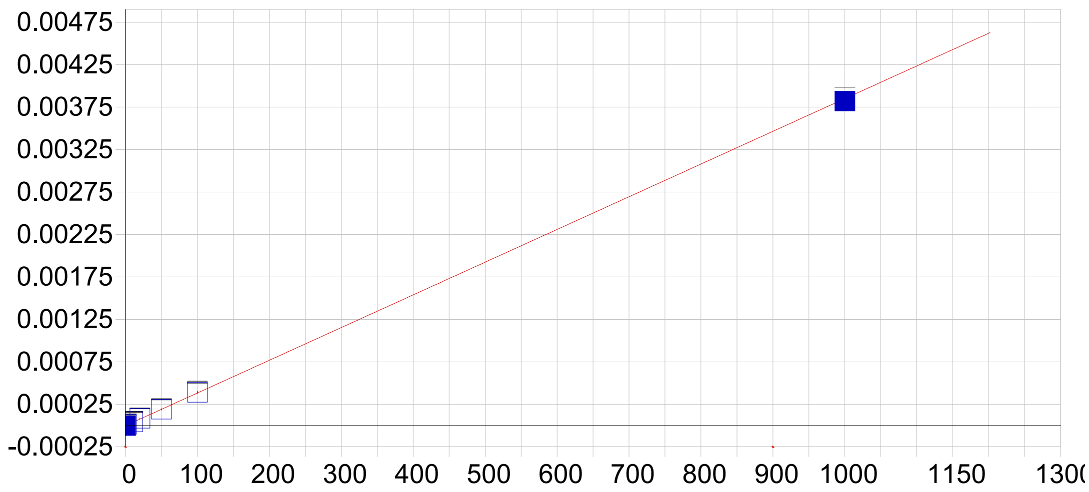



**V 290.882 {116}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000017 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000002 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999931 | Status: | OK . |
| Std Error of Est: | 0.000001 | | |
| Predicted MDL: | 2.569042 | | |
| Predicted MQL: | 8.563474 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00440 | .004 | .000 | .00002 | .000 | 1 |
| CalStd9=100 | 1000.0 | 963.02 | -37.0 | -3.70 | .00220 | .000 | 1 |
| CalStd10=10 | 10000. | 10038. | 38.1 | .381 | .02281 | .001 | 1 |
| CalStd8=100 | 100.00 | 98.919 | -1.08 | -1.08 | .00024 | .000 | 1 |

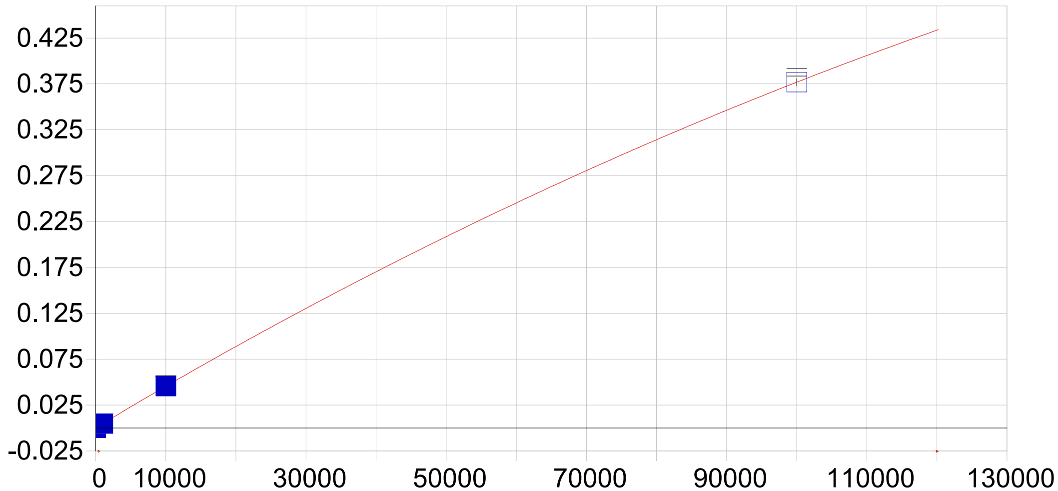



**V 292.402 {115}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000002 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000004 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.997231 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 2.116776 | | |
| Predicted MQL: | 7.055920 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00272 | -.003 | .000 | .00000 | .000 | 1 |
| CalStd7=50 | 50.000 | 49.979 | -.021 | -.041 | .00019 | .000 | 1 |
| CalStd9=100 | 1000.0 | 992.41 | -7.59 | -.759 | .00382 | .000 | 1 |
| CalStd6=20 | 20.000 | 21.971 | 1.97 | 9.86 | .00008 | .000 | 1 |
| CalStd5=10 | 10.000 | 11.565 | 1.56 | 15.6 | .00004 | .000 | 1 |
| CalStd8=100 | 100.00 | 101.62 | 1.62 | 1.62 | .00039 | .000 | 1 |
| CalStd3=1 | 1.0000 | 3.4570 | 2.46 | 246. | .00001 | .000 | 1 |

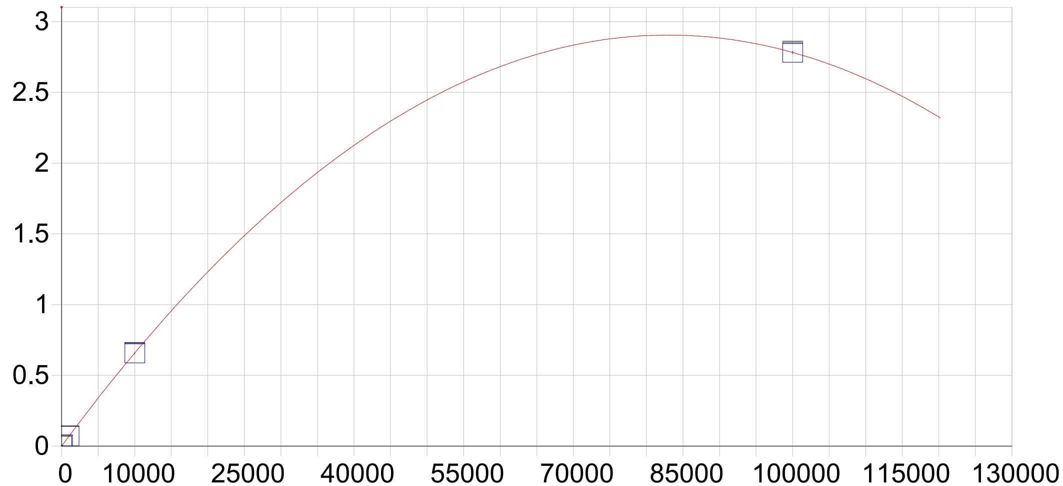



**Zn 206.200 {463}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Full Fit | Weighting: | 1/Conc |

| | | | | |
|---|---|---|---|---|
| A0 (Offset): | 0.000001 | | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000005 | | Y-int: | 0.000000 |
| A2 (Curvature): | -0.000000 | | | |
| n (Exponent): | 0.990000 | | | |
| Correlation: | 1.000000 | Status: | OK. | |
| Std Error of Est: | 0.000000 | | | |
| Predicted MDL: | 0.271475 | | | |
| Predicted MQL: | 0.904917 | | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| CalStd10=10 | 10000. | 10008. | 7.75 | .078 | .04552 | .001 | 1 |
| Blank | .00000 | .00505 | .005 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 993.49 | -6.51 | -.651 | .00470 | .000 | 1 |
| CalStd11-100 | 100000. | 99999. | -1.09 | -.001 | .37683 | .004 | 1 |

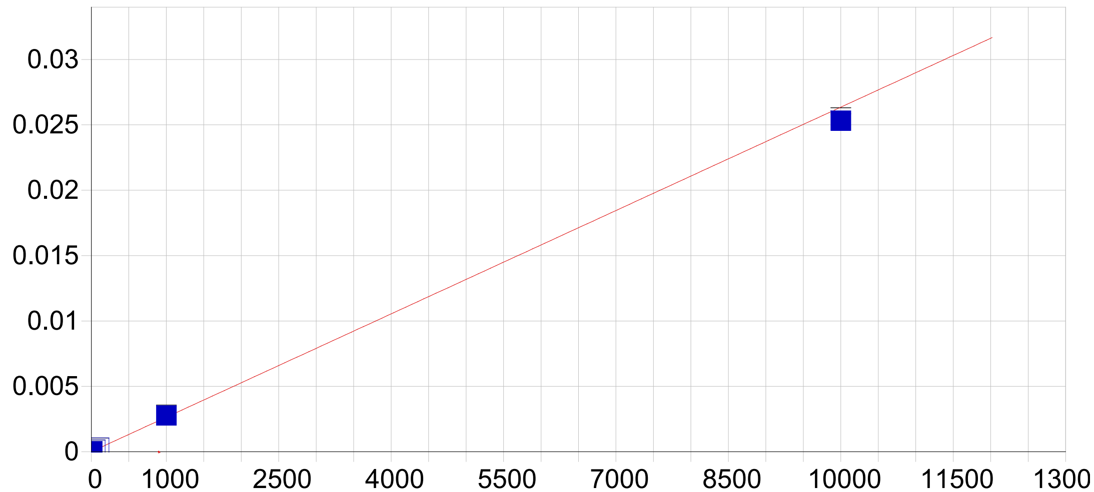



**Zn 213.856 {457}**

Date o▯ Fit: 06/22/2015 07:49:37 Type o▯ Fit: Curvilinear ▯ eighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (O▯▯set): | 0.000052 | Re-Slope: | 1.000000 |
| A1 (▯ ain): | 0.000070 | Y-int: | 0.000000 |
| A2 (Curvature): | -0.000000 | | |
| n (E▯ ponent): | 1.000000 | | |
| Correlation: | 0.999995 | Status: | O▯ . |
| Std Error o▯ Est: | 0.000017 | | |
| Predicted MDL: | 0.117521 | | |
| Predicted MQL: | 0.391735 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| CalStd10=10 | 10000. | 9983.7 | -16.3 | -.163 | .65705 | .004 | 1 |
| Blank | .00000 | -.00451 | -.005 | .000 | .00005 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1009.4 | 9.41 | .941 | .07030 | .001 | 1 |
| CalStd11-100 | 100000. | 65931. | -34100. | -34.1 | 2.7822 | .009 | 1 |
| CalStd8=100 | 100.00 | 103.73 | 3.73 | 3.73 | .00731 | .000 | 1 |




**Zn 213.856 {458}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Var |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000005 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.998929 | Status: | O . |
| Std Error o Est: | 0.000006 | | |
| Predicted MDL: | 0.504760 | | |
| Predicted MQL: | 1.682532 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.73495 | -.735 | .000 | .00000 | .000 | 1 |
| CalStd8=100 | 100.00 | 107.29 | 7.29 | 7.29 | .00029 | .000 | 1 |
| CalStd7=50 | 50.000 | 51.105 | 1.10 | 2.21 | .00014 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.176 | .176 | 1.76 | .00003 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1047.1 | 47.1 | 4.71 | .00276 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.8759 | -.124 | -2.48 | .00002 | .000 | 1 |
| CalStd10=10 | 10000. | 9603.4 | -397. | -3.97 | .02531 | .000 | 1 |


**Y 224.306 {450}***

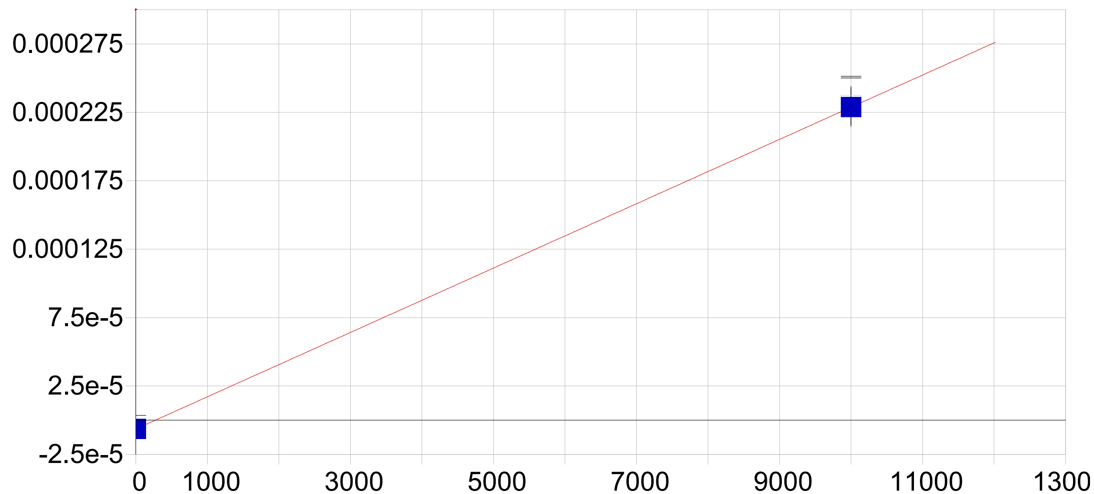
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | | Type of Fit: | Linear | Weighting: | 1/Conc | |
| A0 (Offset): | | 0.000000 | | Re-Slope: | 1.000000 | | |
| A1 (Gain): | | 0.000000 | | Y-int: | 0.000000 | | |
| A2 (Curvature): | | 0.000000 | | | | | |
| n (Exponent): | | 1.000000 | | | | | |
| Correlation: | | 0.000000 | | Status: | Warning | Zero Gain | |
| Std Error of Est: | | 0.000000 | | | | | |
| Predicted MDL: | | n/a | | | | | |
| Predicted MQL: | | n/a | | | | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | 72643. | 181. | 1 |


**Y 371.030 { 91}***

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Conc |
| A0 (Offset): | 0.000000 | Re-Slope: | 1.000000 | | |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 | | |
| A2 (Curvature): | 0.000000 | | | | |
| n (Exponent): | 1.000000 | | | | |
| Correlation: | 0.000000 | Status: | Warning | Zero Gain | |
| Std Error of Est: | 0.000000 | | | | |
| Predicted MDL: | n/a | | | | |
| Predicted MQL: | n/a | | | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | 354870. | 11400. | 1 |

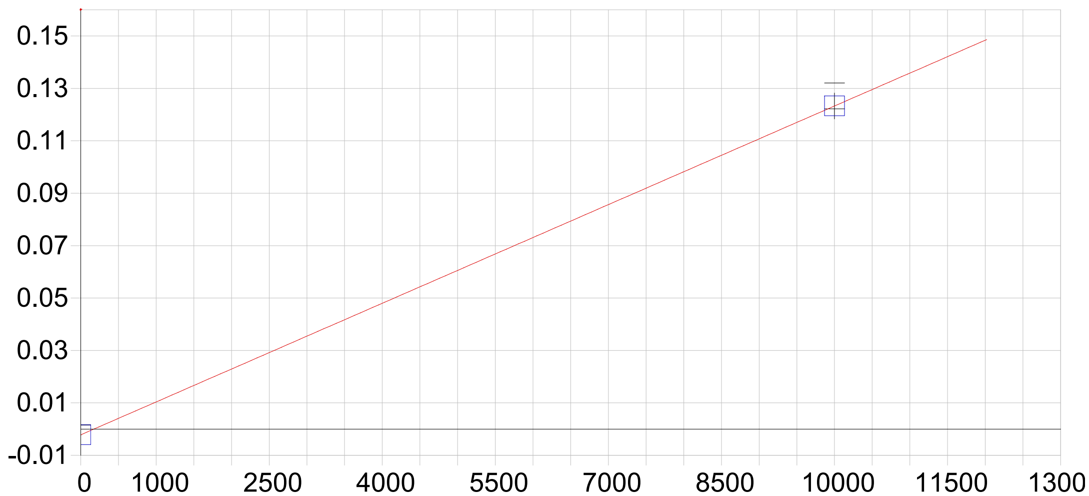



**Na 330.298 {102}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000006 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 449.548403 | | |
| Predicted MQL: | 1498.494675 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | -.00001 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .00023 | .000 | 1 |

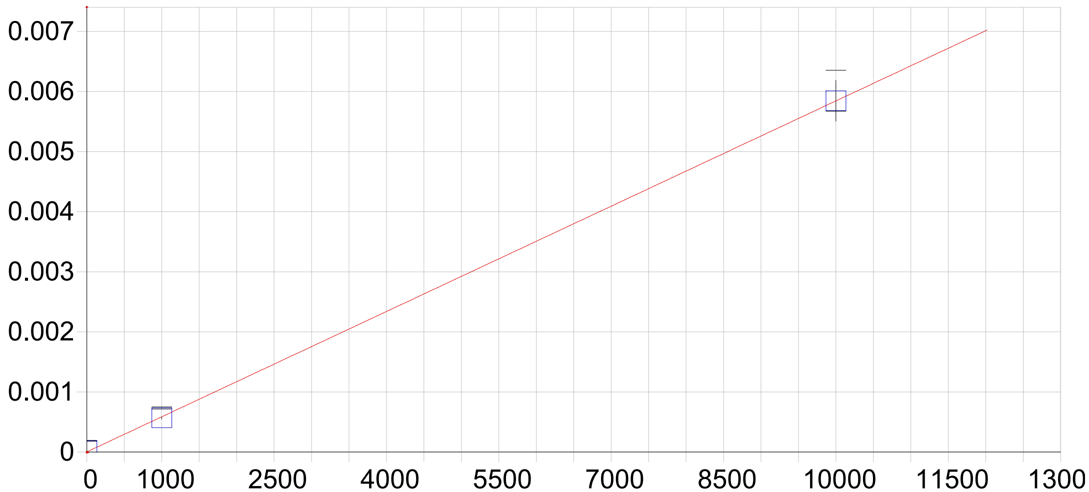



**Na 588.995 { 57}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.002194 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000013 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 3.190485 | | |
| Predicted MQL: | 10.634951 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | -.00219 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .12330 | .005 | 1 |

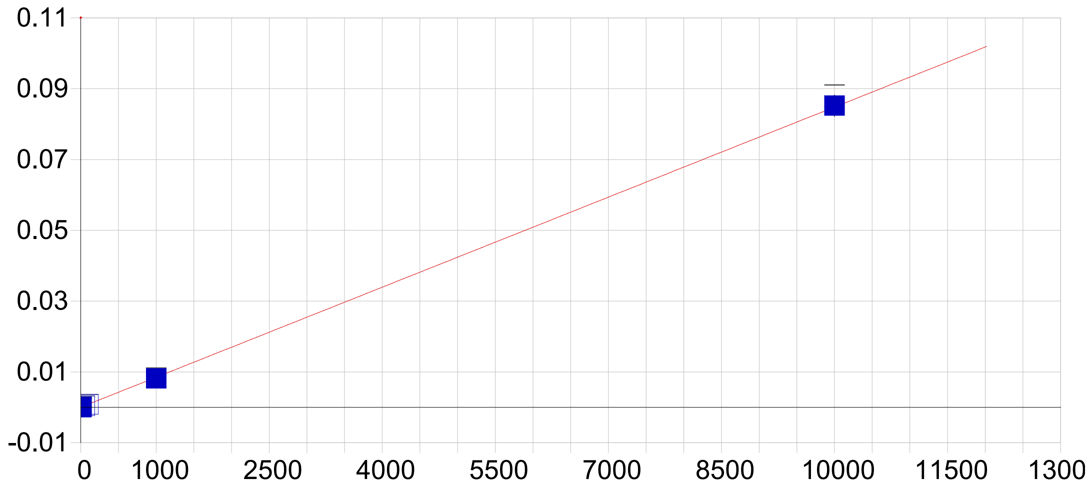



**Si 251.611 {134}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000002 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999982 | Status: | OK . |
| Std Error of Est: | 0.000027 | | |
| Predicted MDL: | 6.656363 | | |
| Predicted MQL: | 22.187877 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 31.130 | 31.1 | .000 | .00002 | .000 | 1 |
| CalStd10=10 | 10000. | 10003. | 3.46 | .035 | .00585 | .000 | 1 |
| CalStd9=100 | 1000.0 | 965.41 | -34.6 | -3.46 | .00057 | .000 | 1 |

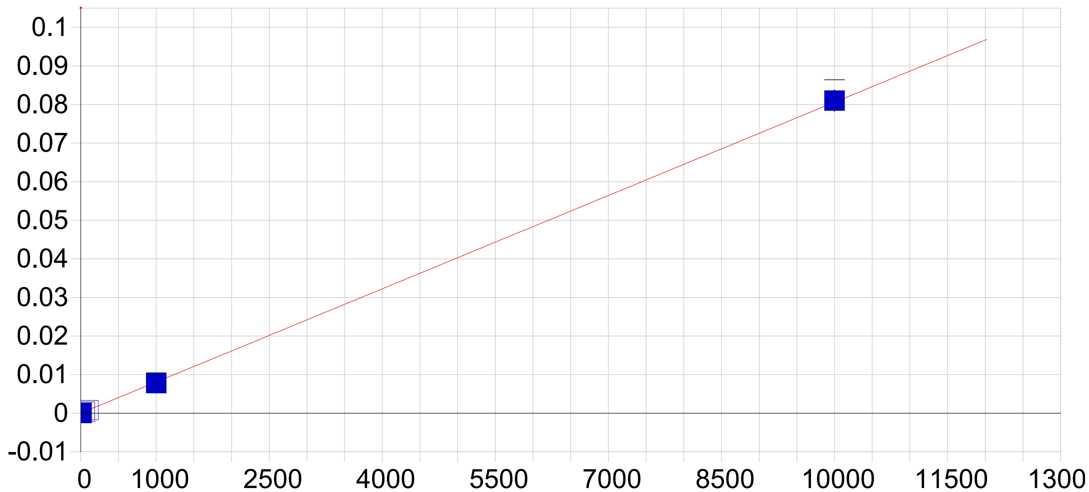



**Ti 334.941 {101}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear |  eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000004 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000008 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999903 | Status: | O . |
| Std Error o Est: | 0.000001 | | |
| Predicted MDL: | 0.796950 | | |
| Predicted MQL: | 2.656500 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00097 | .001 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.126 | .126 | 1.26 | .00009 | .000 | 1 |
| CalStd8=100 | 100.00 | 96.441 | -3.56 | -3.56 | .00082 | .000 | 1 |
| CalStd9=100 | 1000.0 | 959.51 | -40.5 | -4.05 | .00814 | .000 | 1 |
| CalStd10=10 | 10000. | 10047. | 47.0 | .470 | .08521 | .003 | 1 |
| CalStd7=50 | 50.000 | 47.334 | -2.67 | -5.33 | .00041 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.5912 | -.409 | -8.18 | .00004 | .000 | 1 |

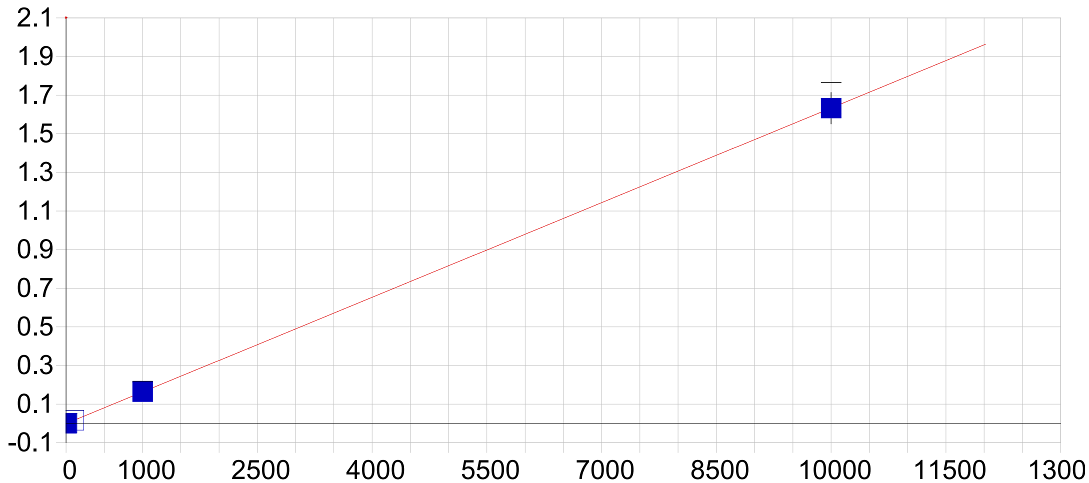



**Ti 337.280 {100}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000004 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000008 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999894 | Status: | OK . |
| Std Error of Est: | 0.000001 | | |
| Predicted MDL: | 1.115439 | | |
| Predicted MQL: | 3.718130 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00149 | .001 | .000 | .00000 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.7658 | -.234 | -2.34 | .00007 | .000 | 1 |
| CalStd8=100 | 100.00 | 95.901 | -4.10 | -4.10 | .00077 | .000 | 1 |
| CalStd9=100 | 1000.0 | 958.69 | -41.3 | -4.13 | .00772 | .000 | 1 |
| CalStd10=10 | 10000. | 10049. | 49.1 | .491 | .08100 | .003 | 1 |
| CalStd7=50 | 50.000 | 47.273 | -2.73 | -5.45 | .00038 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.2892 | -.711 | -14.2 | .00003 | .000 | 1 |

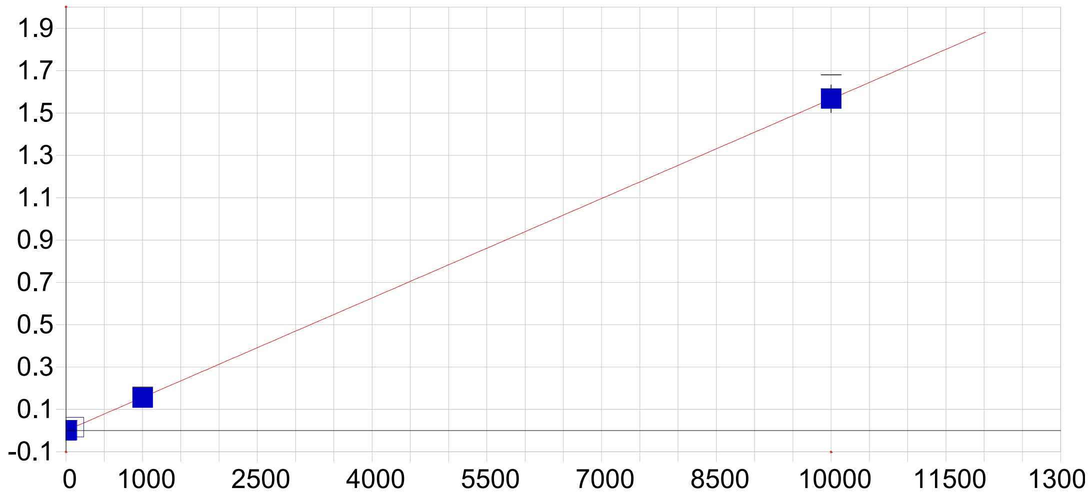



**Sr 407.771 { 83}**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | | Type o Fit: | Linear | eighting: | 1/Conc | |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000906 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000163 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999994 | Status: | O . |
| Std Error o Est: | 0.000002 | | |
| Predicted MDL: | 0.080881 | | |
| Predicted MQL: | 0.269603 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00015 | .000 | .000 | -.00091 | .000 | 1 |
| CalStd3=1 | 1.0000 | 1.0144 | .014 | 1.44 | -.00074 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.1377 | .138 | 2.75 | -.00007 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.852 | .852 | 8.52 | .00087 | .000 | 1 |
| CalStd8=100 | 100.00 | 102.28 | 2.28 | 2.28 | .01581 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1002.6 | 2.56 | .256 | .16295 | .003 | 1 |
| CalStd10=10 | 10000. | 9994.2 | -5.85 | -.058 | 1.6325 | .081 | 1 |

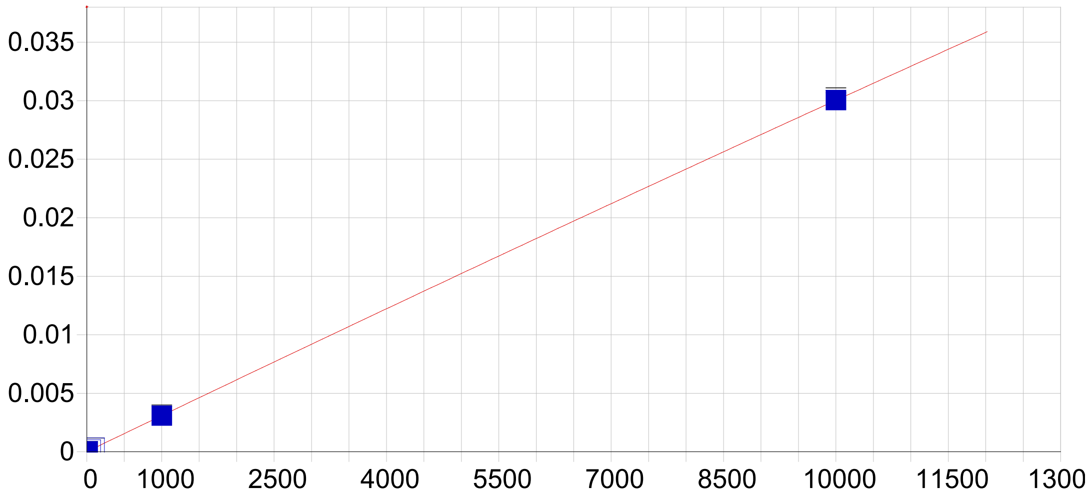



**Sr 421.552 { 80}**

Date of Fit: 06/22/2015 07:49:37 Type of Fit: Linear Weighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000004 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000157 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999991 | Status: | OK . |
| Std Error of Est: | 0.000003 | | |
| Predicted MDL: | 0.076866 | | |
| Predicted MQL: | 0.256222 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00004 | .000 | .000 | .00000 | .000 | 1 |
| CalStd3=1 | 1.0000 | .94608 | -.054 | -5.39 | .00014 | .000 | 1 |
| CalStd4=5 | 5.0000 | 5.1766 | .177 | 3.53 | .00081 | .000 | 1 |
| CalStd5=10 | 10.000 | 10.594 | .594 | 5.94 | .00166 | .000 | 1 |
| CalStd8=100 | 100.00 | 100.57 | .573 | .573 | .01575 | .000 | 1 |
| CalStd9=100 | 1000.0 | 987.72 | -12.3 | -1.23 | .15467 | .003 | 1 |
| CalStd10=10 | 10000. | 10011. | 11.0 | .110 | 1.5677 | .065 | 1 |

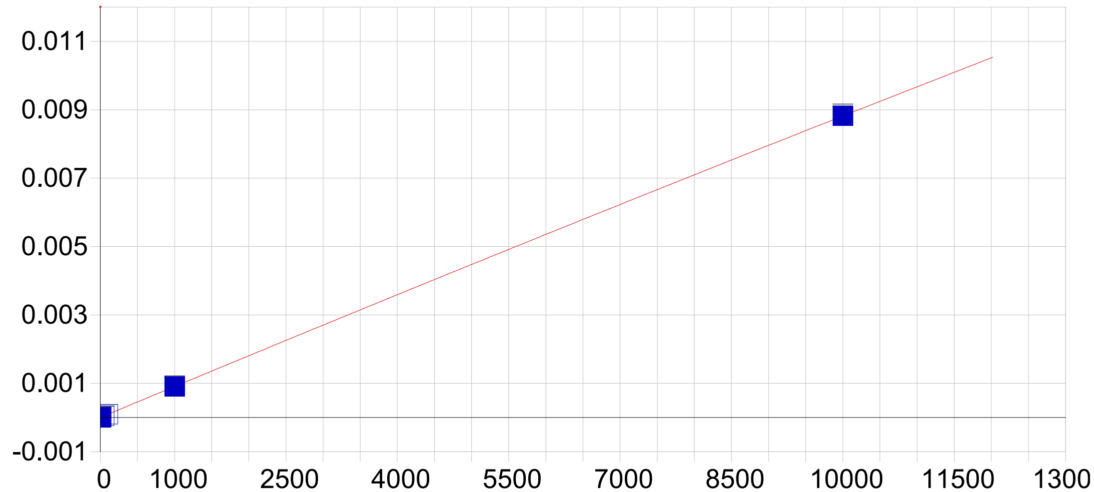



**Sn 189.989 {477}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Curvilinear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000010 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000003 | Y-int: | 0.000000 |
| A2 (Curvature): | -0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999975 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 1.277374 | | |
| Predicted MQL: | 4.257915 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00130 | .001 | .000 | .00001 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .200 | .002 | .03004 | .000 | 1 |
| CalStd9=100 | 1000.0 | 997.81 | -2.19 | -.219 | .00308 | .000 | 1 |
| CalStd8=100 | 100.00 | 102.34 | 2.34 | 2.34 | .00033 | .000 | 1 |
| CalStd5=10 | 10.000 | 9.8935 | -.107 | -1.07 | .00004 | .000 | 1 |
| CalStd7=50 | 50.000 | 51.229 | 1.23 | 2.46 | .00017 | .000 | 1 |
| CalStd4=5 | 5.0000 | 3.5265 | -1.47 | -29.5 | .00002 | .000 | 1 |

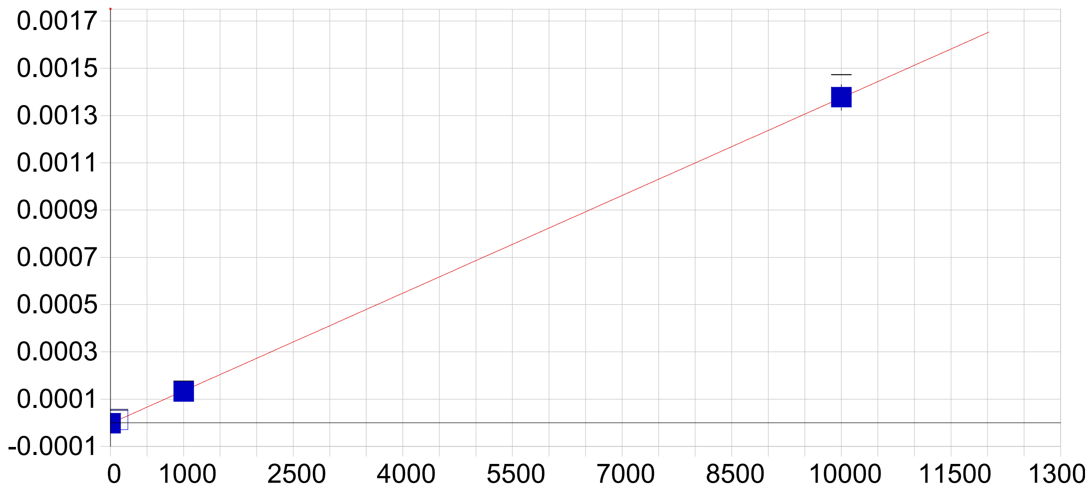



**Sn 189.989 {478}**

Date o Fit: 06/22/2015 07:49:37 Type o Fit: Curvilinear  eighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000002 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | -0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999985 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 4.138420 | | |
| Predicted MQL: | 13.794732 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00037 | .000 | .000 | .00000 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .375 | .004 | .00882 | .000 | 1 |
| CalStd9=100 | 1000.0 | 996.13 | -3.87 | -.387 | .00090 | .000 | 1 |
| CalStd8=100 | 100.00 | 103.36 | 3.36 | 3.36 | .00010 | .000 | 1 |
| CalStd5=10 | 10.000 | 11.227 | 1.23 | 12.3 | .00001 | .000 | 1 |
| CalStd7=50 | 50.000 | 49.225 | -.775 | -1.55 | .00005 | .000 | 1 |
| CalStd4=5 | 5.0000 | 4.6808 | -.319 | -6.38 | .00001 | .000 | 1 |

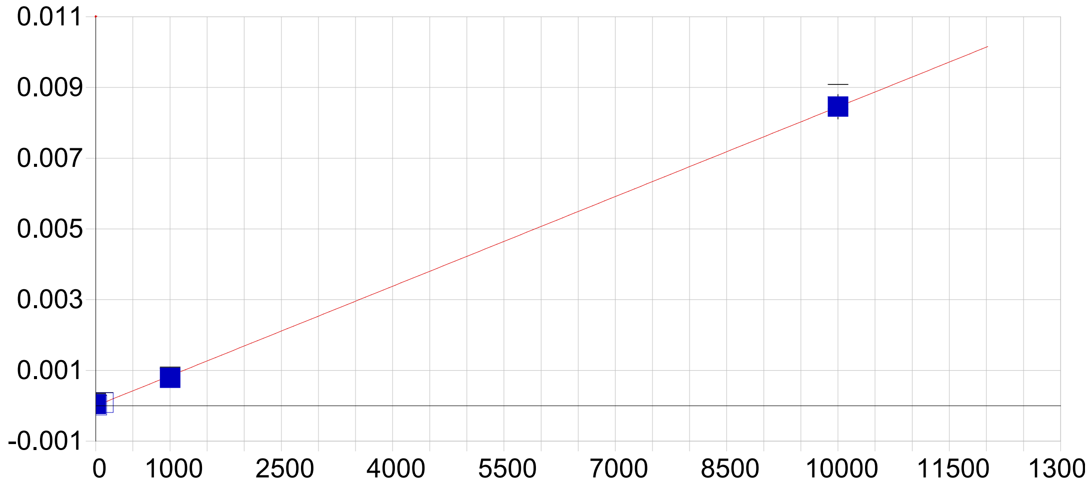



**Sn 283.999 {119}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.000003 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.999931 | Status: | OK. |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 29.754030 | | |
| Predicted MQL: | 99.180102 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | -.00663 | -.007 | .000 | .00000 | .000 | 1 |
| CalStd10=10 | 10000. | 10017. | 16.8 | .168 | .00138 | .000 | 1 |
| CalStd9=100 | 1000.0 | 974.10 | -25.9 | -2.59 | .00013 | .000 | 1 |
| CalStd8=100 | 100.00 | 109.05 | 9.05 | 9.05 | .00001 | .000 | 1 |

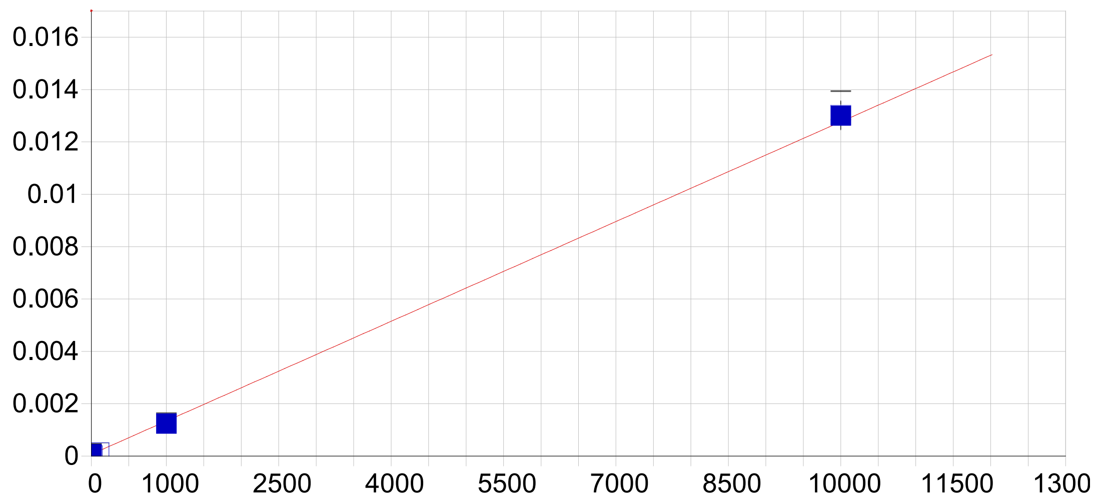



**B 249.678 {135}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | None |

| | | | |
|---|---|---|---|
| A0 (O set): | -0.000000 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999952 | Status: | O . |
| Std Error o Est: | 0.000042 | | |
| Predicted MDL: | 4.669306 | | |
| Predicted MQL: | 15.564355 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 51.865 | 51.9 | .000 | .00004 | .000 | 1 |
| CalStd8=100 | 100.00 | 101.11 | 1.11 | 1.11 | .00009 | .000 | 1 |
| CalStd5=10 | 10.000 | 17.945 | 7.94 | 79.4 | .00001 | .000 | 1 |
| CalStd9=100 | 1000.0 | 932.33 | -67.7 | -6.77 | .00079 | .000 | 1 |
| CalStd10=10 | 10000. | 10007. | 6.75 | .067 | .00845 | .000 | 1 |

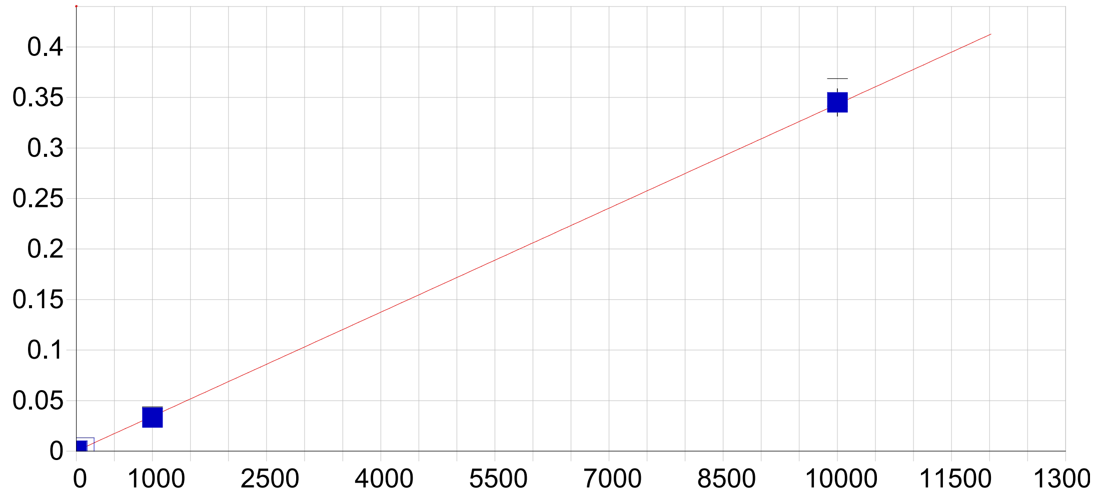



**B 249.773 {135}**

Date o Fit: 06/22/2015 07:49:37 Type o Fit: Linear  eighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000067 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.987071 | Status: | O . |
| Std Error o Est: | 0.000003 | | |
| Predicted MDL: | 3.171921 | | |
| Predicted MQL: | 10.573071 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .05654 | .057 | .000 | .00007 | .000 | 1 |
| CalStd8=100 | 100.00 | 48.150 | -51.9 | -51.9 | .00013 | .000 | 1 |
| CalStd5=10 | 10.000 | -40.741 | -50.7 | -507. | .00002 | .000 | 1 |
| CalStd9=100 | 1000.0 | 920.44 | -79.6 | -7.96 | .00124 | .000 | 1 |
| CalStd10=10 | 10000. | 10182. | 182. | 1.82 | .01303 | .001 | 1 |

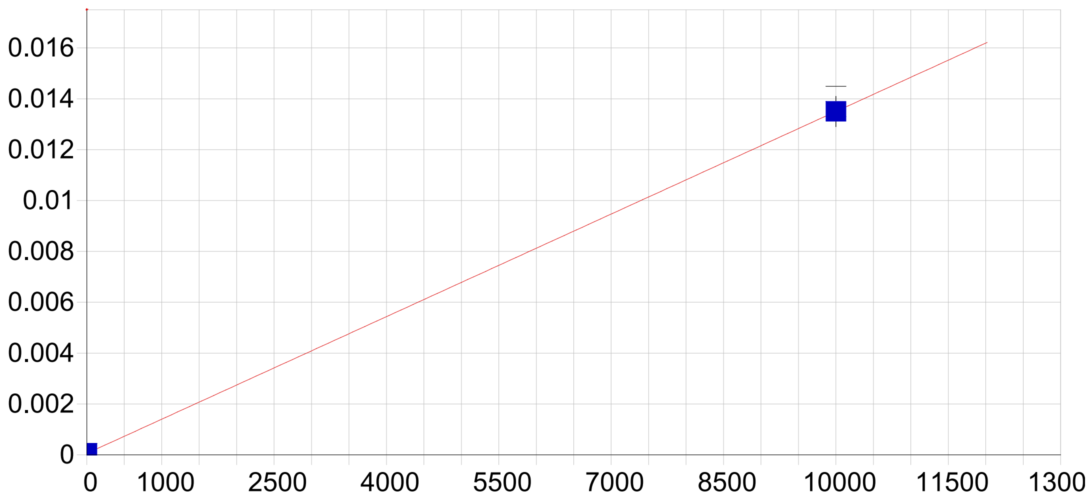



**Li 670.784 { 50}**

Date o Fit: 06/22/2015 07:49:37 Type o Fit: Linear  eighting: 1/Conc

| | | | |
|---|---|---|---|
| A0 (Oset): | 0.000198 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000034 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.999885 | Status: | O . |
| Std Error o Est: | 0.000007 | | |
| Predicted MDL: | 0.828614 | | |
| Predicted MQL: | 2.762048 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00267 | .003 | .000 | .00020 | .000 | 1 |
| CalStd5=10 | 10.000 | 8.2331 | -1.77 | -17.7 | .00048 | .000 | 1 |
| CalStd8=100 | 100.00 | 94.573 | -5.43 | -5.43 | .00344 | .000 | 1 |
| CalStd9=100 | 1000.0 | 958.66 | -41.3 | -4.13 | .03310 | .001 | 1 |
| CalStd10=10 | 10000. | 10049. | 48.5 | .485 | .34506 | .014 | 1 |

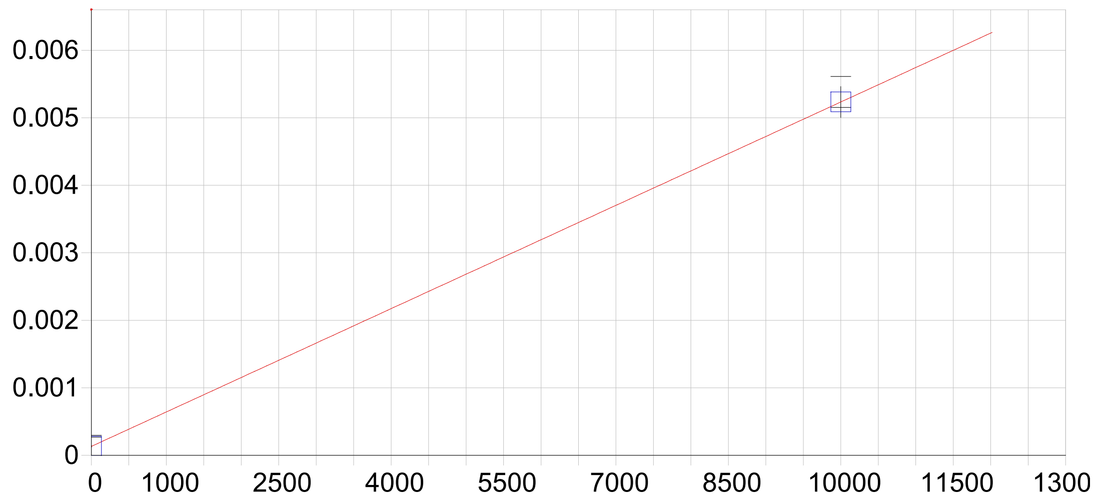



**K 766.490 { 44}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000056 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | OK. |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 16.973591 | | |
| Predicted MQL: | 56.578638 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00006 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .01350 | .001 | 1 |

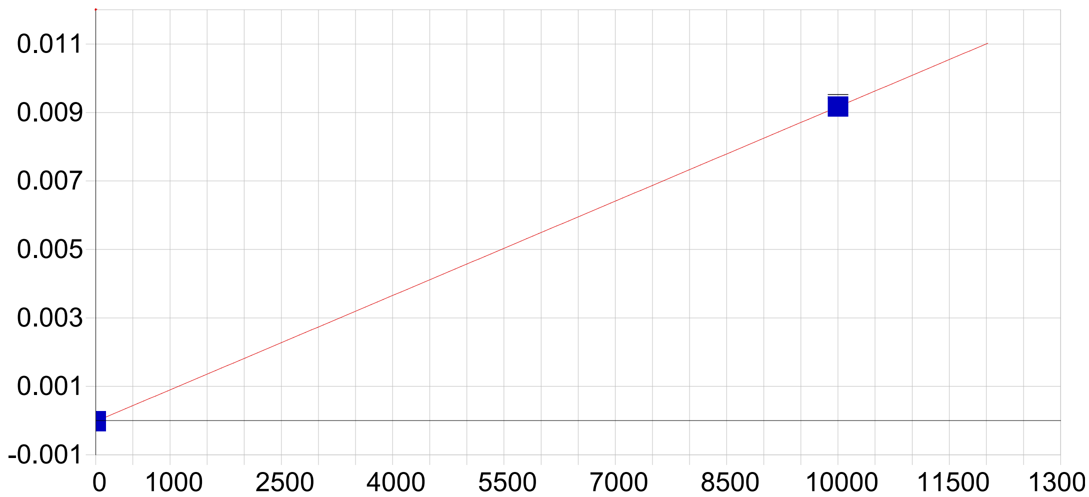



**K 769.896 { 44}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O set): | 0.000132 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 39.855994 | | |
| Predicted MQL: | 132.853314 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00013 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .00523 | .000 | 1 |

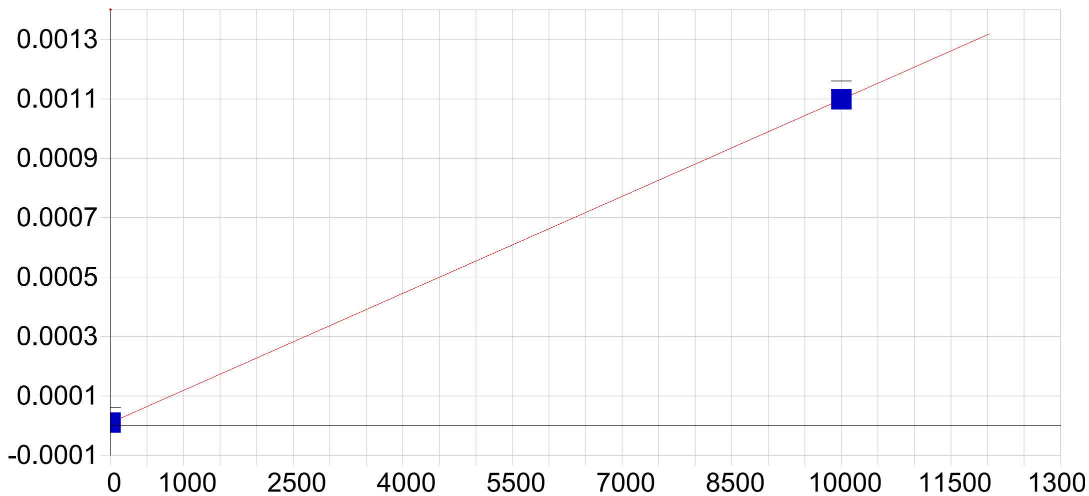



**P 177.495 {489}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000022 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 4.156371 | | |
| Predicted MQL: | 13.854571 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | -.00002 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .00917 | .000 | 1 |

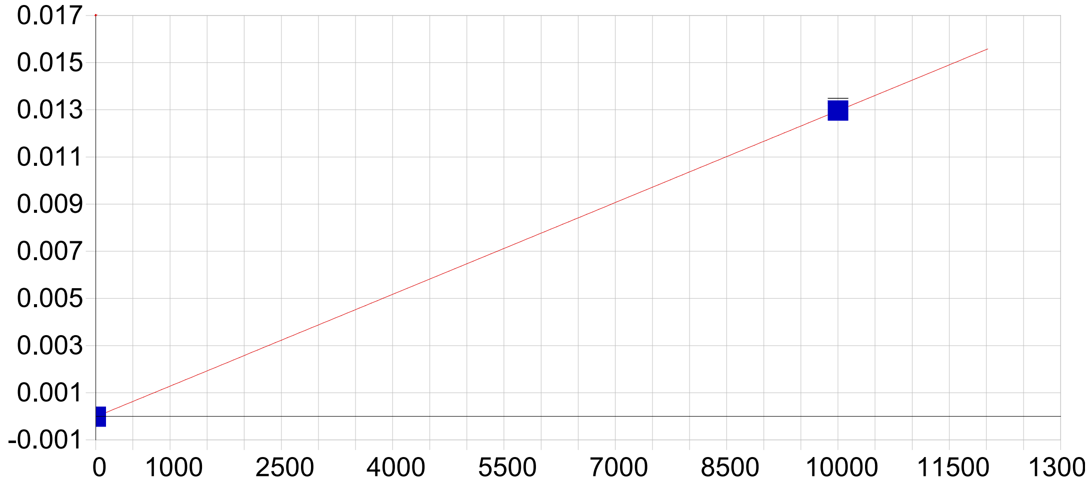



**P 213.618 {158}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Offset): | 0.000010 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | OK . |
| Std Error of Est: | 0.000000 | | |
| Predicted MDL: | 105.730240 | | |
| Predicted MQL: | 352.434133 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00001 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .00110 | .000 | 1 |

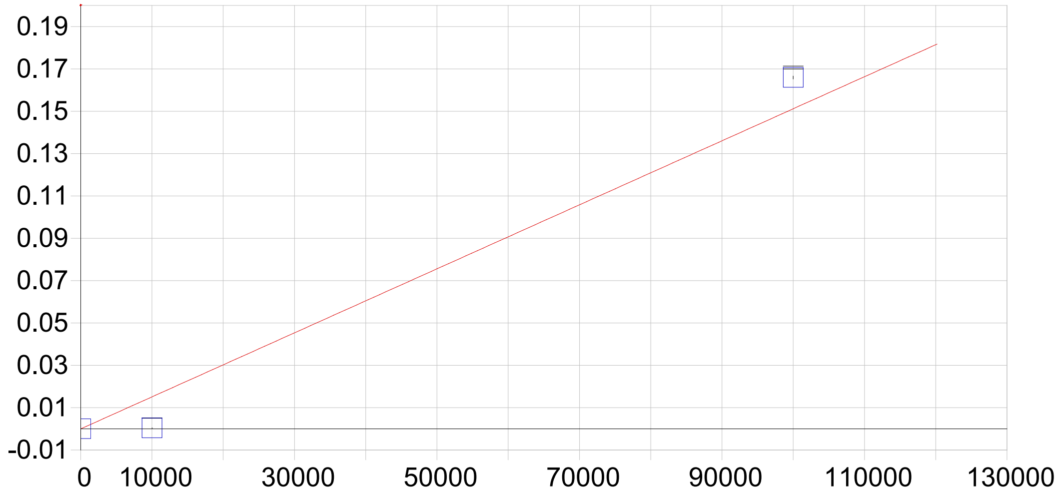



**P 213.618 {457}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000019 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 5.316896 | | |
| Predicted MQL: | 17.722988 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | -.00002 | .000 | 1 |
| CalStd10=10 | 10000. | 10000. | .000 | .000 | .01296 | .000 | 1 |

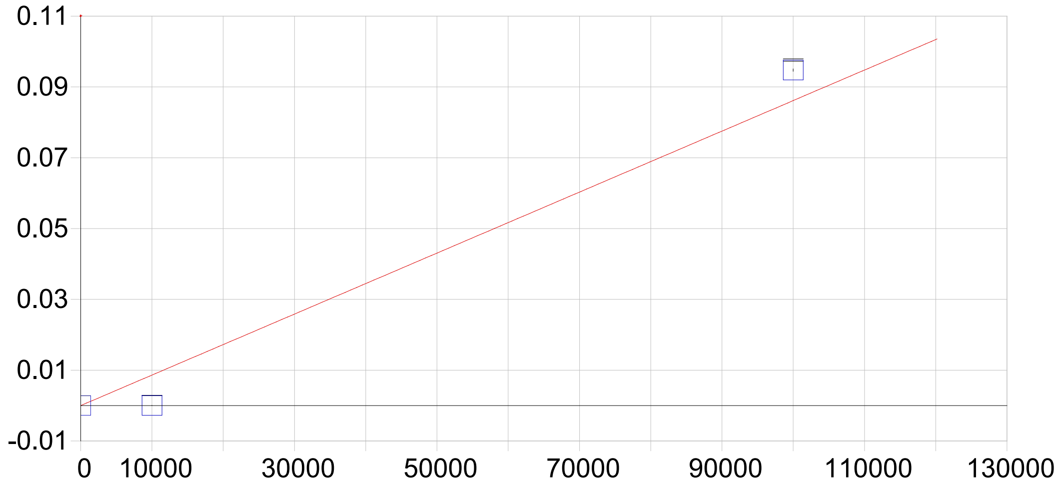



**S 180.731 {486}**

Date of Fit: 06/22/2015 07:49:37 Type of Fit: Linear Weighting: 1/Conc

A0 (Offset): -0.000014 Re-Slope: 1.000000
A1 (Gain): 0.000002 Y-int: 0.000000
A2 (Curvature): 0.000000
n (Exponent): 1.000000
Correlation: 0.955530 Status: OK.
Std Error of Est: 0.000847
Predicted MDL: 3.164688
Predicted MQL: 10.548959

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 8.7786 | 8.78 | .000 | .00000 | .000 | 1 |
| CalStd12-100 | 100000. | 109750. | 9750. | 9.75 | .16594 | .001 | 1 |
| CalStd10=10 | 10000. | 246.02 | -9750. | -97.5 | .00036 | .000 | 1 |

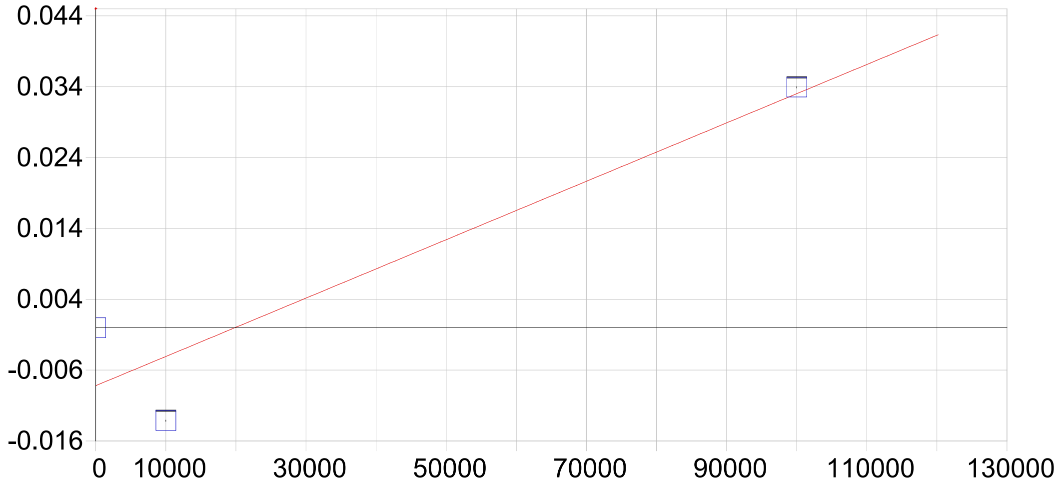



**S 182.034 {485}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000000 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000001 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 0.953553 | Status: | O . |
| Std Error o Est: | 0.000494 | | |
| Predicted MDL: | 5.282500 | | |
| Predicted MQL: | 17.608334 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 8.9857 | 8.99 | .000 | .00001 | .000 | 1 |
| CalStd12-100 | 100000. | 109980. | 9980. | 9.98 | .09476 | .000 | 1 |
| CalStd10=10 | 10000. | 15.896 | -9980. | -99.8 | .00001 | .000 | 1 |

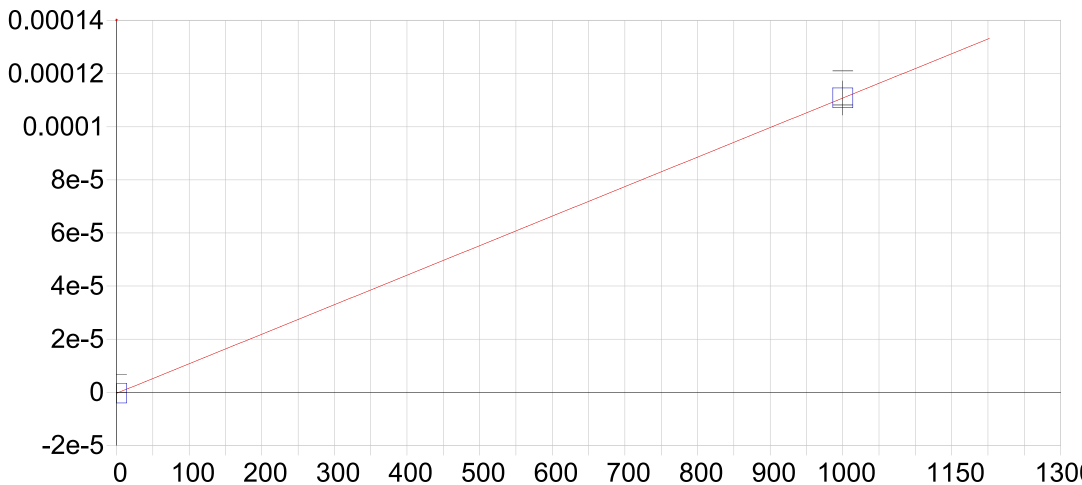



**S 182.624 {484}**

| | | | | | |
|---|---|---|---|---|---|
| Date of Fit: | 06/22/2015 07:49:37 | Type of Fit: | Linear | Weighting: | None |

| | | | |
|---|---|---|---|
| A0 (Offset): | -0.008196 | Re-Slope: | 1.000000 |
| A1 (Gain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (Exponent): | 1.000000 | | |
| Correlation: | 0.934386 | Status: | OK . |
| Std Error of Est: | 0.012240 | | |
| Predicted MDL: | 12.088742 | | |
| Predicted MQL: | 40.295806 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | 19812. | 19800. | .000 | -.00003 | .000 | 1 |
| CalStd12-100 | 100000. | 102200. | 2200. | 2.20 | .03393 | .000 | 1 |
| CalStd10=10 | 10000. | -12013. | -22000. | -220. | -.01315 | .000 | 1 |

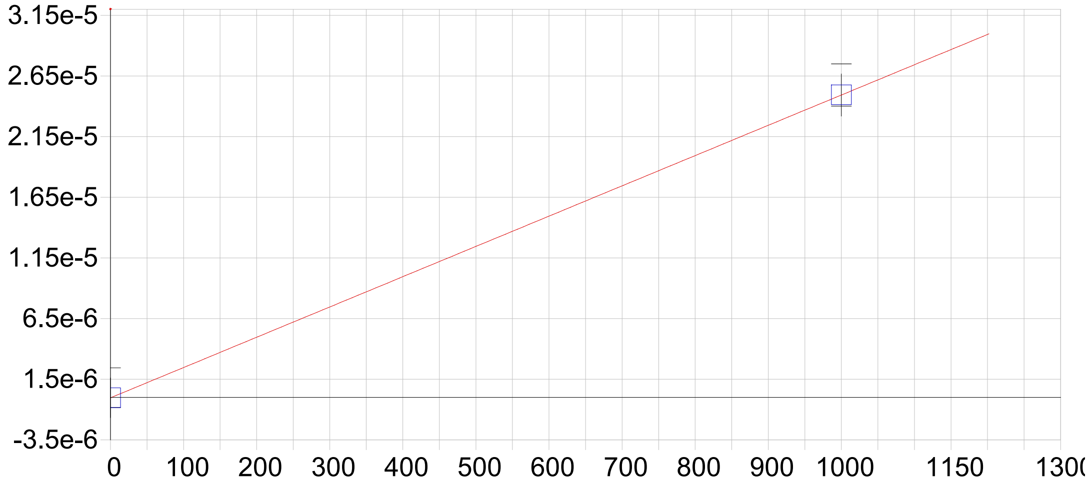



**W 239.709 {140}**

| | | | | | |
|---|---|---|---|---|---|
| Date o▯ Fit: | 06/22/2015 07:49:37 | Type o▯ Fit: | Linear | ▯ eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (O▯▯set): | -0.000000 | Re-Slope: | 1.000000 |
| A1 (▯ ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E▯ ponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | O▯ . |
| Std Error o▯ Est: | 0.000000 | | |
| Predicted MDL: | 28.181532 | | |
| Predicted MQL: | 93.938439 | | |

| **Std. Name** | **Stated Conc.** | **Found Conc.** | **Difference** | **% Diff.** | **(S)IR** | **Std Dev** | **Emphasis** |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1000.0 | .000 | .000 | .00011 | .000 | 1 |




**W 245.148 {137}**

| | | | | | |
|---|---|---|---|---|---|
| Date o Fit: | 06/22/2015 07:49:37 | Type o Fit: | Linear | eighting: | 1/Conc |

| | | | |
|---|---|---|---|
| A0 (Oset): | -0.000000 | Re-Slope: | 1.000000 |
| A1 ( ain): | 0.000000 | Y-int: | 0.000000 |
| A2 (Curvature): | 0.000000 | | |
| n (E ponent): | 1.000000 | | |
| Correlation: | 1.000000 | Status: | O . |
| Std Error o Est: | 0.000000 | | |
| Predicted MDL: | 134.795241 | | |
| Predicted MQL: | 449.317468 | | |

| Std. Name | Stated Conc. | Found Conc. | Difference | % Diff. | (S)IR | Std Dev | Emphasis |
|---|---|---|---|---|---|---|---|
| Blank | .00000 | .00000 | .000 | .000 | .00000 | .000 | 1 |
| CalStd9=100 | 1000.0 | 1000.0 | .000 | .000 | .00002 | .000 | 1 |

Sample Name: Blank Acquired: 06/19/2015 14:19:36 Type: Cal
Method: DOD Calibration Updated 060614(v652) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al3961 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Be2348 | Ca3158 | Ca3933 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.001** | **.000** | **.000** | **.000** | **.000** | **.000** | **-.006** | **.000** | **.000** | **.000** | **.035** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .00 | .000 | .000 | .000 | .000 | .000 | .011 |
| %RSD | 33.1 | 3.75 | 365. | 97.5 | 68500. | 204. | 64.1 | 1.77 | 1420. | 169. | 10.9 | 30.8 |

| Elem | Cd2265 | Cd2288 | Co2286 | Co2388 | Cr2677 | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Fe2599 | Mg2025 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.002** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .00 | .000 | .00 | .000 | .00 | .000 | .000 | .000 | .000 | .00 |
| %RSD | 1280. | 13.4 | 36.1 | 136. | 253. | 11.0 | 24.9 | 3.97 | 70.9 | 125. | 38.3 | 16.0 |

| Elem | Mg2802 | Mn2576 | Mn2593 | Mo2020 | Mo2045 | Ni2316 | Pb2169 | Pb2203 | Sb2068 | Sb2175 | Se1960 | Se2062 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .00 | .000 | .00 |
| %RSD | 22.1 | 476. | 68.6 | 15.0 | 13.6 | 27.3 | 24.7 | 322. | 597. | 1110. | 152. | 183. |

| Elem | Tl1908 | Tl2767 | V_2908 | V_2924 | Zn2062 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .00 | .00 | .000 | .00 | .000 | .000 | .000 |
| %RSD | 71.4 | 442. | 6.96 | 624. | 261. | 39.6 | 43.8 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **72643.** | **354870.** |
| Stddev | 181. | 11379. |
| %RSD | .24948 | 3.2064 |

Sample Name: CalStd1=0.25 Acquired: 06/19/2015 14:24:14 Type: Cal
Method: DOD Calibration Updated 060614(v652) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Be3130 |
|---|---|
| Units | Cts/S |
| Avg | **.000** |
| Stddev | .000 |
| %RSD | 27.0 |

| Int. Std. | Y_2243 |
|---|---|
| Units | Cts/S |
| Avg | **72442.** |
| Stddev | 142. |
| %RSD | .19561 |

Sample Name: CalStd2=0.5 Acquired: 06/19/2015 14:28:53 Type: Cal
Method: DOD Calibration Updated 060614(v652) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ba4554 | Be3130 | Cd2265 | Cd2288 |
|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 |
| %RSD | 30.4 | 12.4 | 13.3 | 5.48 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **72842.** | **353050.** |
| Stddev | 332. | 12083. |
| %RSD | .45546 | 3.4225 |

Sample Name: CalStd3=1 Acquired: 06/19/2015 14:33:33 Type: Cal
Method: DOD Calibration Updated 060614(v652) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Ba4554 | Be3130 | Cd2265 | Cd2288 | Co2286 | Cr2677 | Cu2247 | Ni2316 | V_2924 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .00 | .000 | .000 |
| %RSD | 56.5 | 6.92 | 9.35 | 6.76 | 3.96 | 13.8 | 356. | 18.9 | 17.5 | 56.6 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **72590.** | **355800.** |
| Stddev | 271. | 12016. |
| %RSD | .37282 | 3.3770 |

Sample Name: CalStd4=5 Acquired: 06/19/2015 14:38:11 Type: Cal
Method: DOD Calibration Updated 060614(v652) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Mn2576 | Ni2316 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.001** | **-.003** | **.001** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 12.8 | 126. | 429. | 2.14 | 3.18 | 2.72 | 1.06 | 1.82 | 19.8 | 64.0 | 5.95 | 3.58 |

| Elem | Pb2169 | Pb2203 | Sb2175 | Zn2138 |
|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 |
| %RSD | 17.6 | 41.4 | 53.6 | 7.69 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **72807.** | **352330.** |
| Stddev | 213. | 9522. |
| %RSD | .29296 | 2.7026 |

Sample Name: CalStd5=10 Acquired: 06/19/2015 14:42:50 Type: Cal
Method: DOD Calibration Updated 060614(v652) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Cd2265 | Cd2288 | Co2286 | Cr2677 | Cu2247 | Mn2576 | Mo2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.001** | **.003** | **.001** | **.001** | **.001** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 16.3 | 4.80 | 28.6 | 2.58 | 2.95 | 2.60 | 1.28 | 2.67 | 11.9 | 18.5 | 10.7 | 4.58 |

| Elem | Ni2316 | Pb2169 | Pb2203 | Sb2068 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 1.86 | 24.3 | 11.0 | 23.0 | 11.4 | 82.2 | 9.05 | 14.6 | 4.16 | 34.4 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **72453.** | **354380.** |
| Stddev | 387. | 11757. |
| %RSD | .53406 | 3.3177 |

Sample Name: CalStd6=20 Acquired: 06/19/2015 14:47:31 Type: Cal
Method: DOD Calibration Updated 060614(v652) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ba4554 | Cr2677 | Cu2247 | Fe2599 | Mn2576 | Mo2020 | Sb2175 | V_2924 |
|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.002** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 2.16 | 3.85 | 3.33 | 8.59 | 5.36 | 4.32 | 13.4 | 4.92 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **73117.** | **356020.** |
| Stddev | 278. | 10123. |
| %RSD | .38053 | 2.8434 |

Sample Name: CalStd7=50 Acquired: 06/19/2015 14:52:04 Type: Cal
Method: DOD Calibration Updated 060614(v652) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Al1670 | As1937 | Ba4554 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cr2835 | Cu2247 | Fe2599 | Mg2802 | Mn2576 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.006** | **.086** | **.003** | **.003** | **.000** | **.000** | **.000** | **.000** | **.001** | **.001** |
| Stddev | .000 | .000 | .000 | .003 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 4.55 | 5.87 | 2.99 | 3.85 | 2.21 | 2.60 | 5.81 | 4.38 | 2.93 | 1.63 | 2.12 | 3.03 |

| Elem | Mo2020 | Mo2045 | Ni2316 | Sb2068 | Se1960 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.002** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 2.03 | 1.26 | 2.90 | 3.60 | 3.61 | 4.05 | 1.37 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **72247.** | **356640.** |
| Stddev | 329. | 11463. |
| %RSD | .45575 | 3.2143 |

Sample Name: CalStd8=100    Acquired: 06/19/2015 14:56:38    Type: Cal
Method: DOD Calibration Updated 060614(v652)    Mode: IR    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Be2348 | Ca3933 | Cd2265 | Cd2288 | Co2286 | Co2388 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.001** | **.000** | **.000** | **.012** | **.051** | **.025** | **.000** | **.153** | **.006** | **.011** | **.006** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .002 | .001 | .000 | .005 | .000 | .000 | .000 | .000 |
| %RSD | 2.34 | 5.16 | 23.5 | 2.86 | 4.50 | 3.62 | 2.27 | 3.01 | 2.79 | 2.36 | 2.92 | 5.20 |

| Elem | Cr2677 | Cr2835 | Cu2247 | Cu3247 | Fe2599 | Mg2802 | Mn2576 | Mo2020 | Mo2045 | Ni2316 | Pb2169 | Pb2203 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.002** | **.000** | **.002** | **.002** | **.001** | **.000** | **.004** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 2.00 | 1.45 | 1.33 | 2.10 | 4.40 | 2.00 | 2.84 | 2.21 | 2.56 | 2.78 | 1.67 | 2.24 |

| Elem | Sb2175 | Se1960 | Se2062 | Tl1908 | Tl2767 | V_2908 | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** | **.000** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 1.77 | 7.95 | 12.5 | 2.66 | 24.9 | 2.66 | 3.90 | 1.80 | 3.26 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **72172.** | **354630.** |
| Stddev | 157. | 10801. |
| %RSD | .21805 | 3.0457 |

Sample Name: CalStd9=1000 Acquired: 06/19/2015 15:01:03 Type: Cal
Method: DOD Calibration Updated 060614(v652) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Al3092 | Al3961 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Be2348 | Ca3158 | Ca3933 | Cd2265 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.004** | **.009** | **.000** | **.001** | **.000** | **.117** | **.555** | **.242** | **.003** | **.003** | **1.33** | **.054** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .003 | .016 | .006 | .000 | .000 | .04 | .001 |
| %RSD | 2.07 | 2.98 | 1.19 | 1.76 | 1.64 | 2.20 | 2.83 | 2.64 | 1.62 | 5.81 | 2.71 | 2.10 |

| Elem | Cd2288 | Co2286 | Co2388 | Cr2677 | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Fe2599 | Mg2025 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.101** | **.056** | **.001** | **.002** | **.002** | **.002** | **.005** | **.000** | **.000** | **.001** | **.000** | **.019** |
| Stddev | .002 | .001 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 1.94 | 2.29 | 1.56 | 1.56 | 1.35 | 1.45 | 1.70 | .685 | 1.87 | 1.18 | 1.20 | 1.67 |

| Elem | Mn2576 | Mn2593 | Mo2020 | Mo2045 | Ni2316 | Pb2169 | Pb2203 | Sb2068 | Sb2175 | Se1960 | Se2062 | Tl1908 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.024** | **.043** | **.006** | **.001** | **.036** | **.001** | **.001** | **.000** | **.001** | **.001** | **.000** | **.002** |
| Stddev | .001 | .001 | .000 | .000 | .001 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 3.01 | 2.76 | 2.18 | 1.14 | 2.36 | 1.09 | 1.33 | 1.17 | 1.55 | 2.00 | .986 | 1.38 |

| Elem | Tl2767 | V_2908 | V_2924 | Zn2062 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.000** | **.002** | **.004** | **.005** | **.003** | **.001** |
| Stddev | .000 | .000 | .000 | .000 | .000 | .000 |
| %RSD | 12.0 | 1.46 | 1.19 | 1.48 | 1.35 | 2.56 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **72646.** | **356540.** |
| Stddev | 320. | 8555. |
| %RSD | .44061 | 2.3994 |

Sample Name: CalStd10=10000 Acquired: 06/19/2015 15:05:03 Type: Cal
Method: DOD Calibration Updated 060614(v652) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Al3092 | Al3961 | As1890 | Ba4934 | Ca3158 | Co2388 | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Fe2599 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.038** | **.093** | **.000** | **5.77** | **.035** | **.008** | **.023** | **.022** | **.029** | **.001** | **.003** | **.014** |
| Stddev | .001 | .003 | .000 | .27 | .001 | .000 | .001 | .000 | .001 | .000 | .000 | .001 |
| %RSD | 3.34 | 3.50 | 1.35 | 4.75 | 4.16 | 3.95 | 3.64 | 1.33 | 3.50 | 3.61 | 3.80 | 3.85 |

| Elem | Mg2025 | Mg2802 | Mn2576 | Mn2593 | Mo2045 | Ni2316 | Pb2169 | Sb2068 | Se1960 | Se2062 | Tl2767 | V_2908 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.004** | **.192** | **.247** | **.445** | **.010** | **.357** | **.006** | **.005** | **.007** | **.004** | **.003** | **.023** |
| Stddev | .000 | .008 | .009 | .016 | .000 | .003 | .000 | .000 | .000 | .000 | .000 | .001 |
| %RSD | 1.54 | 3.95 | 3.50 | 3.63 | 1.32 | .804 | 1.48 | 1.24 | .574 | .713 | 4.10 | 3.56 |

| Elem | Zn2062 | Zn2138 | B_2496 |
|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S |
| Avg | **.046** | **.025** | **.008** |
| Stddev | .001 | .000 | .000 |
| %RSD | 1.13 | .896 | 4.11 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **70486.** | **352920.** |
| Stddev | 119. | 3300. |
| %RSD | .16819 | .93503 |

Sample Name: CalStd11-100k    Acquired: 06/19/2015 15:09:37    Type: Cal
Method: DOD Calibration Updated 060614(v652)    Mode: IR    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | Cr2835 | Cu3247 | Mn2593 | Pb2169 | Zn2062 |
|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.221** | **.271** | **4.10** | **.056** | **.377** |
| Stddev | .003 | .004 | .10 | .001 | .004 |
| %RSD | 1.43 | 1.62 | 2.37 | 1.08 | 1.09 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **71238.** | **351790.** |
| Stddev | 364. | 5672. |
| %RSD | .51145 | 1.6122 |

Sample Name: CalStd12-100000 Acquired: 06/19/2015 15:14:12 Type: Cal
Method: DOD Calibration Updated 060614(v652) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Al3092 | Al3961 | Ca3158 | Fe2343 | Fe2395 | Mg2025 |
|---|---|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **.359** | **.896** | **.344** | **.010** | **.026** | **.028** |
| Stddev | .010 | .024 | .012 | .000 | .001 | .000 |
| %RSD | 2.73 | 2.66 | 3.39 | 2.84 | 2.69 | 1.25 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **69388.** | **349640.** |
| Stddev | 162. | 2808. |
| %RSD | .23409 | .80310 |

Sample Name: CalStd13=500000 Acquired: 06/19/2015 15:18:48 Type: Cal
Method: DOD Calibration Updated 060614(v652) Mode: IR Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Al3961 | Ca3158 | Fe2343 | Mg2025 |
|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **4.73** | **1.80** | **.048** | **.116** |
| Stddev | .21 | .07 | .001 | .001 |
| %RSD | 4.42 | 3.83 | 2.42 | .906 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **62772.** | **335590.** |
| Stddev | 356. | 3150. |
| %RSD | .56650 | .93877 |

Sample Name: CalStd14-1000k      Acquired: 06/19/2015 15:23:44      Type: Cal
Method: DOD Calibration Updated 060614(v652)      Mode: IR      Corr. Factor: 1.000000
User: NAH      ICAP6500:      Prep Batch:      Post Digestion dilution: 1
Comment:

| Elem | Al3961 | Ca3158 | Fe2343 | Mg2025 |
|---|---|---|---|---|
| Units | Cts/S | Cts/S | Cts/S | Cts/S |
| Avg | **9.49** | **3.48** | **.088** | **.197** |
| Stddev | .26 | .18 | .004 | .004 |
| %RSD | 2.72 | 5.18 | 4.96 | 1.97 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **58283.** | **325740.** |
| Stddev | 221. | 5091. |
| %RSD | .37961 | 1.5630 |

Sample Name: icv Acquired: 06/19/2015 15:33:40 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al3961 | As1890 | Ba4934 | Be3130 | Ca3158 | Cd2265 | Co2286 | Co2388 | Cr2677 | Cu2247 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **49.1** | **12100.** | **11700.** | **2150.** | **2040.** | **50.6** | **9860.** | **51.0** | **506.** | **524.** | **208.** | **272.** |
| Stddev | 2.5 | 368. | 371. | 14. | 72. | 1.9 | 357. | .9 | 8. | 18. | 5. | 4. |
| %RSD | 4.99 | 3.03 | 3.16 | .647 | 3.55 | 3.66 | 3.62 | 1.74 | 1.65 | 3.50 | 2.32 | 1.33 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Fe2343 | Fe2395 | Mg2025 | Mn2576 | Mn2593 | Mo2020 | Mo2045 | Ni2316 | Pb2169 | Pb2203 | Sb2068 | Sb2175 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **5350.** | **5240.** | **10200.** | **489.** | **517.** | **509.** | **517.** | **529.** | **547.** | **530.** | **523.** | **513.** |
| Stddev | 176. | 169. | 157. | 14. | 19. | 8. | 8. | 9. | 10. | 8. | 7. | 7. |
| %RSD | 3.30 | 3.23 | 1.54 | 2.87 | 3.72 | 1.52 | 1.50 | 1.79 | 1.86 | 1.46 | 1.26 | 1.42 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Se1960 | Se2062 | Tl2767 | V_2908 | V_2924 | Zn2062 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|
| Avg | **2060.** | **2050.** | **1990.** | **507.** | **518.** | **528.** | **548.** | **506.** |
| Stddev | 18. | 24. | 86. | 14. | 16. | 8. | 9. | 17. |
| %RSD | .875 | 1.15 | 4.32 | 2.80 | 3.02 | 1.57 | 1.67 | 3.28 |
| Check ? | None | None | None | None | None | None | None | None |
| Value | | | | | | | | |
| Range | | | | | | | | |

Sample Name: icv Acquired: 06/19/2015 15:33:40 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **72710.** | **348860.** |
| Stddev | 154. | 1155. |
| %RSD | .21187 | .33102 |

Sample Name: ICVLL Acquired: 06/19/2015 15:38:08 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3158 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **66.4** | **1140.** | **1290.** | **71.9** | **31.4** | **12.9** | **1420.** | **1550.** | **14.9** | **31.2** | **32.7** | **31.9** |
| Stddev | 3.8 | 37. | 24. | 4.4 | .8 | .4 | 48. | 54. | .1 | .6 | 4.1 | .5 |
| %RSD | 5.72 | 3.25 | 1.89 | 6.09 | 2.39 | 3.37 | 3.35 | 3.47 | .959 | 1.98 | 12.4 | 1.48 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Fe2343 | Fe2395 | Fe2599 | Mg2802 | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **975.** | **960.** | **952.** | **1580.** | **29.9** | **32.2** | **32.0** | **33.9** | **65.7** | **65.8** | **59.8** | **32.3** |
| Stddev | 25. | 38. | 17. | 39. | 1.2 | .7 | 1.0 | 2.0 | 1.3 | 1.9 | 2.6 | 3.4 |
| %RSD | 2.56 | 4.00 | 1.78 | 2.48 | 4.16 | 2.11 | 3.18 | 6.05 | 1.94 | 2.90 | 4.38 | 10.4 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Zn2138 | B_2496 |
|---|---|---|
| Avg | **35.1** | **68.1** |
| Stddev | .8 | 1.3 |
| %RSD | 2.35 | 1.89 |
| Check ? | Chk Pass | Chk Pass |
| Value | | |
| Range | | |

Sample Name: ICVLL Acquired: 06/19/2015 15:38:08 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **72959.** | **346480.** |
| Stddev | 321. | 9448. |
| %RSD | .43958 | 2.7269 |

Sample Name: icb      Acquired: 06/19/2015 15:47:18      Type: QC
Method: DOD Calibration Updated 060614(v652)      Mode: CONC      Corr. Factor: 1.000000
User: NAH      ICAP6500:      Prep Batch:      Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **-.768** | **-1.14** | **2.85** | **-.258** | **-.003** | **-10.9** | **-1.11** | **.077** | **.690** | **.217** | **6.14** | **-2.21** |
| Stddev | 1.83 | 1.48 | 4.47 | .052 | .023 | .8 | .07 | .116 | 2.19 | .325 | 1.19 | .15 |
| %RSD | 239. | 131. | 157. | 20.2 | 777. | 7.11 | 6.53 | 151. | 317. | 150. | 19.3 | 6.58 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **.113** | **-.580** | **-.030** | **1.36** | **1.19** | **-1.30** | **-.682** | **-.560** | **-.129** | **1.86** |
| Stddev | .599 | .439 | .126 | 2.38 | 1.07 | 3.35 | 2.05 | 1.73 | .460 | 1.43 |
| %RSD | 532. | 75.7 | 418. | 175. | 89.6 | 257. | 300. | 309. | 357. | 76.6 |
| Check ? | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | |
| Range | | | | | | | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **73520.** | **347190.** |
| Stddev | 141. | 10991. |
| %RSD | .19161 | 3.1658 |

Sample Name: MRL    Acquired: 06/19/2015 15:51:57    Type: QC
Method: DOD Calibration Updated 060614(v652)    Mode: CONC    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **46.9** | **419.** | **17.3** | **9.73** | **3.95** | **464.** | **3.93** | **9.60** | **9.47** | **9.11** | **323.** | **490.** |
| Stddev | .8 | 4. | 7.5 | .35 | .08 | 14. | .12 | .22 | 2.41 | .43 | 7. | 7. |
| %RSD | 1.74 | 1.05 | 43.2 | 3.58 | 1.94 | 3.10 | 3.07 | 2.29 | 25.4 | 4.74 | 2.07 | 1.41 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **9.06** | **9.41** | **9.84** | **12.4** | **22.1** | **16.5** | **18.3** | **12.0** | **11.7** | **21.1** |
| Stddev | .23 | .83 | .25 | 1.2 | 1.0 | 9.4 | .4 | 2.3 | .4 | 2.9 |
| %RSD | 2.57 | 8.88 | 2.56 | 9.96 | 4.51 | 56.8 | 2.21 | 19.5 | 3.27 | 13.6 |
| Check ? | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | |
| Range | | | | | | | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **73963.** | **345650.** |
| Stddev | 116. | 9623. |
| %RSD | .15658 | 2.7839 |

Sample Name: icsa Acquired: 06/19/2015 15:56:31 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3961 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2343 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **.000** | **527000.** | **.009** | **.000** | **-.062** | **504000.** | **.000** | **-.190** | **-.690** | **.002** | **460000.** |
| Stddev | 2.41 | 27200. | 18.3 | .08 | .536 | 18000. | 2.22 | .422 | 2.71 | 1.42 | 15800. |
| %RSD | 619e15 | 5.16 | 211000. | 238000. | 859. | 3.58 | 8870000. | 222. | 393. | 87100. | 3.44 |
| Check ? | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None |
| High Limit | | | | | | | | | | | |
| Low Limit | | | | | | | | | | | |

| Elem | Mg2025 | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **461000.** | **.381** | **.000** | **.980** | **.002** | **.000** | **.007** | **.000** | **.000** | **-.001** | **-.005** |
| Stddev | 7180. | .732 | .848 | 1.08 | 1.96 | 2.32 | 13.5 | 6.68 | .981 | 1.84 | 7.34 |
| %RSD | 1.56 | 192. | 1890000. | 110. | 98800. | 1580000. | 197000. | 32e6 | 4300000. | 163000. | 146000. |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| High Limit | | | | | | | | | | | |
| Low Limit | | | | | | | | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **62799.** | **333130.** |
| Stddev | 76. | 4593. |
| %RSD | .12075 | 1.3787 |

Sample Name: icsab    Acquired: 06/19/2015 16:01:29    Type: QC
Method: DOD Calibration Updated 060614(v652)    Mode: CONC    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3961 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Be2348 | Ca3158 | Cd2265 | Cd2288 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **540.** | **524000.** | **537.** | **481.** | **533.** | **486.** | **540.** | **511.** | **496000.** | **455.** | **530.** |
| Stddev | 25. | 24200. | 22. | 41. | 19. | 21. | 19. | 21. | 20300. | 3. | 5. |
| %RSD | 4.63 | 4.62 | 4.01 | 8.61 | 3.55 | 4.22 | 3.59 | 4.19 | 4.08 | .572 | .941 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | |
| Range | | | | | | | | | | | |

| Elem | Co2286 | Co2388 | Cr2677 | Cr2835 | Cu2247 | Cu3247 | Fe2343 | Mg2025 | Mn2576 | Mn2593 | Mo2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **451.** | **440.** | **497.** | **537.** | **434.** | **500.** | **450000.** | **459000.** | **518.** | **505.** | **496.** |
| Stddev | 4. | 10. | 16. | 18. | 2. | 17. | 14200. | 3000. | 18. | 42. | 7. |
| %RSD | .949 | 2.35 | 3.23 | 3.35 | .493 | 3.31 | 3.16 | .654 | 3.43 | 8.32 | 1.35 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | |
| Range | | | | | | | | | | | |

| Elem | Mo2045 | Ni2316 | Pb2169 | Pb2203 | Sb2068 | Sb2175 | Se1960 | Se2062 | Tl1908 | V_2908 | V_2924 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **439.** | **449.** | **580.** | **515.** | **472.** | **472.** | **509.** | **546.** | **421.** | **451.** | **509.** |
| Stddev | 2. | 4. | 34. | 4. | 7. | 7. | 18. | 15. | 7. | 15. | 14. |
| %RSD | .502 | .804 | 5.79 | .728 | 1.41 | 1.41 | 3.43 | 2.75 | 1.62 | 3.28 | 2.85 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | |
| Range | | | | | | | | | | | |

Sample Name: icsab Acquired: 06/19/2015 16:01:29 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Zn2062 | Zn2138 | B_2496 |
|---|---|---|---|
| Avg | **437.** | **503.** | **505.** |
| Stddev | 3. | 3. | 30. |
| %RSD | .604 | .656 | 5.96 |
| | | | |
| Check ? | Chk Pass | Chk Pass | None |
| Value | | | |
| Range | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **62852.** | **332120.** |
| Stddev | 165. | 1951. |
| %RSD | .26316 | .58743 |

Sample Name: ccv1 Acquired: 06/19/2015 17:54:37 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al3961 | As1890 | Ba4934 | Be3130 | Be2348 | Ca3158 | Cd2265 | Cd2288 | Co2388 | Cr2835 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **496.** | **5020.** | **4990.** | **4540.** | **5110.** | **520.** | **469.** | **4730.** | **487.** | **503.** | **4640.** | **4660.** |
| Stddev | 12. | 165. | 179. | 259. | 212. | 19. | 23. | 146. | 1. | 1. | 230. | 231. |
| %RSD | 2.48 | 3.30 | 3.58 | 5.71 | 4.15 | 3.70 | 4.98 | 3.08 | .120 | .109 | 4.97 | 4.97 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Mg2025 | Mg2802 | Mn2593 | Mo2045 | Ni2316 | Pb2169 | Sb2068 | Sb2175 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **4640.** | **4590.** | **4630.** | F **4470.** | **4640.** | **4580.** | **5260.** | **4570.** | **4950.** | **4640.** | **4510.** | **4450.** |
| Stddev | 250. | 280. | 234. | 222. | 281. | 238. | 206. | 248. | 10. | 263. | 240. | 244. |
| %RSD | 5.39 | 6.11 | 5.06 | 4.96 | 6.06 | 5.18 | 3.91 | 5.42 | .211 | 5.67 | 5.33 | 5.48 |
| Check ? | None | Chk Pass | Chk Pass | Chk Fail | Chk Pass | None | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None |
| Value | | | | 5000. | | | | | | | | |
| Range | | | | -10.4% | | | | | | | | |

| Elem | Se1960 | Se2062 | Tl2767 | V_2908 | Zn2062 | B_2496 |
|---|---|---|---|---|---|---|
| Avg | **4970.** | **4920.** | **4840.** | **4550.** | F **4360.** | **4570.** |
| Stddev | 12. | 36. | 168. | 245. | 236. | 226. |
| %RSD | .250 | .723 | 3.47 | 5.38 | 5.41 | 4.95 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Fail | None |
| Value | | | | | 5000. | |
| Range | | | | | -10.4% | |

Sample Name: ccv1 Acquired: 06/19/2015 17:54:37 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **70039.** | **376920.** |
| Stddev | 103. | 22219. |
| %RSD | .14777 | 5.8949 |

Sample Name: ccv2 Acquired: 06/19/2015 17:59:21 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Ca3933 | Cd2265 | Co2286 | Co2388 | Cr2677 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **46.8** | **519.** | **491.** | **491.** | **490.** | **492.** | **48.0** | **484.** | **47.2** | **478.** | **474.** | **475.** |
| Stddev | 1.4 | 6. | 8. | 22. | 8. | 14. | 1.3 | 13. | 1.0 | 10. | 7. | 6. |
| %RSD | 2.97 | 1.14 | 1.64 | 4.44 | 1.58 | 2.91 | 2.77 | 2.59 | 2.17 | 2.01 | 1.49 | 1.23 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Cr2835 | Cu2247 | Cu3247 | Fe2599 | Mg2802 | Mn2576 | Mn2593 | Mo2020 | Mo2045 | Ni2316 | Pb2169 | Pb2203 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **477.** | **497.** | **468.** | **470.** | **472.** | **464.** | **499.** | **489.** | **484.** | **492.** | **512.** | **481.** |
| Stddev | 8. | 3. | 25. | 6. | 5. | 14. | 14. | 6. | 7. | 10. | 8. | 7. |
| %RSD | 1.65 | .655 | 5.35 | 1.20 | 1.08 | 3.02 | 2.87 | 1.25 | 1.40 | 2.07 | 1.56 | 1.46 |
| Check ? | None | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | None | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Sb2068 | Sb2175 | Se1960 | Se2062 | Tl1908 | Tl2767 | V_2908 | V_2924 | Zn2062 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **484.** | **476.** | **499.** | **497.** | **486.** | **566.** | **465.** | **479.** | **461.** | **491.** | **478.** |
| Stddev | 6. | 7. | 3. | 14. | 5. | 64. | 6. | 6. | 3. | 6. | 17. |
| %RSD | 1.15 | 1.41 | .631 | 2.92 | 1.04 | 11.2 | 1.19 | 1.18 | .733 | 1.15 | 3.57 |
| Check ? | None | Chk Pass | Chk Pass | None | Chk Pass | None | None | Chk Pass | None | Chk Pass | None |
| Value | | | | | | | | | | | |
| Range | | | | | | | | | | | |

Sample Name: ccv2 Acquired: 06/19/2015 17:59:21 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **71884.** | **355850.** |
| Stddev | 210. | 9545. |
| %RSD | .29153 | 2.6822 |

Sample Name: ccb Acquired: 06/19/2015 18:03:36 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **.424** | **-2.51** | **4.83** | **-.217** | **.017** | **-13.9** | **-1.12** | **.237** | **-.272** | **.113** | **-.166** | **-3.81** |
| Stddev | 1.53 | 1.21 | 4.94 | .118 | .060 | 1.9 | .03 | .097 | .997 | .525 | 2.44 | .27 |
| %RSD | 362. | 48.3 | 102. | 54.3 | 362. | 13.2 | 2.94 | 40.8 | 366. | 462. | 1470. | 7.05 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **-.103** | **1.59** | **-.790** | **.197** | **1.11** | **2.05** | **.747** | **.234** | **-.852** | **9.70** |
| Stddev | .968 | .89 | .307 | .350 | .81 | 1.71 | .333 | 1.40 | .173 | 4.41 |
| %RSD | 938. | 55.8 | 38.9 | 177. | 72.5 | 83.2 | 44.6 | 599. | 20.2 | 45.5 |
| Check ? | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | |
| Range | | | | | | | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **72425.** | **361120.** |
| Stddev | 259. | 15553. |
| %RSD | .35764 | 4.3069 |

Sample Name: lcsw52930 Acquired: 06/19/2015 18:13:12 Type: Unk
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **17.4** | **804.** | **783.** | **790.** | **736.** | **787.** | **837.** | **20.2** | **.911** | **18.4** | **189.** | **72.4** |
| Stddev | 1.7 | 21. | 15. | 16. | 39. | 14. | 26. | .6 | .803 | .3 | 3. | 3.5 |
| %RSD | 9.58 | 2.61 | 1.91 | 2.04 | 5.24 | 1.78 | 3.08 | 2.89 | 88.1 | 1.52 | 1.79 | 4.83 |

| Elem | Cu2247 | Fe2599 | Mg2802 | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Se2062 | Tl1908 | Tl2767 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **94.6** | **367.** | **-.503** | **194.** | **-.865** | **204.** | **184.** | **186.** | **799.** | **779.** | **788.** | **906.** |
| Stddev | 1.6 | 8. | .293 | 7. | .431 | 3. | 2. | 5. | 15. | 23. | 8. | 38. |
| %RSD | 1.69 | 2.20 | 58.3 | 3.40 | 49.8 | 1.71 | 1.12 | 2.68 | 1.85 | 3.00 | 1.06 | 4.23 |

| Elem | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|
| Units | ug/L | ug/L | ug/L |
| Avg | **188.** | **184.** | **6.35** |
| Stddev | 3. | 4. | 2.44 |
| %RSD | 1.70 | 1.98 | 38.4 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **68462.** | **358760.** |
| Stddev | 158. | 11626. |
| %RSD | .23088 | 3.2406 |

Sample Name: mbw52930 Acquired: 06/19/2015 18:17:43 Type: Unk
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-.962** | **-1.21** | **-1.07** | **-.231** | **.017** | **-10.7** | **-1.25** | **.060** | **-1.31** | **.792** | **.529** | **-3.51** |
| Stddev | 2.69 | 1.50 | 7.29 | .159 | .047 | 1.8 | .16 | .060 | 1.48 | .441 | 3.09 | .09 |
| %RSD | 279. | 124. | 678. | 68.7 | 270. | 16.6 | 12.4 | 101. | 113. | 55.7 | 585. | 2.60 |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **.193** | **-1.43** | **-.734** | **-.709** | **.045** | **4.97** | **1.73** | **.343** | **-1.02** | **3.78** |
| Stddev | .151 | .52 | .236 | 1.09 | 1.53 | 3.13 | 2.60 | 2.18 | .15 | 4.71 |
| %RSD | 77.9 | 36.4 | 32.1 | 154. | 3390. | 63.0 | 150. | 634. | 15.0 | 125. |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **69020.** | **357100.** |
| Stddev | 171. | 8247. |
| %RSD | .24783 | 2.3094 |

Sample Name: 595909 Acquired: 06/19/2015 18:22:24 Type: Unk
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2025 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | mg/L |
| Avg | **-1.31** | **366.** | **17.5** | **74.9** | **-.258** | **48500.** | **-.871** | **7.32** | **-1.07** | **68.8** | **102.** | **16300.** |
| Stddev | 1.31 | 4. | 12.7 | .7 | .731 | 1590. | .166 | .12 | 1.28 | 1.8 | 4. | 232. |
| %RSD | 100. | 1.19 | 72.9 | .995 | 283. | 3.29 | 19.1 | 1.69 | 119. | 2.59 | 3.60 | 1.42 |

| Elem | Mn2576 | Mn2593 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **1490.** | **1590.** | **-.925** | **11.4** | **3.00** | **-.268** | **22.7** | **.150** | **.366** | **110.** | **368.** |
| Stddev | 47. | 48. | .637 | .2 | .53 | 1.76 | 6.2 | 2.74 | .409 | 1. | 3. |
| %RSD | 3.11 | 3.00 | 68.9 | 2.17 | 17.7 | 654. | 27.5 | 1830. | 112. | .973 | .836 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **59351.** | **356630.** |
| Stddev | 341. | 8686. |
| %RSD | .57407 | 2.4356 |

Sample Name: I595909 Acquired: 06/19/2015 18:27:28 Type: Unk
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-.031** | **115.** | **11.3** | **19.1** | **.030** | **11500.** | **-1.06** | **1.84** | **-1.52** | **20.2** | **24.1** | **5810.** |
| Stddev | 2.72 | 2. | 5.0 | .5 | .196 | 482. | .20 | .14 | 2.87 | .6 | 1.2 | 175. |
| %RSD | 8760. | 2.10 | 44.1 | 2.83 | 651. | 4.18 | 19.1 | 7.90 | 189. | 2.89 | 5.06 | 3.01 |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **354.** | **-1.84** | **2.57** | **.838** | **.215** | **9.27** | **3.48** | **.839** | **30.4** | **101.** |
| Stddev | 14. | 1.09 | .36 | 2.12 | .929 | 6.15 | 3.16 | 2.76 | .8 | 5. |
| %RSD | 4.08 | 59.2 | 14.1 | 253. | 433. | 66.3 | 90.8 | 328. | 2.72 | 4.93 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **66900.** | **354170.** |
| Stddev | 1038. | 6028. |
| %RSD | 1.5518 | 1.7019 |

Sample Name: dup595909 Acquired: 06/19/2015 18:32:29 Type: Unk
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2025 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | mg/L |
| Avg | **.170** | **378.** | **18.3** | **76.0** | **-.005** | **48100.** | **-.705** | **7.40** | **-.334** | **70.0** | **109.** | **16900.** |
| Stddev | 1.03 | 5. | 4.1 | 2.9 | .921 | 975. | .066 | .14 | .892 | .2 | 3. | 78. |
| %RSD | 605. | 1.40 | 22.1 | 3.84 | 17700. | 2.03 | 9.43 | 1.88 | 267. | .327 | 2.52 | .463 |

| Elem | Mn2576 | Mn2593 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **1500.** | **1570.** | **-1.14** | **11.8** | **4.77** | **-.662** | **5.63** | **1.79** | **-.418** | **117.** | **374.** |
| Stddev | 33. | 34. | .68 | .5 | 1.09 | 2.47 | 6.47 | .85 | 1.43 | 1. | 11. |
| %RSD | 2.23 | 2.16 | 59.3 | 4.25 | 22.9 | 373. | 115. | 47.5 | 341. | .711 | 2.81 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **60139.** | **349880.** |
| Stddev | 991. | 1085. |
| %RSD | 1.6477 | .31013 |

Sample Name: msw595909 Acquired: 06/19/2015 18:37:33 Type: Unk
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **16.6** | **1340.** | **907.** | **777.** | **658.** | **817.** | **898.** | **19.9** | **43600.** | **14.9** | **152.** | **70.3** |
| Stddev | 4.0 | 291. | 22. | 201. | 76. | 15. | 156. | 3.0 | 7700. | 3.1 | 32. | 2.8 |
| %RSD | 24.1 | 21.8 | 2.45 | 25.9 | 11.5 | 1.79 | 17.4 | 15.3 | 17.6 | 21.0 | 21.0 | 4.01 |

| Elem | Cu2247 | Fe2599 | Mg2025 | Mn2576 | Mn2593 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Se2062 | Tl1908 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | mg/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **135.** | **435.** | **15400.** | **1530.** | **1630.** | **-.881** | **163.** | **126.** | **149.** | **778.** | **782.** | **488.** |
| Stddev | 8. | 7. | 1960. | 270. | 288. | .241 | 34. | 4. | 22. | 222. | 202. | 107. |
| %RSD | 6.04 | 1.59 | 12.7 | 17.6 | 17.7 | 27.4 | 20.7 | 2.94 | 14.5 | 28.5 | 25.8 | 21.9 |

| Elem | Tl2767 | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L |
| Avg | **868.** | **181.** | **265.** | **366.** |
| Stddev | 189. | 4. | 17. | 8. |
| %RSD | 21.8 | 2.24 | 6.37 | 2.13 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | ********* | **356500.** |
| Stddev | ----- | 11538. |
| %RSD | ----- | 3.2364 |

Sample Name: msdw595909 Acquired: 06/19/2015 18:42:35 Type: Unk
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **18.5** | **1480.** | **915.** | **871.** | **719.** | **822.** | **965.** | **21.5** | **47400.** | **16.2** | **167.** | **69.3** |
| Stddev | 2.2 | 42. | 16. | 13. | 51. | 17. | 32. | .7 | 1470. | .4 | 2. | 2.2 |
| %RSD | 11.9 | 2.85 | 1.79 | 1.52 | 7.06 | 2.01 | 3.26 | 3.38 | 3.10 | 2.18 | 1.40 | 3.13 |

| Elem | Cu2247 | Fe2599 | Mg2025 | Mn2576 | Mn2593 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Se2062 | Tl1908 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | mg/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **142.** | **438.** | **16600.** | **1650.** | **1760.** | **-2.14** | **179.** | **132.** | **161.** | **883.** | **882.** | **531.** |
| Stddev | 2. | 9. | 318. | 49. | 55. | 1.32 | 2. | 2. | 4. | 14. | 30. | 2. |
| %RSD | 1.35 | 2.06 | 1.91 | 2.98 | 3.12 | 61.6 | 1.36 | 1.26 | 2.76 | 1.60 | 3.39 | .391 |

| Elem | Tl2767 | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L |
| Avg | **922.** | **181.** | **283.** | **373.** |
| Stddev | 48. | 3. | 6. | 7. |
| %RSD | 5.17 | 1.62 | 2.04 | 2.01 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **60499.** | **350110.** |
| Stddev | 753. | 8030. |
| %RSD | 1.2454 | 2.2935 |

Sample Name: pdsw595909 Acquired: 06/19/2015 18:47:37 Type: Unk
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al3961 | As1890 | Ba4934 | Be3130 | Be2348 | Ca3158 | Cd2265 | Cd2288 | Co2286 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **101.** | **5760.** | **5220.** | **3610.** | **5040.** | **105.** | **93.8** | **454000.** | **84.2** | **135.** | **813.** |
| Stddev | 3. | 54. | 70. | 31. | 90. | 3. | 2.2 | 6620. | .9 | 1. | 8. |
| %RSD | 3.06 | .933 | 1.34 | .850 | 1.79 | 3.19 | 2.33 | 1.46 | 1.03 | .908 | 1.03 |

| Elem | Co2388 | Cr2677 | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Mg2025 | Mn2593 | Mo2020 | Ni2316 | Pb2169 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | mg/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **881.** | **349.** | **413.** | **531.** | **1810.** | **1770.** | **172000.** | **2480.** | **-1.25** | **848.** | **885.** |
| Stddev | 16. | 8. | 3. | 12. | 11. | 25. | 1600. | 52. | 1.76 | 9. | 7. |
| %RSD | 1.76 | 2.28 | .630 | 2.25 | .587 | 1.41 | .931 | 2.09 | 141. | 1.08 | .830 |

| Elem | Pb2203 | Sb2068 | Sb2175 | Se1960 | Se2062 | Tl2767 | V_2908 | Zn2062 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **608.** | **837.** | **825.** | **4600.** | **4610.** | **4040.** | **914.** | **763.** | **366.** |
| Stddev | 6. | 10. | 12. | 47. | 13. | 795. | 10. | 5. | 13. |
| %RSD | 1.03 | 1.15 | 1.41 | 1.02 | .285 | 19.7 | 1.10 | .631 | 3.56 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **55128.** | **336740.** |
| Stddev | 491. | 4026. |
| %RSD | .89024 | 1.1954 |

Sample Name: 595911 Acquired: 06/19/2015 18:52:25 Type: Unk
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2025 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | mg/L |
| Avg | **-.830** | **307.** | **16.2** | **226.** | **-.500** | **93300.** | **.114** | **1.44** | **2.09** | **20.5** | **356.** | **10700.** |
| Stddev | 1.92 | 3. | 15.5 | 2. | .625 | 3540. | .074 | .07 | 2.37 | 1.3 | 4. | 187. |
| %RSD | 231. | 1.02 | 95.6 | .865 | 125. | 3.80 | 64.6 | 4.56 | 113. | 6.25 | 1.23 | 1.74 |

| Elem | Mn2576 | Mn2593 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **903.** | **954.** | **-1.59** | **5.56** | **12.8** | **-1.01** | **29.4** | **1.80** | **1.03** | **454.** | **495.** |
| Stddev | 34. | 37. | .53 | .83 | 2.6 | 2.41 | 7.0 | 3.56 | .74 | 11. | 8. |
| %RSD | 3.77 | 3.86 | 33.2 | 14.9 | 20.4 | 240. | 23.7 | 198. | 71.5 | 2.43 | 1.57 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **58350.** | **347580.** |
| Stddev | 538. | 9554. |
| %RSD | .92240 | 2.7486 |

Sample Name: ccv1 Acquired: 06/19/2015 18:57:05 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al3961 | As1890 | Ba4934 | Be3130 | Be2348 | Ca3158 | Cd2265 | Cd2288 | Co2388 | Cr2835 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **497.** | **5010.** | **5010.** | **4660.** | **5180.** | **515.** | **478.** | **4670.** | **484.** | **499.** | **4720.** | **4750.** |
| Stddev | 17. | 180. | 184. | 43. | 237. | 19. | 15. | 235. | 3. | 3. | 162. | 143. |
| %RSD | 3.34 | 3.60 | 3.67 | .913 | 4.58 | 3.66 | 3.21 | 5.04 | .679 | .622 | 3.44 | 3.00 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Mg2025 | Mg2802 | Mn2593 | Mo2045 | Ni2316 | Pb2169 | Sb2068 | Sb2175 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **4740.** | **4730.** | **4690.** | **4550.** | **4730.** | **4680.** | **5230.** | **4670.** | **4900.** | **4690.** | **4620.** | **4550.** |
| Stddev | 28. | 172. | 159. | 139. | 23. | 158. | 203. | 29. | 37. | 33. | 27. | 31. |
| %RSD | .585 | 3.64 | 3.39 | 3.05 | .475 | 3.38 | 3.87 | .621 | .745 | .694 | .577 | .679 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Se1960 | Se2062 | Tl2767 | V_2908 | Zn2062 | B_2496 |
|---|---|---|---|---|---|---|
| Avg | **4950.** | **4920.** | **5010.** | **4660.** | F **4450.** | **4620.** |
| Stddev | 21. | 38. | 179. | 142. | 31. | 151. |
| %RSD | .421 | .782 | 3.57 | 3.04 | .686 | 3.27 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Fail | None |
| Value | | | | | 5000. | |
| Range | | | | | -10.4% | |

Sample Name: ccv1 Acquired: 06/19/2015 18:57:05 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **69283.** | **363280.** |
| Stddev | 164. | 1869. |
| %RSD | .23650 | .51448 |

Sample Name: ccv2 Acquired: 06/19/2015 19:01:51 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Ca3933 | Cd2265 | Co2286 | Co2388 | Cr2677 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **47.8** | **527.** | **504.** | **477.** | **495.** | **500.** | **48.7** | **495.** | **48.2** | **489.** | **481.** | **486.** |
| Stddev | 1.3 | 13. | 6. | 30. | 11. | 17. | 1.5 | 17. | .9 | 9. | 15. | 9. |
| %RSD | 2.78 | 2.52 | 1.26 | 6.28 | 2.28 | 3.37 | 3.07 | 3.33 | 1.88 | 1.89 | 3.10 | 1.85 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Cr2835 | Cu2247 | Cu3247 | Fe2599 | Mg2802 | Mn2576 | Mn2593 | Mo2020 | Mo2045 | Ni2316 | Pb2169 | Pb2203 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **484.** | **508.** | **472.** | **475.** | **477.** | **472.** | **506.** | **501.** | **494.** | **504.** | **512.** | **489.** |
| Stddev | 11. | 11. | 35. | 13. | 12. | 13. | 14. | 6. | 13. | 12. | 14. | 14. |
| %RSD | 2.30 | 2.18 | 7.31 | 2.73 | 2.40 | 2.82 | 2.87 | 1.27 | 2.55 | 2.29 | 2.75 | 2.93 |
| Check ? | None | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | None | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Sb2068 | Sb2175 | Se1960 | Se2062 | Tl1908 | Tl2767 | V_2908 | V_2924 | Zn2062 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **492.** | **479.** | **513.** | **493.** | **490.** | **550.** | **472.** | **487.** | **471.** | **503.** | **477.** |
| Stddev | 13. | 11. | 7. | 20. | 3. | 41. | 13. | 11. | 13. | 12. | 12. |
| %RSD | 2.54 | 2.18 | 1.42 | 3.99 | .550 | 7.53 | 2.77 | 2.26 | 2.73 | 2.46 | 2.53 |
| Check ? | None | Chk Pass | Chk Pass | None | Chk Pass | None | None | Chk Pass | None | Chk Pass | None |
| Value | | | | | | | | | | | |
| Range | | | | | | | | | | | |

Sample Name: ccv2 Acquired: 06/19/2015 19:01:51 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **70560.** | **350500.** |
| Stddev | 76. | 11061. |
| %RSD | .10821 | 3.1558 |

Sample Name: ccb Acquired: 06/19/2015 19:06:04 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **-1.32** | **-2.64** | **3.69** | **-.331** | **.025** | **-14.2** | **-1.15** | **.188** | **-.922** | **.528** | **.882** | **-3.80** |
| Stddev | 2.45 | .85 | 3.45 | .112 | .039 | .3 | .14 | .118 | 1.37 | .273 | 1.46 | .14 |
| %RSD | 185. | 32.4 | 93.3 | 33.7 | 156. | 2.19 | 12.2 | 62.6 | 148. | 51.7 | 165. | 3.66 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **.118** | **1.28** | **-.436** | **.452** | **1.44** | **5.08** | **1.45** | **.385** | **-.933** | **6.02** |
| Stddev | .443 | .83 | .136 | 1.45 | 1.33 | 10.0 | 2.02 | 1.36 | .578 | 1.92 |
| %RSD | 377. | 65.0 | 31.1 | 321. | 92.4 | 197. | 139. | 354. | 61.9 | 31.9 |
| Check ? | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | |
| Range | | | | | | | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **70722.** | **350770.** |
| Stddev | 286. | 12351. |
| %RSD | .40502 | 3.5210 |

Sample Name: 595913 Acquired: 06/19/2015 19:10:45 Type: Unk
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2025 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | mg/L |
| Avg | **1.05** | **156.** | **23.1** | **122.** | **-.430** | **96000.** | **-.355** | **3.20** | **2.33** | **76.0** | **184.** | **17500.** |
| Stddev | 3.06 | 5. | 6.3 | 3. | .718 | 2860. | .072 | .05 | 1.60 | .3 | 5. | 164. |
| %RSD | 292. | 3.04 | 27.2 | 2.66 | 167. | 2.98 | 20.2 | 1.55 | 68.4 | .424 | 2.73 | .939 |

| Elem | Mn2576 | Mn2593 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **989.** | **1040.** | **.445** | **8.95** | **2.32** | **1.59** | **6.80** | **3.62** | **1.47** | **238.** | **407.** |
| Stddev | 26. | 35. | .744 | .55 | 1.01 | 2.18 | 6.02 | 6.14 | 2.50 | 3. | 15. |
| %RSD | 2.61 | 3.36 | 167. | 6.11 | 43.6 | 137. | 88.5 | 169. | 170. | 1.29 | 3.67 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **59032.** | **341990.** |
| Stddev | 717. | 5771. |
| %RSD | 1.2139 | 1.6874 |

Sample Name: 595915 Acquired: 06/19/2015 19:15:37 Type: Unk
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3158 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **.932** | **821.** | **432.** | **24.8** | **102.** | **-.277** | **97000.** | **-.436** | **2.12** | **1.66** | **6.68** | **577.** |
| Stddev | .538 | 33. | 7. | 10.6 | 2. | .264 | 4550. | .313 | .10 | .84 | .45 | 13. |
| %RSD | 57.8 | 3.98 | 1.69 | 42.6 | 1.63 | 95.6 | 4.69 | 71.7 | 4.54 | 50.5 | 6.70 | 2.22 |

| Elem | Mg2025 | Mn2576 | Mn2593 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | mg/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **16200.** | **1340.** | **1430.** | **-.739** | **10.6** | **.287** | **-.700** | **18.6** | **3.02** | **3.22** | **140.** | **507.** |
| Stddev | 216. | 57. | 63. | .569 | .3 | .588 | 1.47 | 11.1 | 2.68 | 2.32 | 2. | 6. |
| %RSD | 1.33 | 4.22 | 4.40 | 77.1 | 2.74 | 205. | 210. | 59.8 | 89.0 | 72.3 | 1.13 | 1.18 |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **58001.** | **349210.** |
| Stddev | 1043. | 5433. |
| %RSD | 1.7975 | 1.5557 |

Sample Name: ccv1    Acquired: 06/19/2015 19:57:21    Type: QC
Method: DOD Calibration Updated 060614(v652)    Mode: CONC    Corr. Factor: 1.000000
User: NAH    ICAP6500:    Prep Batch:    Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al3092 | Al3961 | As1890 | Ba4934 | Be3130 | Be2348 | Ca3158 | Cd2265 | Cd2288 | Co2388 | Cr2835 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **491.** | **4960.** | **4930.** | **4570.** | **5070.** | **508.** | **468.** | **4630.** | **478.** | **493.** | **4620.** | **4670.** |
| Stddev | 19. | 216. | 209. | 19. | 295. | 23. | 17. | 247. | 4. | 3. | 165. | 160. |
| %RSD | 3.82 | 4.36 | 4.23 | .415 | 5.81 | 4.43 | 3.56 | 5.34 | .770 | .662 | 3.58 | 3.43 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Cu2247 | Cu3247 | Fe2343 | Fe2395 | Mg2025 | Mg2802 | Mn2593 | Mo2045 | Ni2316 | Pb2169 | Sb2068 | Sb2175 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **4660.** | **4650.** | **4590.** | F **4460.** | **4670.** | **4610.** | **5130.** | **4600.** | **4830.** | **4650.** | **4580.** | **4500.** |
| Stddev | 28. | 180. | 176. | 153. | 33. | 166. | 224. | 36. | 44. | 23. | 31. | 26. |
| %RSD | .593 | 3.88 | 3.83 | 3.43 | .699 | 3.60 | 4.37 | .790 | .909 | .485 | .673 | .579 |
| Check ? | None | Chk Pass | Chk Pass | Chk Fail | Chk Pass | None | Chk Pass | Chk Pass | None | Chk Pass | Chk Pass | None |
| Value | | | | 5000. | | | | | | | | |
| Range | | | | -10.4% | | | | | | | | |

| Elem | Se1960 | Se2062 | Tl2767 | V_2908 | Zn2062 | B_2496 |
|---|---|---|---|---|---|---|
| Avg | **4890.** | **4840.** | **4800.** | **4590.** | F **4370.** | **4550.** |
| Stddev | 31. | 29. | 237. | 153. | 35. | 160. |
| %RSD | .635 | .605 | 4.93 | 3.33 | .803 | 3.51 |
| Check ? | None | Chk Pass | Chk Pass | Chk Pass | Chk Fail | None |
| Value | | | | | 5000. | |
| Range | | | | | -10.4% | |

Sample Name: ccv1 Acquired: 06/19/2015 19:57:21 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **69749.** | **365920.** |
| Stddev | 423. | 2523. |
| %RSD | .60583 | .68961 |

Sample Name: ccv2 Acquired: 06/19/2015 20:02:06 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | As1890 | Ba4554 | Ba4934 | Be3130 | Ca3933 | Cd2265 | Co2286 | Co2388 | Cr2677 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **45.5** | **498.** | **490.** | **466.** | **475.** | **489.** | **47.6** | **486.** | **46.7** | **472.** | **457.** | **461.** |
| Stddev | .8 | 6. | 8. | 25. | 6. | 11. | 1.0 | 9. | .9 | 9. | 8. | 3. |
| %RSD | 1.66 | 1.21 | 1.58 | 5.43 | 1.32 | 2.14 | 2.15 | 1.85 | 1.97 | 1.87 | 1.79 | .589 |
| Check ? | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Cr2835 | Cu2247 | Cu3247 | Fe2599 | Mg2802 | Mn2576 | Mn2593 | Mo2020 | Mo2045 | Ni2316 | Pb2169 | Pb2203 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **459.** | **485.** | **469.** | **449.** | **454.** | **458.** | **489.** | **485.** | **469.** | **488.** | **496.** | **462.** |
| Stddev | 9. | 6. | 24. | 5. | 5. | 8. | 10. | 7. | 7. | 9. | 7. | 8. |
| %RSD | 1.87 | 1.15 | 5.02 | 1.04 | 1.04 | 1.74 | 2.13 | 1.47 | 1.47 | 1.90 | 1.37 | 1.67 |
| Check ? | None | Chk Pass | None | Chk Pass | Chk Pass | Chk Pass | Chk Pass | Chk Pass | None | Chk Pass | None | Chk Pass |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Sb2068 | Sb2175 | Se1960 | Se2062 | Tl1908 | Tl2767 | V_2908 | V_2924 | Zn2062 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **470.** | **463.** | **496.** | **481.** | **477.** | **494.** | **452.** | **464.** | **440.** | **466.** | **451.** |
| Stddev | 7. | 7. | 6. | 17. | 4. | 33. | 4. | 4. | 7. | 10. | 12. |
| %RSD | 1.57 | 1.44 | 1.29 | 3.47 | .827 | 6.70 | .876 | .762 | 1.59 | 2.11 | 2.71 |
| Check ? | None | Chk Pass | Chk Pass | None | Chk Pass | None | None | Chk Pass | None | Chk Pass | None |
| Value | | | | | | | | | | | |
| Range | | | | | | | | | | | |

Sample Name: ccv2 Acquired: 06/19/2015 20:02:06 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **71232.** | **360650.** |
| Stddev | 293. | 8324. |
| %RSD | .41142 | 2.3081 |

Sample Name: ccb Acquired: 06/19/2015 20:06:22 Type: QC
Method: DOD Calibration Updated 060614(v652) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **-1.66** | **-2.77** | **.219** | **-.337** | **-.006** | **-14.8** | **-1.10** | **.037** | **-.563** | **.101** | **1.48** | **-3.82** |
| Stddev | 1.46 | 1.13 | 3.36 | .093 | .063 | 1.0 | .08 | .160 | 1.15 | .487 | 1.68 | .17 |
| %RSD | 87.8 | 40.7 | 1540. | 27.6 | 1060. | 7.07 | 7.21 | 436. | 205. | 480. | 113. | 4.52 |
| Check ? | None | None | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | | | |
| Range | | | | | | | | | | | | |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 | B_2496 |
|---|---|---|---|---|---|---|---|---|---|---|
| Avg | **.081** | **1.82** | **-.289** | **-1.84** | **-.276** | **5.67** | **2.23** | **-.756** | **-.902** | **6.23** |
| Stddev | .533 | .66 | .304 | 1.08 | 1.51 | 6.40 | 1.24 | .825 | .378 | 5.47 |
| %RSD | 658. | 36.2 | 105. | 58.7 | 547. | 113. | 55.7 | 109. | 41.9 | 87.8 |
| Check ? | None | None | None | None | None | None | None | None | None | None |
| Value | | | | | | | | | | |
| Range | | | | | | | | | | |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Avg | **72356.** | **361570.** |
| Stddev | 399. | 11990. |
| %RSD | .55159 | 3.3160 |

# METALS LOGBOOK DOCUMENTS

# MICP WATER QSM Analytical Run
# 115833 on 06/30/2015

Date Analyzed: ________________ Date Reviewed: ________________

Date Entered: ________________ Date Validated: ________________

| COC | ORDER | SAMPLE DECRIPTION | SAMPLE DATE/ TIME | | QC TYPE (Parent Sample) | | CLIENT | PROJECT | TEST | PREP BATCH | MATRIX | DEL | RUSH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 597432 | | | | ICV | | | | MICP WATER QSM | 0 | | | |
| | 597433 | | | | ICVLL | | | | MICP WATER QSM | 0 | | | |
| | 597434 | | | | ICB | | | | MICP WATER QSM | 0 | | | |
| | 597436 | | | | ICSA | | | | MICP WATER QSM | 0 | | | |
| | 597437 | | | | ICSAB | | | | MICP WATER QSM | 0 | | | |
| | 596103 | | | | LCSW | | | | ICP TOTAL QSM | 52892 | | | |
| | 596102 | | | | MBW | | | | ICP TOTAL QSM | 52892 | | | |
| | 597438 | | | | CCV1 | | | | MICP WATER QSM | 0 | | | |
| | 597439 | | | | CCV2 | | | | MICP WATER QSM | 0 | | | |
| | 597440 | | | | CCB | | | | MICP WATER QSM | 0 | | | |
| 111888 | 595902 | SW-1 | 06/09/2015 | 1010 | | | AECOM | GULL ROCK | ICP TOTAL QSM | 52892 | SW | **4** | |
| 111888 | 595903 | SW-2 | 06/09/2015 | 1005 | Designated MS/MSD | | AECOM | GULL ROCK | ICP TOTAL QSM | 52892 | SW | **4** | |
| | 597441 | | | | L | 595903 | | | ICP TOTAL QSM | 0 | | | |
| | 596104 | SW-2 | 06/09/2015 | 1005 | DUP | 595903 | | | ICP TOTAL QSM | 52892 | | | |
| | 596105 | SW-2 | 06/09/2015 | 1005 | MSW | 595903 | | | ICP TOTAL QSM | 52892 | | | |
| | 596106 | SW-2 | 06/09/2015 | 1005 | MSDW | 596105 | | | ICP TOTAL QSM | 52892 | | | |
| | 597442 | | | | PDSW | 595903 | | | ICP TOTAL QSM | 0 | | | |
| 111888 | 595904 | SW-3 | 06/09/2015 | 0957 | | | AECOM | GULL ROCK | ICP TOTAL QSM | 52892 | SW | **4** | |
| 111888 | 595905 | SW-4 | 06/09/2015 | 0951 | | | AECOM | GULL ROCK | ICP TOTAL QSM | 52892 | SW | **4** | |

**Matrix: S-Soil Slg-Sludge GW-GroundWater M-Misc Waste SW-Surface Water A-Air WW-WasteWater DW-Drinking Water SD=Sediment Leachate=LE**

Distribution: Metals C:\LIMSREPS\ANALYTICALRUN.RPT 

# MICP WATER QSM Analytical Run
# 115833 on 06/30/2015

Date Analyzed: ________________ Date Reviewed: ________________

Date Entered: ________________ Date Validated: ________________

| COC | ORDER | SAMPLE DECRIPTION | SAMPLE DATE/ TIME | QC TYPE (Parent Sample) | CLIENT | PROJECT | TEST | PREP BATCH | MATRIX | DEL | RUSH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 111888 | 595906 | DUP-SW | 06/09/2015 | | AECOM | GULL ROCK | ICP TOTAL QSM | 52892 | SW | **4** | |
| | 597443 | | | CCV1 | | | MICP WATER QSM | 0 | | | |
| | 597444 | | | CCV2 | | | MICP WATER QSM | 0 | | | |
| | 597445 | | | CCB | | | MICP WATER QSM | 0 | | | |
| 111888 | 595907 | SW-5 | 06/09/2015 1030 | | AECOM | GULL ROCK | ICP TOTAL QSM | 52892 | SW | **4** | |
| | 597446 | | | CCV1 | | | MICP WATER QSM | 0 | | | |
| | 597447 | | | CCV2 | | | MICP WATER QSM | 0 | | | |
| | 597448 | | | CCB | | | MICP WATER QSM | 0 | | | |

**27** SAMPLE COUNT ON RUN, INCLUDING METHOD AND INSTRUMENT QC



**Matrix: S-Soil Slg-Sludge GW-GroundWater M-Misc Waste SW-Surface Water A-Air WW-WasteWater DW-Drinking Water SD=Sediment Leachate=LE**

Distribution: C:\LIMSREPS\ANALYTICALRUN.RPT

# MICP SOIL QSM Analytical Run
# 115839 on 06/30/2015

Date Analyzed: ________________ Date Reviewed: ________________

Date Entered: ________________ Date Validated: ________________

| COC | ORDER | SAMPLE DECRIPTION | SAMPLE DATE/ TIME | QC TYPE (Parent Sample) | CLIENT | PROJECT | TEST | PREP BATCH | MATRIX | DEL | RUSH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 597241 | | | ICV | | | MICP SOIL QSM | 0 | | | |
| | 597242 | | | ICVLL | | | MICP SOIL QSM | 0 | | | |
| | 597243 | | | ICB | | | MICP SOIL QSM | 0 | | | |
| | 597245 | | | ICSA | | | MICP SOIL QSM | 0 | | | |
| | 597246 | | | ICSAB | | | MICP SOIL QSM | 0 | | | |
| | 597688 | | | CCV1 | | | MICP SOIL QSM | | | | |
| | 597689 | | | CCV2 | | | MICP SOIL QSM | | | | |
| | 597690 | | | CCB | | | MICP SOIL QSM | | | | |
| | 596029 | | | LCSS | | | ICP QSM | 52891 | | | |
| | 597691 | | | CCV1 | | | MICP SOIL QSM | | | | |
| | 597692 | | | CCV2 | | | MICP SOIL QSM | | | | |
| | 597693 | | | CCB | | | MICP SOIL QSM | | | | |
| | 596028 | | | MBS | | | ICP QSM | 52891 | | | |
| 111888 | 595908 | G-25 | 06/09/2015 0955 | | AECOM | GULL ROCK | ICP QSM | 52891 | S | **4** | |
| | 597683 | | | L 595908 | | | ICP QSM | | | | |
| | 596030 | G-25 | 06/09/2015 0955 | DUP 595908 | | | ICP QSM | 52891 | | | |
| | 596031 | G-25 | 06/09/2015 0955 | MSS 595908 | | | ICP QSM | 52891 | | | |
| | 596032 | G-25 | 06/09/2015 0955 | MSDS 596031 | | | ICP QSM | 52891 | | | |
| | 597682 | | | PDSS 595908 | | | ICP QSM | | | | |

**Matrix: S-Soil Slg-Sludge GW-GroundWater M-Misc Waste SW-Surface Water A-Air WW-WasteWater DW-Drinking Water SD=Sediment Leachate=LE**

MICP SOIL QSM Analytical Run
# 115839 on 06/30/2015

Date Analyzed: ________________ Date Reviewed: ________________

Date Entered: ________________ Date Validated: ________________

| COC | ORDER | SAMPLE DECRIPTION | SAMPLE DATE/ TIME | | QC TYPE (Parent Sample) | CLIENT | PROJECT | TEST | PREP BATCH | MATRIX | DEL | RUSH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 111888 | 595910 | G-21 | 06/09/2015 | 1005 | | AECOM | GULL ROCK | ICP QSM | 52891 | S | **4** | |
| 111888 | 595912 | G-22 | 06/09/2015 | 1015 | | AECOM | GULL ROCK | ICP QSM | 52891 | S | **4** | |
| 111888 | 595914 | G-26 | 06/09/2015 | 0945 | | AECOM | GULL ROCK | ICP QSM | 52891 | S | **4** | |
| | 597247 | | | | CCV1 | | | MICP SOIL QSM | 0 | | | |
| | 597248 | | | | CCV2 | | | MICP SOIL QSM | 0 | | | |
| | 597249 | | | | CCB | | | MICP SOIL QSM | 0 | | | |

**25** SAMPLE COUNT ON RUN, INCLUDING METHOD AND INSTRUMENT QC



**Matrix: S-Soil Slg-Sludge GW-GroundWater M-Misc Waste SW-Surface Water A-Air WW-WasteWater DW-Drinking Water SD=Sediment Leachate=LE**

Distribution: C:\LIMSREPS\ANALYTICALRUN.RPT

# MICP QSM TCLP/HARDNESS Analytical Run
# 115840 on 06/30/2015

Date Analyzed: ______________  Date Reviewed: ______________

Date Entered: ______________  Date Validated: ______________

| COC | ORDER | SAMPLE DECRIPTION | SAMPLE DATE/ TIME | QC TYPE (Parent Sample) | CLIENT | PROJECT | TEST | PREP BATCH | MATRIX | DEL | RUSH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 597412 | | | ICV | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 597413 | | | ICVLL | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 597414 | | | ICB | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 597416 | | | ICSA | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 597417 | | | ICSAB | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 596108 | | | LCSW | | | HARDNESS TOTAL QSM | 52893 | | | |
| | 596107 | | | MBW | | | HARDNESS TOTAL QSM | 52893 | | | |
| | 597418 | | | CCV1 | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 597419 | | | CCV2 | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 597420 | | | CCB | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| 111888 | 595902 | SW-1 | 06/09/2015 1010 | | AECOM | GULL ROCK | HARDNESS TOTAL QSM | 52893 | SW | **4** | |
| 111888 | 595903 | SW-2 | 06/09/2015 1005 | Designated MS/MSD | AECOM | GULL ROCK | HARDNESS TOTAL QSM | 52893 | SW | **4** | |
| | 597421 | | | L 595903 | | | HARDNESS TOTAL QSM | 0 | | | |
| | 596109 | SW-2 | 06/09/2015 1005 | DUP 595903 | | | HARDNESS TOTAL QSM | 52893 | | | |
| | 596110 | SW-2 | 06/09/2015 1005 | MSW 595903 | | | HARDNESS TOTAL QSM | 52893 | | | |
| | 596111 | SW-2 | 06/09/2015 1005 | MSDW 596110 | | | HARDNESS TOTAL QSM | 52893 | | | |
| | 597422 | | | PDSW 595903 | | | HARDNESS TOTAL QSM | 0 | | | |
| 111888 | 595904 | SW-3 | 06/09/2015 0957 | | AECOM | GULL ROCK | HARDNESS TOTAL QSM | 52893 | SW | **4** | |
| 111888 | 595905 | SW-4 | 06/09/2015 0951 | | AECOM | GULL ROCK | HARDNESS TOTAL QSM | 52893 | SW | **4** | |

**Matrix: S-Soil Slg-Sludge GW-GroundWater M-Misc Waste SW-Surface Water A-Air WW-WasteWater DW-Drinking Water SD=Sediment Leachate=LE**

Distribution: Metals  C:\LIMSREPS\ANALYTICALRUN.RPT

MICP QSM TCLP/HARDNESS Analytical Run
# 115840 on 06/30/2015

Date Analyzed: ____________ Date Reviewed: ____________

Date Entered: ____________ Date Validated: ____________

| COC | ORDER | SAMPLE DECRIPTION | SAMPLE DATE/ TIME | | QC TYPE (Parent Sample) | CLIENT | PROJECT | TEST | PREP BATCH | MATRIX | DEL | RUSH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 111888 | 595906 | DUP-SW | 06/09/2015 | | | AECOM | GULL ROCK | HARDNESS TOTAL QSM | 52893 | SW | **4** | |
| | 597423 | | | | CCV1 | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 597424 | | | | CCV2 | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 597425 | | | | CCB | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| 111888 | 595907 | SW-5 | 06/09/2015 | 1030 | | AECOM | GULL ROCK | HARDNESS TOTAL QSM | 52893 | SW | **4** | |
| | 597426 | | | | CCV1 | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 597427 | | | | CCV2 | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 597428 | | | | CCB | | | MICP QSM TCLP/HARDNESS | 0 | | | |

**27** SAMPLE COUNT ON RUN, INCLUDING METHOD AND INSTRUMENT QC



**Matrix: S-Soil Slg-Sludge GW-GroundWater M-Misc Waste SW-Surface Water A-Air WW-WasteWater DW-Drinking Water SD=Sediment Leachate=LE**

Distribution: C:\LIMSREPS\ANALYTICALRUN.RPT

# MICP QSM TCLP/HARDNESS Analytical Run
# 115935 on 06/30/2015

Date Analyzed: ________________ Date Reviewed: ________________

Date Entered: ________________ Date Validated: ________________

| COC | ORDER | SAMPLE DECRIPTION | SAMPLE DATE/ TIME | QC TYPE (Parent Sample) | CLIENT | PROJECT | TEST | PREP BATCH | MATRIX | DEL | RUSH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 598443 | | | ICV | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 598444 | | | ICVLL | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 598445 | | | ICB | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 598446 | | | MRL | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 598447 | | | ICSA | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 598448 | | | ICSAB | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 598449 | | | CCV1 | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 598450 | | | CCV2 | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 598451 | | | CCB | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 597567 | | | LCSW | | | ICP QSM TCLP | 52930 | | | |
| | 597566 | | | MBW | | | ICP QSM TCLP | 52930 | | | |
| 111888 | 595909 | G-25 | 06/09/2015 0955 | | AECOM | GULL ROCK | ICP QSM TCLP | 52930 | M | **4** | |
| | 598452 | | | L 595909 | | | ICP QSM TCLP | 0 | | | |
| | 597568 | G-25 | 06/09/2015 0955 | DUP 595909 | | | ICP QSM TCLP | 52930 | | | |
| | 597569 | G-25 | 06/09/2015 0955 | MSW 595909 | | | ICP QSM TCLP | 52930 | | | |
| | 597570 | G-25 | 06/09/2015 0955 | MSDW 597569 | | | ICP QSM TCLP | 52930 | | | |
| | 598453 | | | PDSW 595909 | | | ICP QSM TCLP | 0 | | | |
| 111888 | 595911 | G-21 | 06/09/2015 1005 | | AECOM | GULL ROCK | ICP QSM TCLP | 52930 | M | **4** | |
| | 598454 | | | CCV1 | | | MICP QSM TCLP/HARDNESS | 0 | | | |

**Matrix: S-Soil Slg-Sludge GW-GroundWater M-Misc Waste SW-Surface Water A-Air WW-WasteWater DW-Drinking Water SD=Sediment Leachate=LE**

MICP QSM TCLP/HARDNESS Analytical Run
# 115935 on 06/30/2015

Date Analyzed: ____________ Date Reviewed: ____________

Date Entered: ____________ Date Validated: ____________

| COC | ORDER | SAMPLE DECRIPTION | SAMPLE DATE/ TIME | | QC TYPE (Parent Sample) | CLIENT | PROJECT | TEST | PREP BATCH | MATRIX | DEL | RUSH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 598455 | | | | CCV2 | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 598456 | | | | CCB | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| 111888 | 595913 | G-22 | 06/09/2015 | 1015 | | AECOM | GULL ROCK | ICP QSM TCLP | 52930 | M | **4** | |
| 111888 | 595915 | G-26 | 06/09/2015 | 0945 | | AECOM | GULL ROCK | ICP QSM TCLP | 52930 | M | **4** | |
| | 598457 | | | | CCV1 | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 598458 | | | | CCV2 | | | MICP QSM TCLP/HARDNESS | 0 | | | |
| | 598459 | | | | CCB | | | MICP QSM TCLP/HARDNESS | 0 | | | |

**26** SAMPLE COUNT ON RUN, INCLUDING METHOD AND INSTRUMENT QC



**Matrix: S-Soil Slg-Sludge GW-GroundWater M-Misc Waste SW-Surface Water A-Air WW-WasteWater DW-Drinking Water SD=Sediment Leachate=LE**

Distribution: C:\LIMSREPS\ANALYTICALRUN.RPT

# PREP WORKSHEET
## on 06/30/2015

Prep Batch **52,892** Date Prepped: 06/16/2015 Prepped By LJF

| Folder # | Order | QC Type | Link | Test | Matrix | Volume | Weight | Initial Volume | SDG Level | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| | 596102 | MBW | | ICP TOTAL QSM | LIQUID | 50 | | 50.0 | | |
| | 596103 | LCSW | | ICP TOTAL QSM | LIQUID | 50 | | 50.0 | | |
| 111888 | 595902 | | | ICP TOTAL QSM | SURFACE WATER | 50 | | 50.0 | 4 | |
| | 595903 | * | | ICP TOTAL QSM | SURFACE WATER | 50 | | 50.0 | 4 | |
| | 595904 | | | ICP TOTAL QSM | SURFACE WATER | 50 | | 50.0 | 4 | |
| | 595905 | | | ICP TOTAL QSM | SURFACE WATER | 50 | | 50.0 | 4 | |
| | 595906 | | | ICP TOTAL QSM | SURFACE WATER | 50 | | 50.0 | 4 | |
| | 595907 | | | ICP TOTAL QSM | SURFACE WATER | 50 | | 50.0 | 4 | |
| | 596104 | DUP | 595903 | ICP TOTAL QSM | SURFACE WATER | 50 | | 50.0 | | |
| | 596105 | MSW | 595903 | ICP TOTAL QSM | SURFACE WATER | 50 | | 50.0 | | |
| | 596106 | MSDW | 596105 | ICP TOTAL QSM | SURFACE WATER | 50 | | 50.0 | | |

Notes:________________________________________

# PREP WORKSHEET
# on 06/30/2015

Prep Batch **52,891** Date Prepped: 06/16/2015 Prepped By LJF

| Folder # | Order | QC Type | Link | Test | Matrix | Volume | Weight | Initial Volume | SDG Level | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| | 596028 | MBS | | ICP QSM | SOLID | 50 | 2.00 | | | |
| | 596029 | LCSS | | ICP QSM | SOLID | 50 | 2.00 | | | |
| 111888 | 595908 | | | ICP QSM | SOIL | 50 | 1.96 | | 4 | |
| | 595910 | | | ICP QSM | SOIL | 50 | 2.02 | | 4 | |
| | 595912 | | | ICP QSM | SOIL | 50 | 1.92 | | 4 | |
| | 595914 | | | ICP QSM | SOIL | 50 | 2.00 | | 4 | |
| | 596030 | DUP | 595908 | ICP QSM | SOIL | 50 | 1.95 | | | |
| | 596031 | MSS | 595908 | ICP QSM | SOIL | 50 | 1.93 | | | |
| | 596032 | MSDS | 596031 | ICP QSM | SOIL | 50 | 2.07 | | | |

Notes:________________________________________________

# PREP WORKSHEET
# on 06/30/2015

Prep Batch **52,893** Date Prepped: 06/16/2015 Prepped By LJF

| Folder # | Order | QC Type | Link | Test | Matrix | Volume | Weight | Initial Volume | SDG Level | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| | 596107 | MBW | | HARDNESS TOTAL | LIQUID | 50 | | 50.0 | | |
| | 596108 | LCSW | | HARDNESS TOTAL | LIQUID | 50 | | 50.0 | | |
| 111888 | 595902 | | | HARDNESS TOTAL | SURFACE WATER | 50 | | 50.0 | 4 | |
| | 595903 | * | | HARDNESS TOTAL | SURFACE WATER | 50 | | 50.0 | 4 | |
| | 595904 | | | HARDNESS TOTAL | SURFACE WATER | 50 | | 50.0 | 4 | |
| | 595905 | | | HARDNESS TOTAL | SURFACE WATER | 50 | | 50.0 | 4 | |
| | 595906 | | | HARDNESS TOTAL | SURFACE WATER | 50 | | 50.0 | 4 | |
| | 595907 | | | HARDNESS TOTAL | SURFACE WATER | 50 | | 50.0 | 4 | |
| | 596109 | DUP | 595903 | HARDNESS TOTAL | SURFACE WATER | 50 | | 50.0 | | |
| | 596110 | MSW | 595903 | HARDNESS TOTAL | SURFACE WATER | 50 | | 50.0 | | |
| | 596111 | MSDW | 596110 | HARDNESS TOTAL | SURFACE WATER | 50 | | 50.0 | | |

Notes:____________________

# PREP WORKSHEET
## on 06/30/2015

Prep Batch **52,930** Date Prepped: 06/19/2015 Prepped By LJF

| Folder # | Order | QC Type | Link | Test | Matrix | Volume | Weight | Initial Volume | SDG Level | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| | 597566 | MBW | | ICP QSM TCLP | LIQUID | 50 | | 50.0 | | |
| | 597567 | LCSW | | ICP QSM TCLP | LIQUID | 50 | | 50.0 | | |
| 111888 | 595909 | | | ICP QSM TCLP | TCLP | 50 | | 50.0 | 4 | |
| | 595911 | | | ICP QSM TCLP | TCLP | 50 | | 50.0 | 4 | |
| | 595913 | | | ICP QSM TCLP | TCLP | 50 | | 50.0 | 4 | |
| | 595915 | | | ICP QSM TCLP | TCLP | 50 | | 50.0 | 4 | |
| | 597568 | DUP | 595909 | ICP QSM TCLP | TCLP | 50 | | 50.0 | | |
| | 597569 | MSW | 595909 | ICP QSM TCLP | TCLP | 50 | | 50.0 | | |
| | 597570 | MSDW | 597569 | ICP QSM TCLP | TCLP | 50 | | 50.0 | | |

Notes:____________________________________________

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FMT3,4,5,6,7,8-01

# Metals Digestion Bench Sheet

(Prep Methods 3010, 3020, 3005, & 3050)

Program: QSM
*Matrix: SW

3010= ICP Liquids
3020= GFAA Liquids
3005= Sb Liquids
3050= ICP/GFAA Solids
7060/7740= GFAA, As & Se Liquids

| | |
|---|---|
| **Prep Batch #:** | 52892 |
| **Prep Method:** | 3010 |
| **Analyst:** | LJF |
| **Date:** | 06/16/2015 |
| **Start Time:** | 12:00 |

Prep Analyst: LJF
Balance ID:
End Date: 06/16/2015
End Time: 17:00

| Reagent: | Ref. # |
|---|---|
| Nitric Acid: | AB.601 |
| Hydrochloric Acid: | AB.600 |
| Hydrogen Peroxide: | |

Digestion Tube Lot #: 408268-7A-5039-CM
Block Used: A
Cell Position for Temp. Check: F-4
Initial-DigestionTemp (ºC): 93.2
Final-Digestion Temp (ºC): 93.2

| | Sample ID | | | (Solids) Sample Weight (g) | (Liquids) Sample Volume (ml) | Final Volume (ml) |
|---|---|---|---|---|---|---|
| | 596102 | (MB) | | | 50.0 | 50 |
| | 596103 | (LCS) | | | 50.0 | 50 |
| | 595902 | | | | 50.0 | 50 |
| | 595903 | Comments: | | | 50.0 | 50 |
| | 595904 | | | | 50.0 | 50 |
| | 595905 | | | | 50.0 | 50 |
| | 595906 | | | | 50.0 | 50 |
| | 595907 | | | | 50.0 | 50 |
| | | | | | | 50 |
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| | | | | | | 50 |
| | | | | | | 50 |
| | | | | | | 50 |
| | 596104 | (DUP) if applicable | | | 50.0 | 50 |
| | 596105 | (MS) | Parent Sample | | 50.0 | 50 |
| | 596106 | (MSD) | 595903 | | 50.0 | 50 |
| Leave >> | | (DUP) if applicable | | | | 50 |
| blank | | (MS) | Parent Sample | | | 50 |
| if N/A | | (MSD) | | | | 50 |

MB=Method Blank, LCS=Laboratory Control Sample, DUP=Duplicate, MS=Matrix Spike & MSD=Matrix Spike Duplicate
*Matrix: Soil, Sludge, Waste, GW=Groundwater, WW=Wastewater, Tissue, TLCP, SPLP, ASTM or other.

MS/MSD

| Spike Amount (ml) | Spike Ref. # |
|---|---|
| 0.2 | M12380 |
| 0.5 | M12320 |
| | |
| | |
| | |
| | |

LCS

| Spike Amount (ml) | Spike Ref. # |
|---|---|
| 0.2 | M12380 |
| 0.5 | M12320 |
| | |
| | |
| | |
| | |

Reviewed By/Date:

FMT3,4,5,6,7,8-01

# Metals Digestion Bench Sheet

(Prep Methods 3010, 3020, 3005, & 3050)

Program: QSM
*Matrix: SOIL

3010= ICP Liquids
3020= GFAA Liquids
3005= Sb Liquids
3050= ICP/GFAA Solids
7060/7740= GFAA, As & Se Liquids

| | |
|---|---|
| **Prep Batch #:** | 52891 |
| **Prep Method:** | 3050 |
| **Analyst:** | LJF |
| **Date:** | 06/16/2015 |
| **Start Time:** | 10:00 |

Prep Analyst: LJF
Balance ID: WXD2200
End Date: 06/16/2015
End Time: 14:00

| Reagent: | Ref. # |
|---|---|
| Nitric Acid: | AB.601 |
| Hydrochloric Acid: | AB.600 |
| Hydrogen Peroxide: | AB.595 |

Digestion Tube Lot #: 408268-7A-5039-CM
Block Used: B
Cell Position for Temp. Check: F-6
Initial-DigestionTemp (ºC): 93.2
Final-Digestion Temp (ºC): 93.2

| | Sample ID | | | (Solids) Sample Weight (g) | (Liquids) Sample Volume (ml) | Final Volume (ml) |
|---|---|---|---|---|---|---|
| | 596028 | (MB) | | 2.00 | | 50 |
| | 596029 | (LCS) | | 2.00 | | 50 |
| | 595908 | | | 1.96 | | 50 |
| | 595910 | **Comments:** | | 2.02 | | 50 |
| | 595912 | | | 1.92 | | 50 |
| | 595914 | | | 2.00 | | 50 |
| | | | | | | 50 |
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| | | | | | | 50 |
| | | | | | | 50 |
| | | | | | | 50 |
| | 596030 | (DUP) if applicable | | 1.95 | | 50 |
| | 596031 | (MS) | Parent Sample | 1.93 | | 50 |
| | 596032 | (MSD) | 595908 | 2.07 | | 50 |
| Leave >> | | (DUP) if applicable | | | | 50 |
| blank | | (MS) | Parent Sample | | | 50 |
| if N/A | | (MSD) | | | | 50 |

MB=Method Blank, LCS=Laboratory Control Sample, DUP=Duplicate, MS=Matrix Spike & MSD=Matrix Spike Duplicate
*Matrix: Soil, Sludge, Waste, GW=Groundwater, WW=Wastewater, Tissue, TLCP, SPLP, ASTM or other.

MS/MSD

| Spike Amount (ml) | Spike Ref. # |
|---|---|
| 1 | M12380 |
| | |
| | |
| | |
| | |
| | |

LCS

| Spike Amount (ml) | Spike Ref. # |
|---|---|
| 1 | M12380 |
| | |
| | |
| | |
| | |
| | |

Reviewed By/Date:________________

FMT3,4,5,6,7,8-01

# Metals Digestion Bench Sheet

(Prep Methods 3010, 3020, 3005, & 3050)

Program: QSM
*Matrix: SW

3010= ICP Liquids
3020= GFAA Liquids
3005= Sb Liquids
3050= ICP/GFAA Solids
7060/7740= GFAA, As & Se Liquids

| | |
|---|---|
| **Prep Batch #:** | 52893 |
| **Prep Method:** | 3010 |
| **Analyst:** | LJF |
| **Date:** | 06/16/2015 |
| **Start Time:** | 12:00 |

Prep Analyst: LJF
Balance ID:
End Date: 06/16/2015
End Time: 17:00

| Reagent: | Ref. # |
|---|---|
| Nitric Acid: | AB.601 |
| Hydrochloric Acid: | AB.600 |
| Hydrogen Peroxide: | |

Digestion Tube Lot #: 408268-7A-5039-CM
Block Used: A
Cell Position for Temp. Check: F-4
Initial-DigestionTemp (ºC): 93.2
Final-Digestion Temp (ºC): 93.2

| | Sample ID | | | (Solids) Sample Weight (g) | (Liquids) Sample Volume (ml) | Final Volume (ml) |
|---|---|---|---|---|---|---|
| | 596107 | (MB) | | | 50.0 | 50 |
| | 596108 | (LCS) | | | 50.0 | 50 |
| | 595902 | | | | 50.0 | 50 |
| | 595903 | Comments: | | | 50.0 | 50 |
| | 595904 | | | | 50.0 | 50 |
| | 595905 | | | | 50.0 | 50 |
| | 595906 | | | | 50.0 | 50 |
| | 595907 | | | | 50.0 | 50 |
| | | | | | | 50 |
| | | | | | | 50 |
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| | | | | | | 50 |
| | | | | | | 50 |
| | | | | | | 50 |
| | | | | | | 50 |
| | 596109 | (DUP) if applicable | | | 50.0 | 50 |
| | 596110 | (MS) | Parent Sample | | 50.0 | 50 |
| | 596111 | (MSD) | 595903 | | 50.0 | 50 |
| Leave >> | | (DUP) if applicable | | | | 50 |
| blank | | (MS) | Parent Sample | | | 50 |
| if N/A | | (MSD) | | | | 50 |

MB=Method Blank, LCS=Laboratory Control Sample, DUP=Duplicate, MS=Matrix Spike & MSD=Matrix Spike Duplicate
*Matrix: Soil, Sludge, Waste, GW=Groundwater, WW=Wastewater, Tissue, TLCP, SPLP, ASTM or other.

MS/MSD

| Spike Amount (ml) | Spike Ref. # |
|---|---|
| 0.2 | M12380 |
| 0.5 | M12320 |
| | |
| | |
| | |
| | |

LCS

| Spike Amount (ml) | Spike Ref. # |
|---|---|
| 0.2 | M12380 |
| 0.5 | M12320 |
| | |
| | |
| | |
| | |

Reviewed By/Date:

FMT3,4,5,6,7,8-01

# Metals Digestion Bench Sheet

(Prep Methods 3010, 3020, 3005, & 3050)

Program: QSM
*Matrix: TCLP

3010= ICP Liquids
3020= GFAA Liquids
3005= Sb Liquids
3050= ICP/GFAA Solids
7060/7740= GFAA, As & Se Liquids

| | |
|---|---|
| **Prep Batch #:** | 52930 |
| **Prep Method:** | 3010 |
| **Analyst:** | LJF |
| **Date:** | 06/19/2015 |
| **Start Time:** | 07:00 |

Prep Analyst: LJF
Balance ID:
End Date: 06/19/2015
End Time: 12:00

| Reagent: | Ref. # |
|---|---|
| Nitric Acid: | AB.601 |
| Hydrochloric Acid: | AB.600 |
| Hydrogen Peroxide: | |

Digestion Tube Lot #: 408268-7A-5039-CM
Block Used: A
Cell Position for Temp. Check: F-4
Initial-DigestionTemp (ºC): 93.2
Final-Digestion Temp (ºC): 93.2

| | Sample ID | | | (Solids) Sample Weight (g) | (Liquids) Sample Volume (ml) | Final Volume (ml) |
|---|---|---|---|---|---|---|
| | 597566 | (MB) | | | 50.0 | 50 |
| | 597567 | (LCS) | | | 50.0 | 50 |
| | 595909 | | | | 50.0 | 50 |
| | 595911 | Comments: | | | 50.0 | 50 |
| | 595913 | | | | 50.0 | 50 |
| | 595915 | | | | 50.0 | 50 |
| | | | | | | 50 |
| | | | | | | 50 |
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| | | | | | | 50 |
| | | | | | | 50 |
| | | | | | | 50 |
| | 597568 | (DUP) if applicable | | | 50.0 | 50 |
| | 597569 | (MS) | Parent Sample | | 50.0 | 50 |
| | 597570 | (MSD) | 595909 | | 50.0 | 50 |
| Leave >> | | (DUP) if applicable | | | | 50 |
| blank | | (MS) | Parent Sample | | | 50 |
| if N/A | | (MSD) | | | | 50 |

MB=Method Blank, LCS=Laboratory Control Sample, DUP=Duplicate, MS=Matrix Spike & MSD=Matrix Spike Duplicate
*Matrix: Soil, Sludge, Waste, GW=Groundwater, WW=Wastewater, Tissue, TLCP, SPLP, ASTM or other.

MS/MSD

| Spike Amount (ml) | Spike Ref. # |
|---|---|
| 0.2 | M12380 |
| | |
| | |
| | |
| | |
| | |

LCS

| Spike Amount (ml) | Spike Ref. # |
|---|---|
| 0.2 | M12380 |
| | |
| | |
| | |
| | |
| | |

Reviewed By/Date:

| iCAP 6000 / 6500 Data Review Checklist | Analysis Date: 6-16-15 | | Data File: DO Orresults v643 | Date of review: 06/23/15 |
|---|---|---|---|---|
| Cal Std ID: 1112522 LIMS #: 115839 | Analyst: | Reviewer: mos | Approved? Yes No | |

Is Audit Trail turned on or Manual Manipulations addressed? Yes / No (If no, any manual manipulations must be initialed, dated, and reason(s) stated for change)

| QC Parameters : 6010 / 200.7 / QSM / Other | YES | NO | YES | NO | Comments: |
|---|---|---|---|---|---|
| 1) Calibration linearity: r > 0.995 / r > 0.998 | ✓ | | ✓ | | |
| 2) ICV: 90-110% / 95-105% | ✓ | | ✓ | | |
| 2) ICVLL: 70-130% / 80-120% | ✓ | | ✓ | | |
| 3) ICB: < 3X IDL / <LOD / <LOQ | ✓ | | ✓ | | |
| 4) ICSA: < ABS LOD | ✓ | | ✓ | | |
| 5) ICSAB: 80-120% | ✓ | | ✓ | | |
| 6) MRL: 70-130% / 80-120% | | | | | |
| 7) MDL Check: >LOD | | | | | |
| 8) CCV1/CCB1 (CCV: 90-110% ) | ✓ | | ✓ | | |
| 9) CCV2/CCB2 (CCB: < 3X IDL / <LOD / <LOQ) | | | | | |
| 10) CCV3/CCB3 | | | | | |
| 11) CCV4/CCB4 | | | | | |
| 12) CCV5/CCB5 | | | | | |
| **Preparation Batch Parameters** | **YES** | **NO** | **YES** | **NO** | |
| Prep Batch ID#: 528911 Dig. Meth. 3050 | ✓ | | ✓ | | |
| LCS - generated limits or project specific limits | ✓ | | ✓ | | |
| MB - <LOD or ≤ ½ RL | ✓ | | ✓ | | |
| Spiked samples in batch: | | | | | |
| a) 595908 matrix = S | ✓ | ✓ | ✓ | ✓ | MS, MSD fail Linvalid |
| b)____ matrix = ____ | | | | | |
| c)____ matrix = ____ | | | | | |
| PDS: ±15% / 20% / 25% Sample#: a | ✓ | ✓ | ✓ | ✓ | fail "M" |
| Prep Batch ID#:____ Dig. Meth.____ | | | | | |
| LCS - generated limits or project specific limits | | | | | |
| MB - <LOD or ≤ ½ RL | | | | | |
| Spiked samples in batch: | | | | | |
| a)____ matrix = ____ | | | | | |
| b)____ matrix = ____ | | | | | |
| c)____ matrix = ____ | | | | | |
| PDS: ±15% / 20% / 25% Sample#:____ | | | | | |
| Prep Batch ID#:____ Dig. Meth.____ | | | | | |
| LCS - generated limits or project specific limits | | | | | |
| MB - <LOD or ≤ ½ RL | | | | | |
| Spiked samples in batch: | | | | | |
| a)____ matrix = ____ | | | | | |
| b)____ matrix = ____ | | | | | |
| c)____ matrix = ____ | | | | | |
| PDS: ±15% / 20% / 25% Sample#:____ | | | | | |
| Prep Batch ID#:____ Dig. Meth.____ | | | | | |
| LCS - generated limits or project specific limits | | | | | |
| MB - <LOD or ≤ ½ RL | | | | | |
| Spiked samples in batch: | | | | | |
| a)____ matrix = ____ | | | | | |
| b)____ matrix = ____ | | | | | |
| c)____ matrix = ____ | | | | | |
| PDS: ±15% / 20% / 25% Sample#:____ | | | | | |

| iCAP 6000 / 6500 Data Review Checklist | Analysis Date: 6-17-15 | Data File: DODResults v644 | Date of review: 06/19/15 |
|---|---|---|---|
| Cal Std ID: M15523 LIMS #: 115840 115833 | Analyst: [illegible] | Reviewer: MDS | Approved? Yes No |

Is Audit Trail turned on or Manual Manipulations addressed? Yes / No (If no, any manual manipulations must be initialed, dated, and reason(s) stated for change)

| QC Parameters : 6010 / 200.7 / QSM / Other | YES | NO | YES | NO | Comments: |
|---|---|---|---|---|---|
| 1) Calibration linearity: r > 0.995 / r > 0.998 | ✓ | | ✓ | | |
| 2) ICV: 90-110% / 95-105% | ✓ | | ✓ | | |
| 2) ICVLL: 70-130% / 80-120% | ✓ | | ✓ | | |
| 3) ICB: < 3X IDL / <LOD / <LOQ | ✓ | | ✓ | | |
| 4) ICSA: < ABS LOD | ✓ | | ✓ | | |
| 5) ICSAB: 80-120% | ✓ | | ✓ | | |
| 6) MRL: 70-130% / 80-120% | | | | | |
| 7) MDL Check: >LOD | | | | | |
| 8) CCV1/CCB1 (CCV: 90-110% ) | ✓ | | ✓ | | |
| 9) CCV2/CCB2 (CCB: < 3X IDL / <LOD / <LOQ) | | | | | |
| 10) CCV3/CCB3 | | | | | |
| 11) CCV4/CCB4 | | | | | |
| 12) CCV5/CCB5 | | | | | |
| **Preparation Batch Parameters** | **YES** | **NO** | **YES** | **NO** | |
| Prep Batch ID#: 52893 Dig. Meth. 3010 | ✓ | | ✓ | | |
| LCS - generated limits or project specific limits | ✓ | | ✓ | | |
| MB - <LOD or ≤ ½ RL | ✓ | ✓ | ✓ | ✓ | mg >LOD <½RL Samples >10x |
| Spiked samples in batch: | | | | | |
| a) 595903 matrix = SW | ✓ | ✓ | ✓ | ✓ | L fail mg MS failed Pb |
| b)____ matrix = ____ | | | | | |
| c)____ matrix = ____ | | | | | |
| PDS: ±15% / 20% / 25% Sample#: a | ✓ | | ✓ | | Pass no flags |
| Prep Batch ID#:____ Dig. Meth.____ | | | | | |
| LCS - generated limits or project specific limits | | | | | |
| MB - <LOD or ≤ ½ RL | | | | | |
| Spiked samples in batch: | | | | | |
| a)____ matrix = ____ | | | | | |
| b)____ matrix = ____ | | | | | |
| c)____ matrix = ____ | | | | | |
| PDS: ±15% / 20% / 25% Sample#:____ | | | | | |
| Prep Batch ID#:____ Dig. Meth.____ | | | | | |
| LCS - generated limits or project specific limits | | | | | |
| MB - <LOD or ≤ ½ RL | | | | | |
| Spiked samples in batch: | | | | | |
| a)____ matrix = ____ | | | | | |
| b)____ matrix = ____ | | | | | |
| c)____ matrix = ____ | | | | | |
| PDS: ±15% / 20% / 25% Sample#:____ | | | | | |
| Prep Batch ID#:____ Dig. Meth.____ | | | | | |
| LCS - generated limits or project specific limits | | | | | |
| MB - <LOD or ≤ ½ RL | | | | | |
| Spiked samples in batch: | | | | | |
| a)____ matrix = ____ | | | | | |
| b)____ matrix = ____ | | | | | |
| c)____ matrix = ____ | | | | | |
| PDS: ±15% / 20% / 25% Sample#:____ | | | | | |

| iCAP 6000 / 6500 Data Review Checklist | Analysis Date: 06/19/15 | | Data File: DOD Revision 652 Date of review: 6/23/15 | | |
|---|---|---|---|---|---|
| Cal Std ID: MT2522 LIMS #: 115935 | Analyst: NAH (MOS) | Reviewer: [illegible] | Approved? Yes No | | |
| Is Audit Trail turned on or Manual Manipulations addressed? Yes / No (If no, any manual manipulations must be initialed, dated, and reason(s) stated for change) | | | | | |
| **QC Parameters : 6010 / 200.7 / QSM / Other** | **YES** | **NO** | **YES** | **NO** | **Comments:** |
| 1) Calibration linearity: r > 0.995 / r > 0.998 | ✓ | | ✓ | | |
| 2) ICV: 90-110% / 95-105% | ✓ | | ✓ | | |
| 2) ICVLL: 70-130% / 80-120% | ✓ | | ✓ | | |
| 3) ICB: < 3X IDL / <LOD / <LOQ | ✓ | | ✓ | | |
| 4) ICSA: < ABS LOD | ✓ | | ✓ | | |
| 5) ICSAB: 80-120% | ✓ | | ✓ | | |
| 6) MRL: 70-130% / 80-120% | ✓ | | ✓ | | |
| 7) MDL Check: >LOD | | | | | |
| 8) CCV1/CCB1 (CCV: 90-110% ) | ✓ | | ✓ | | |
| 9) CCV2/CCB2 (CCB: < 3X IDL / <LOD / <LOQ) | | | | | |
| 10) CCV3/CCB3 | | | | | |
| 11) CCV4/CCB4 | | | | | |
| 12) CCV5/CCB5 | | | | | |
| **Preparation Batch Parameters** | **YES** | **NO** | **YES** | **NO** | |
| Prep Batch ID#: 52930 Dig. Meth. M | ✓ | | ✓ | | |
| LCS - generated limits or project specific limits | ✓ | | ✓ | | |
| MB - <LOD or ≤ ½ RL | ✓ | | ✓ | | |
| Spiked samples in batch: | | | | | |
| a) 595909 matrix = M | ✓ | ✓ | ✓ | ✓ | L+Dup invalid, MS/MSD Failed |
| b)___ matrix = ___ | | | | | |
| c)___ matrix = ___ | | | | | |
| PDS: ±15% / 20% / 25% Sample#: 9 | ✓ | | ✓ | | PDS ok, no Flag |
| Prep Batch ID#:___ Dig. Meth.___ | | | | | |
| LCS - generated limits or project specific limits | | | | | |
| MB - <LOD or ≤ ½ RL | | | | | |
| Spiked samples in batch: | | | | | |
| a)___ matrix = ___ | | | | | |
| b)___ matrix = ___ | | | | | |
| c)___ matrix = ___ | | | | | |
| PDS: ±15% / 20% / 25% Sample#:___ | | | | | |
| Prep Batch ID#:___ Dig. Meth.___ | | | | | |
| LCS - generated limits or project specific limits | | | | | |
| MB - <LOD or ≤ ½ RL | | | | | |
| Spiked samples in batch: | | | | | |
| a)___ matrix = ___ | | | | | |
| b)___ matrix = ___ | | | | | |
| c)___ matrix = ___ | | | | | |
| PDS: ±15% / 20% / 25% Sample#:___ | | | | | |
| Prep Batch ID#:___ Dig. Meth.___ | | | | | |
| LCS - generated limits or project specific limits | | | | | |
| MB - <LOD or ≤ ½ RL | | | | | |
| Spiked samples in batch: | | | | | |
| a)___ matrix = ___ | | | | | |
| b)___ matrix = ___ | | | | | |
| c)___ matrix = ___ | | | | | |
| PDS: ±15% / 20% / 25% Sample#:___ | | | | | |

# CT Laboratories Instrument Run Log

**Instrument ID: ICP 6500**

| Date | Time Start/End | Analyst | Analytes | LIMS run or Samples Analyzed | Sequence ID | Cal Std ID | Neb Pressure | Comments |
|---|---|---|---|---|---|---|---|---|
| 6-3-15 | 1216/1832 | JA | Dod Cal u | 115321 115450 115323 115378 | D060315 | M12522 | 280 | V628 |
| 6-4-15 | 1214/0447 | JA | Dod Cal u | 115466 115467 115502, 115501, 115514 115502 115470, 115469 115510 | D060415 | M12522 | 280 | V630 |
| 6-8-15 | 1054/0140 | JA | DOD Cal u | 115568 115470 115585 115553 115546 115360 115469 115567 115552 115551 | D060815 | M12522 | 300 | V634, V635 |
| 6-10-15 | 1056/1724 | JA | DOD Cal u 115[illegible] 115[illegible] | 115536 115569 115510 115576, 115582 115567 115553, 115552, 115546, 115[illegible] 115[illegible] | D061015 | M12522 | 300 | V636 |
| 6-11-15 | 1400/1905 | JA | DOD Cal u | 115672, 115673 | D061115 | M12522 | 300 | V637 |
| 6-12-15 | 0830/1944 | JA | DOD Cal u | 115374, 115781 115702 115690 115706, 115704, 115688 | D061215 | M12522 | 300 | V638, V639, V640 |
| 6-15-15 | 1426/1831 | JA | DOD Cal u | 115750, 115752 | D061515 | M12522 | 300 | V641 |
| 6-16-15 | 1350/0240 | JA | DOD Cal u | 115690, 115832 115752, 115750 115774 115702 115810 115747 115749 1157[illegible] | D061515 | M12522 | 300 | V642, V643, V648 |
| 6-17-15 | 1317/1831 | JA | DOD Cal u | 115773, 115771 115835 115839 115770 115834, 115837 115840, 115833 | D061715 | M12522 | 300 | V644 |
| 6-18-15 | 1323/2233 | JA | DOD Cal u | 115704 115915 115851, 115852, 853 115807 115856 115880, 115881 115913 115918 115888 115886 115885 115750 115945 | D061815 | M12522 | 300 | V647, V649 |
| 6-19-15 | 1419/2201 | JA | DOD Cal u | 115937, 115935, 115936, 115946 | D061915 | M12522 | 300 | V652, ~~V654~~ ~~V655~~ V658 |
| 6-22-15 | 1619/2236 | MOS | DOD Cal u | 115945, 115936, 115937, 115966, 115967 | D062215 | M12522 | 300 | V659 |
| 6-23-15 | ~~1056~~ 0727/1359 | MOS | DODCal u | 115750, 116010, 116008 116012, 116011 | D062315 | M12522 | 300 | V660 |
| 6-24-15 | ~~1056~~ 0859/2013 | MOS | DODCal u | 116011, 115937, 115967, 116010 115750, 116069, 115945, 115936, 116008, 116012 | D062415 | M12522 | 300 | ~~V662~~ V664 |
| 6-25-15 | 1123/1530 | MOS | DODCal u | 116083, 116082, 115967 | D062515 | M12522 | 300 | V667 |
| 6-26-15 | 1030/1351 | MOS | DODCal u | 116145, 116144, 115967 | D062615 | M12522 | 320 | V670 |
| 6-29-15 | 0908/ | JA | DOD Cal u | 116177 116178, 116180 116175 116170, 1161[illegible] 116176 115697 116173 116169 | D0629-15 | M12522 | 300 | V669 |
| 6-30-15 | / | JA | DOD Cal u | | D0630-15 | M12522 | 300 | |
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| Type | Date/Time | Message | User name | Application | Sequence Name |
|---|---|---|---|---|---|
| | 06/15/2015 23:06:30 | Running l594599 (69) | NAH | Analyst | S_DOD Calibration |
| | 06/15/2015 23:11:00 | Running dup594599 (70) | NAH | Analyst | S_DOD Calibration |
| | 06/15/2015 23:15:18 | Running ccv1 (28) | NAH | Analyst | S_DOD Calibration |
| | 06/15/2015 23:19:45 | Running ccv2 (26) | NAH | Analyst | S_DOD Calibration |
| | 06/15/2015 23:23:38 | Running ccb (27) | NAH | Analyst | S_DOD Calibration |
| | 06/15/2015 23:28:00 | Running msw594599 (71) | NAH | Analyst | S_DOD Calibration |
| | 06/15/2015 23:32:12 | Running msdw594599 (72) | NAH | Analyst | S_DOD Calibration |
| | 06/15/2015 23:36:24 | Running pdsw594599 (73) | NAH | Analyst | S_DOD Calibration |
| | 06/15/2015 23:40:52 | Running lcsw52871 (74) | NAH | Analyst | S_DOD Calibration |
| | 06/15/2015 23:45:28 | Running mbw52871 (75) | NAH | Analyst | S_DOD Calibration |
| | 06/15/2015 23:49:49 | Running 595161 (76) | NAH | Analyst | S_DOD Calibration |
| | 06/15/2015 23:54:22 | Running l595161 (77) | NAH | Analyst | S_DOD Calibration |
| | 06/15/2015 23:59:04 | Running dup595161 (78) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 00:03:39 | Running msw595161 (79) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 00:08:12 | Running msdw595161 (80) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 00:12:45 | Running ccv1 (28) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 00:16:24 | Running ccv2 (26) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 00:20:46 | Running ccb (27) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 00:25:08 | Running pdsw595161 (81) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 00:29:41 | Running MRL (24) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 00:33:59 | Running ccv1 (28) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 00:38:21 | Running ccv2 (26) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 00:42:44 | Running ccb (27) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 00:47:00 | Plasma off | NAH | iTEVA Control Center | |
| | 06/16/2015 00:47:01 | Plasma extinguished successfully | NAH | Analyst | |
| | 06/16/2015 00:47:03 | Autosampler Run Completed | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 07:19:55 | Plasma On | NAH | iTEVA Control Center | |
| | 06/16/2015 07:20:00 | Plasma ignition successful | NAH | Analyst | |
| | 06/16/2015 07:20:46 | D33534 - Debug:Wavelength check : x = 1.751, y =0.233 | NAH | Analyst | |
| | 06/16/2015 13:44:44 | Autosampler Run Started | NAH | Analyst | |
| | 06/16/2015 13:44:44 | Sequence Started | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 13:45:10 | Running Blank (1) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 13:49:34 | Running CalStd1=0.25 (2) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 13:50:11 | Autosampler Run Completed | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 13:50:27 | Autosampler Run Started | NAH | Analyst | |
| | 06/16/2015 13:50:27 | Sequence Started | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 13:50:53 | Running Blank (1) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 13:55:17 | Running CalStd1=0.25 (2) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 13:59:41 | Running CalStd2=0.5 (3) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 14:04:03 | Running CalStd3=1 (4) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 14:08:26 | Running CalStd4=5 (5) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 14:12:48 | Running CalStd5=10 (6) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 14:17:10 | Running CalStd6=20 (7) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 14:18:28 | Closing will close the method and all associated samples. | NAH | Analyst | |
| | 06/16/2015 14:21:28 | Running CalStd7=50 (8) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 14:25:47 | Running CalStd8=100 (9) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 14:30:00 | Running CalStd9=1000 (10) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 14:33:51 | Running CalStd10=10000 (11) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 14:38:16 | Running CalStd11-100k (12) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 14:42:37 | Running CalStd12-100000 (13) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 14:47:28 | Running CalStd13=500000 (14) | NAH | Analyst | S_DOD Calibration |

| Type | Date/Time | Message | User name | Application | Sequence Name |
|---|---|---|---|---|---|
| | 06/16/2015 14:52:10 | Running CalStd14-1000k (15) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 14:57:12 | Running blkrinse (22) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 15:01:31 | Running icv (16) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 15:05:44 | Running ICVLL (25) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 15:09:57 | Running icb (17) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 15:14:19 | Running icb (17) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 15:18:40 | Running MRL (24) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 15:22:58 | Running icsa (20) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 15:27:39 | Running icsab (21) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 15:32:02 | Running 593817 (1) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 15:36:16 | Running 593826 (2) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 15:40:37 | Running 593829 (3) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 15:45:04 | Running 572336 (4) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 15:48:58 | Running 572336 (5) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 15:52:53 | Running lcsw52900 (6) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 15:56:49 | Running mbw52900 (7) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 16:01:10 | Running 595834 (8) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 16:05:07 | Running l595834 (9) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 16:09:12 | Running dup595834 (10) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 16:13:06 | Running ccv1 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 16:17:27 | Running ccv2 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 16:21:24 | Running ccb (19) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 16:25:46 | Running msw595834 (11) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 16:29:55 | Running pdsw595834 (12) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 16:34:03 | Running 595870 (13) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 16:38:47 | Running msw595870 (14) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 16:43:20 | Running msdw595870 (15) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 16:47:49 | Running lcsw52856 55 (16) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 16:52:28 | Running mbw52856 55 (17) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 16:56:47 | Running 594191 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 17:01:29 | Running msw594191 (19) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 17:06:04 | Running msdw594191 (20) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 17:10:38 | Running ccv1 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 17:15:04 | Running ccv2 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 17:19:02 | Running ccb (19) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 17:23:23 | Running pdsw594191 (21) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 17:27:54 | Running 594399 (22) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 17:32:42 | Running msw594399 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 17:37:22 | Running msdw594399 (24) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 17:42:09 | Running pdsw594399 (25) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 17:46:53 | Running 594400 (26) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 17:51:57 | Running 594401 (27) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 17:56:39 | Running 594460 (28) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 18:01:16 | Running lcsw52857  (29) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 18:05:53 | Running mbw52757 (30) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 18:10:12 | Running ccv1 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 18:14:38 | Running ccv2 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 18:18:35 | Running ccb (19) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 18:22:57 | Running 594255 (31) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 18:27:47 | Running l594255 (32) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 18:32:19 | Running dup594255 (33) | NAH | Analyst | S_DOD Calibration |

| Type | Date/Time | Message | User name | Application | Sequence Name |
|---|---|---|---|---|---|
| | 06/16/2015 18:37:10 | Running msw594255 (34) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 18:41:41 | Running msdw594255 (35) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 18:46:12 | Running pdsw594255 (36) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 18:50:43 | Running 594300 (37) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 18:55:24 | Running 594302 (38) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 19:00:15 | Running 594303 (39) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 19:05:05 | Running lcsw52858 (40) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 19:09:16 | Running ccv1 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 19:13:46 | Running ccv2 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 19:17:43 | Running ccb (19) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 19:22:05 | Running mbw52858 (41) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 19:26:26 | Running 594408 (42) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 19:31:08 | Running l594408 (43) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 19:35:43 | Running dup594408 (44) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 19:40:24 | Running msw594408 (45) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 19:44:57 | Running msdw594408 (46) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 19:49:31 | Running pdsw594408 (47) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 19:54:05 | Running 594415 (48) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 19:58:32 | Running 594416 (49) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 20:03:04 | Running 594243 (50) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 20:07:36 | Running ccv1 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 20:12:02 | Running ccv2 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 20:16:00 | Running ccb (19) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 20:20:23 | Running 594245 (51) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 20:25:04 | Running 594249 (52) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 20:29:38 | Running 594250 (53) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 20:34:12 | Running 594251 (54) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 20:38:58 | Running 594252 (55) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 20:43:28 | Running 594253 (56) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 20:47:57 | Running 594254 (57) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 20:52:28 | Running 594255 (58) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 20:56:57 | Running 594256 (59) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 21:01:29 | Running 594257 (60) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 21:06:04 | Running ccv1 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 21:10:30 | Running ccv2 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 21:14:28 | Running ccb (19) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 21:18:50 | Running 594258 (61) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 21:23:25 | Running 594259 (62) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 21:27:54 | Running 594262 (63) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 21:32:33 | Running 594263 (64) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 21:36:53 | Running 594265 (65) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 21:41:39 | Running msw594265 (66) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 21:46:13 | Running msdw594265 (67) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 21:50:50 | Running 595272 (68) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 21:55:20 | Running 595273 (69) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 22:00:00 | Running 595275 (70) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 22:04:33 | Running ccv1 (28) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 22:08:30 | Running ccv2 (26) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 22:12:29 | Running ccb (27) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 22:16:52 | Running 595276 (71) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 22:21:26 | Running msw595276 (72) | NAH | Analyst | S_DOD Calibration |

| Type | Date/Time | Message | User name | Application | Sequence Name |
|---|---|---|---|---|---|
| | 06/16/2015 22:25:58 | Running msdw595276 (73) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 22:30:29 | Running 595340 (74) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 22:35:16 | Running lcsw52873 (75) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 22:39:28 | Running mbw52873 (76) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 22:43:49 | Running 594599 (77) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 22:48:07 | Running l594599 (78) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 22:52:53 | Running dup594599 (79) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 22:57:11 | Running msw594599 (80) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 23:01:24 | Running ccv1 (28) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 23:05:52 | Running ccv2 (26) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 23:09:48 | Running ccb (27) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 23:14:10 | Running msdw594599 (81) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 23:18:22 | Running pdsw594599 (82) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 23:22:44 | Running lcsw52871 (83) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 23:27:20 | Running mbw52871 (84) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 23:31:40 | Running 595161 (85) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 23:36:15 | Running l595161 (86) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 23:40:56 | Running dup595161 (87) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 23:45:31 | Running msw595161 (88) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 23:50:04 | Running msdw595161 (89) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 23:54:39 | Running pdsw595161 (90) | NAH | Analyst | S_DOD Calibration |
| | 06/16/2015 23:59:20 | Running ccv1 (28) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 00:03:48 | Running ccv2 (26) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 00:07:46 | Running ccb (27) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 00:12:08 | Running lcswtclp1 (91) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 00:16:03 | Running mbwtclp1 (92) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 00:20:25 | Running 594030 (93) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 00:24:53 | Running 594032 (94) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 00:29:19 | Running 594034 (95) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 00:33:49 | Running msw594034 (96) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 00:38:13 | Running blk1 (97) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 00:42:34 | Running blk2 (98) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 00:46:56 | Running blk3 (99) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 00:51:19 | Running lcss52891 (100) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 00:55:10 | Running ccv1 (28) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 00:59:41 | Running ccv2 (26) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 01:03:39 | Running ccb (27) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 01:08:02 | Running mbs52891 (101) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 01:12:22 | Running 595908 (102) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 01:16:44 | Running l595908 (103) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 01:20:49 | Running dup595908 (104) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 01:25:06 | Running mss595908 (105) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 01:29:25 | Running msds595908 (106) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 01:33:38 | Running pdss595908 (107) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 01:37:56 | Running 595910 (108) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 01:42:11 | Running 595912 (109) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 01:46:30 | Running 595914 (110) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 01:50:53 | Running ccv1 (28) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 01:55:20 | Running ccv2 (26) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 01:59:18 | Running ccb (27) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 02:03:41 | Running lcss52890 (111) | NAH | Analyst | S_DOD Calibration |

| Type | Date/Time | Message | User name | Application | Sequence Name |
|---|---|---|---|---|---|
| | 06/17/2015 02:07:31 | Running mbs52890 (112) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 02:11:51 | Running 595922 (113) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 02:15:53 | Running mss595922 (114) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 02:19:56 | Running msds595922 (115) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 02:23:59 | Running pdss595922 (116) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 02:28:07 | Running MRL (24) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 02:32:25 | Running ccv1 (28) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 02:36:49 | Running ccv2 (26) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 02:40:50 | Running ccb (27) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 02:45:09 | Plasma off | NAH | iTEVA Control Center | |
| | 06/17/2015 02:45:10 | Plasma extinguished successfully | NAH | Analyst | |
| | 06/17/2015 02:45:12 | Autosampler Run Completed | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 06:53:08 | Plasma On | NAH | iTEVA Control Center | |
| | 06/17/2015 06:53:13 | Plasma ignition successful | NAH | Analyst | |
| | 06/17/2015 06:54:00 | D33534 - Debug:Wavelength check : x = 1.858, y =0.383 | NAH | Analyst | |
| | 06/17/2015 11:27:01 | iTEVA loaded | NAH | iTEVA Control Center | |
| | 06/17/2015 11:27:19 | Connected to instrument 20082101 | NAH | iTEVA Control Center | |
| | 06/17/2015 11:27:59 | Plasma On | NAH | iTEVA Control Center | |
| | 06/17/2015 13:06:29 | Autosampler Run Started | NAH | Analyst | |
| | 06/17/2015 13:06:29 | Sequence Started | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 13:06:55 | Running Blank (1) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 13:11:20 | Running CalStd1=0.25 (2) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 13:15:44 | Running CalStd2=0.5 (3) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 13:17:12 | Autosampler Run Completed | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 13:17:21 | Autosampler Run Started | NAH | Analyst | |
| | 06/17/2015 13:17:21 | Sequence Started | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 13:17:48 | Running Blank (1) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 13:22:12 | Running CalStd1=0.25 (2) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 13:26:35 | Running CalStd2=0.5 (3) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 13:31:00 | Running CalStd3=1 (4) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 13:35:24 | Running CalStd4=5 (5) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 13:39:26 | Closing will close the method and all associated samples. | NAH | Analyst | |
| | 06/17/2015 13:39:47 | Running CalStd5=10 (6) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 13:44:12 | Running CalStd6=20 (7) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 13:47:19 | Closing will close the method and all associated samples. | NAH | Analyst | |
| | 06/17/2015 13:48:32 | Running CalStd7=50 (8) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 13:52:52 | Running CalStd8=100 (9) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 13:57:02 | Running CalStd9=1000 (10) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 14:00:48 | Running CalStd10=10000 (11) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 14:05:07 | Running CalStd11-100k (12) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 14:09:16 | Running CalStd12-100000 (13) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 14:13:36 | Running CalStd13=500000 (14) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 14:16:27 | Closing will close the method and all associated samples. | NAH | Analyst | |
| | 06/17/2015 14:18:19 | Running CalStd14-1000k (15) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 14:23:15 | Running blkrinse (22) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 14:25:26 | Closing will close the method and all associated samples. | NAH | Analyst | |
| | 06/17/2015 14:27:36 | Running icv (16) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 14:31:49 | Running ICVLL (25) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 14:36:06 | Running icb (17) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 14:40:30 | Running icb (17) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 14:44:54 | Running MRL (24) | NAH | Analyst | S_DOD Calibration |

| Type | Date/Time | Message | User name | Application | Sequence Name |
|---|---|---|---|---|---|
| | 06/17/2015 14:49:14 | Running icsa (20) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 14:50:48 | Closing will close the method and all associated samples. | NAH | Analyst | |
| | 06/17/2015 14:53:56 | Running icsab (21) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 14:58:18 | Running lcsw52897 (1) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 15:02:30 | Running mbw52897 (2) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 15:06:53 | Running 595188 (3) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 15:11:16 | Running l595188 (4) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 15:15:45 | Running dup595188 (5) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 15:20:05 | Running msw595188 (6) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 15:24:19 | Running msdw595188 (7) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 15:28:30 | Running pdsw595188 (8) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 15:32:52 | Running lcsw52893 92 (9) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 15:37:32 | Running mbw52893 92 (10) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 15:41:53 | Running ccv1 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 15:46:23 | Running ccv2 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 15:50:23 | Running ccb (19) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 15:54:46 | Running 595902 (11) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 15:59:23 | Running 595903 (12) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 16:04:00 | Running l595903 (13) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 16:08:42 | Running dup595903 (14) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 16:13:19 | Running msw595903 (15) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 16:17:54 | Running msdw595903 (16) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 16:22:30 | Running pdsw595903 (17) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 16:27:00 | Running 595904 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 16:31:37 | Running 595905 (19) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 16:36:14 | Running 595906 (20) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 16:40:50 | Running ccv1 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 16:45:14 | Running ccv2 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 16:49:14 | Running ccb (19) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 16:53:38 | Running 595907 (21) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 16:58:14 | Running lcsw52894 (22) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 17:02:28 | Running mbw52894 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 17:06:53 | Running 595260 (24) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 17:11:24 | Running msw595260 (25) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 17:15:48 | Running msdw595260 (26) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 17:20:11 | Running pdsw595260 (27) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 17:24:41 | Running 595261 (28) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 17:29:12 | Running 595264 (29) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 17:33:34 | Running 595266 (30) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 17:38:04 | Running ccv1 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 17:42:28 | Running ccv2 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 17:46:29 | Running ccb (19) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 17:50:54 | Running 595267 (31) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 17:55:24 | Running 595268 (32) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 17:59:53 | Running 595269 (33) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 18:04:29 | Running 595270 (34) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 18:09:04 | Running 595271 (35) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 18:13:46 | Running pdsw595161 (36) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 18:18:15 | Running MRL (24) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 18:22:34 | Running ccv1 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/17/2015 18:27:02 | Running ccv2 (18) | NAH | Analyst | S_DOD Calibration |

| Type | Date/Time | Message | User name | Application | Sequence Name |
|---|---|---|---|---|---|
| | 06/19/2015 11:59:21 | Sequence Started | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 11:59:21 | Autosampler Run Started | NAH | Analyst | |
| | 06/19/2015 11:59:47 | Running Blank (1) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 12:04:30 | Running CalStd1=0.25 (2) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 12:09:09 | Running CalStd2=0.5 (3) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 12:13:48 | Running CalStd3=1 (4) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 12:18:27 | Running CalStd4=5 (5) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 12:23:06 | Running CalStd5=10 (6) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 12:25:18 | The standard CalStd10=10000 will be permanently removed from the st | NAH | Analyst | |
| | 06/19/2015 12:25:28 | The standard CalStd10=10000 will be permanently removed from the st | NAH | Analyst | |
| | 06/19/2015 12:25:34 | The standard CalStd10=10000 will be permanently removed from the st | NAH | Analyst | |
| | 06/19/2015 12:27:46 | Running CalStd6=20 (7) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 12:32:20 | Running CalStd7=50 (8) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 12:37:09 | Running CalStd8=100 (9) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 12:39:00 | Closing will close the method and all associated samples. | NAH | Analyst | |
| | 06/19/2015 12:41:33 | Running CalStd9=1000 (10) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 12:45:35 | Running CalStd10=10000 (11) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 12:50:09 | Running CalStd11-100k (12) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 12:54:44 | Running CalStd12-100000 (13) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 12:59:19 | Running CalStd13=500000 (14) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 13:04:16 | Running CalStd14-1000k (15) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 13:09:36 | Running blkrinse (22) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 13:14:12 | Running icv (16) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 13:18:40 | Running ICVLL (25) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 13:23:10 | Running icb (17) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 13:23:14 | Closing will close the method and all associated samples. | NAH | Analyst | |
| | 06/19/2015 13:27:49 | Running icb (17) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 13:32:27 | Running MRL (24) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 13:37:03 | Running icsa (20) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 13:41:59 | Running icsab (21) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 13:46:35 | Running blk (1) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 13:50:42 | Closing will close the method and all associated samples. | NAH | Analyst | |
| | 06/19/2015 13:51:12 | Running blk (2) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 13:55:51 | Running lcsw52856 (3) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 14:00:40 | Running mbw52856 (4) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 14:05:17 | Running 594191 (5) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 14:09:49 | Running msw594191 (6) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 14:14:27 | Running msdw594191 (7) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 14:18:12 | Autosampler Run Completed | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 14:19:09 | Autosampler Run Started | NAH | Analyst | |
| | 06/19/2015 14:19:09 | Sequence Started | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 14:19:36 | Running Blank (1) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 14:24:14 | Running CalStd1=0.25 (2) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 14:28:53 | Running CalStd2=0.5 (3) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 14:33:33 | Running CalStd3=1 (4) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 14:38:11 | Running CalStd4=5 (5) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 14:39:14 | Closing will close the method and all associated samples. | NAH | Analyst | |
| | 06/19/2015 14:42:50 | Running CalStd5=10 (6) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 14:47:31 | Running CalStd6=20 (7) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 14:52:04 | Running CalStd7=50 (8) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 14:56:38 | Running CalStd8=100 (9) | NAH | Analyst | S_DOD Calibration |

| Type | Date/Time | Message | User name | Application | Sequence Name |
|---|---|---|---|---|---|
| | 06/19/2015 15:01:03 | Running CalStd9=1000 (10) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 15:05:03 | Running CalStd10=10000 (11) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 15:09:37 | Running CalStd11-100k (12) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 15:14:12 | Running CalStd12-100000 (13) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 15:18:48 | Running CalStd13=500000 (14) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 15:23:44 | Running CalStd14-1000k (15) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 15:29:04 | Running blkrinse (22) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 15:33:40 | Running icv (16) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 15:38:08 | Running ICVLL (25) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 15:42:39 | Running icb (17) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 15:47:18 | Running icb (17) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 15:51:57 | Running MRL (24) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 15:56:31 | Running icsa (20) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 16:01:29 | Running icsab (21) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 16:06:06 | Running blk (1) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 16:10:43 | Running blk (2) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 16:15:21 | Running lcsw52856 (3) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 16:20:12 | Running mbw52856 (4) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 16:24:51 | Running 594191 (5) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 16:29:20 | Running msw594191 (6) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 16:33:58 | Running msdw594191 (7) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 16:38:32 | Running pdsw594191 (8) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 16:43:15 | Running lcswtclp (9) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 16:47:30 | Running mbwtclp (10) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 16:52:08 | Running ccv1 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 16:56:53 | Running ccv2 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 17:01:05 | Running ccb (19) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 17:05:45 | Running 597222 (11) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 17:10:43 | Running msw597222 (12) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 17:15:52 | Running lcsw52931 (13) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 17:20:19 | Running mbw52931 (14) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 17:24:58 | Running 596356 (15) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 17:29:53 | Running l596356 (16) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 17:34:50 | Running dup596356 (17) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 17:39:45 | Running msw596356 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 17:44:36 | Running msdw596356 (19) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 17:49:28 | Running pdsw596356 (20) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 17:54:37 | Running ccv1 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 17:59:21 | Running ccv2 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 18:03:36 | Running ccb (19) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 18:08:16 | Running 596360 (21) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 18:13:12 | Running lcsw52930 (22) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 18:17:43 | Running mbw52930 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 18:22:24 | Running 595909 (24) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 18:27:28 | Running l595909 (25) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 18:32:29 | Running dup595909 (26) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 18:37:33 | Running msw595909 (27) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 18:42:35 | Running msdw595909 (28) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 18:47:37 | Running pdsw595909 (29) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 18:52:25 | Running 595911 (30) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 18:57:05 | Running ccv1 (23) | NAH | Analyst | S_DOD Calibration |

| Type | Date/Time | Message | User name | Application | Sequence Name |
|---|---|---|---|---|---|
| | 06/19/2015 19:01:51 | Running ccv2 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 19:06:04 | Running ccb (19) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 19:10:45 | Running 595913 (31) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 19:15:37 | Running 595915 (32) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 19:20:28 | Running lcsw52932 (33) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 19:24:59 | Running mbw52932 (34) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 19:29:38 | Running 597296 (35) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 19:34:13 | Running l597296 (36) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 19:38:49 | Running dup597296 (37) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 19:43:24 | Running msw597296 (38) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 19:47:50 | Running msdw597296 (39) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 19:52:17 | Running pdsw597296 (40) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 19:57:21 | Running ccv1 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 20:02:06 | Running ccv2 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 20:06:22 | Running ccb (19) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 20:11:02 | Running 597300 (41) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 20:15:36 | Running 597301 (42) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 20:20:16 | Running 597302 (43) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 20:24:51 | Running 597303 (44) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 20:29:25 | Running 597304 (45) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 20:33:36 | Running lcss52933 (46) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 20:38:13 | Running mbs52933 (47) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 20:43:38 | Running 596100 (48) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 20:48:53 | Running mss596100 (49) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 20:54:16 | Running msds596100 (50) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 20:59:35 | Running ccv1 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 21:04:20 | Running ccv2 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 21:08:35 | Running ccb (19) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 21:13:15 | Running pdss596100 (51) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 21:17:43 | Running 597136 (52) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 21:22:01 | Running 597137 (53) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 21:26:29 | Running 597138 (54) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 21:30:59 | Running 597139 (55) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 21:35:37 | Running 597140 (56) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 21:39:46 | Running lcss52924 (57) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 21:43:56 | Running 596357 (58) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 21:48:23 | Running MRL (24) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 21:52:57 | Running ccv1 (23) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 21:57:43 | Running ccv2 (18) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 22:01:57 | Running ccb (19) | NAH | Analyst | S_DOD Calibration |
| | 06/19/2015 22:06:35 | Plasma extinguished successfully | NAH | Analyst | |
| | 06/19/2015 22:06:35 | Plasma off | NAH | iTEVA Control Center | |
| | 06/19/2015 22:06:37 | Autosampler Run Completed | NAH | Analyst | S_DOD Calibration |
| | 06/22/2015 11:58:01 | E2208 - : Plasma ignition failed; RF seems OK. Check your sample intr | NAH | Analyst | |
| | 06/22/2015 11:58:36 | Plasma On | NAH | iTEVA Control Center | |
| | 06/22/2015 11:58:42 | Plasma ignition successful | NAH | Analyst | |
| | 06/22/2015 11:59:28 | D33534 - Debug:Wavelength check : x = 2.048, y =0.330 | NAH | Analyst | |
| | 06/22/2015 16:19:24 | Autosampler Run Started | NAH | Analyst | |
| | 06/22/2015 16:19:24 | Sequence Started | NAH | Analyst | S_DOD Calibration |
| | 06/22/2015 16:19:52 | Running Blank (1) | NAH | Analyst | S_DOD Calibration |
| | 06/22/2015 16:24:30 | Running CalStd1=0.25 (2) | NAH | Analyst | S_DOD Calibration |

| | | | |
|---|---|---|---|
| Standard Log #: | M12543 | Reagent: | 10N NaOH |
| Analyst: | LJF | | |
| Prep Date: | 06/18/15 | Expiration Date: | 06/18/16 |
| Prep: | Into a 1 L volumetric flask, added **400 g** NaOH M11852 and brought up to volume. | | |

| | | | |
|---|---|---|---|
| Standard Log #: | M12544 | Reagent: | TCLP EXTRACTION FLUID #1 |
| Analyst: | LJF | pH: | 4.93 ± 0.05 |
| Prep Date: | 06/18/15 | Expiration Date: | 06/18/16 |
| Prep: | Into a 20 L carboy filled with 19 L of DI $H_2O$, add **114 mL** Glacial acetic acid AB.579 and **128.6 mL** 10N NaOH M12543. Dilute to 20 L and mix. | | |

| | | | |
|---|---|---|---|
| Standard Log #: | M12541 | Reagent: | Potassium Permanganate Solution |
| Analyst: | LJF | | |
| Prep Date: | 06/16/15 | Expiration Date: | 12/16/15 |
| Prep: | Into a 1 L volumetric flask, partially filled with milli-Q $H_2O$, dissolved **50 g** potassium permanganate M11285 and brought up to volume. | | |

| | | | |
|---|---|---|---|
| Standard Log #: | M12542 | Reagent: | NaCl Hydroxylamine Sulfate |
| Analyst: | LJF | | |
| Prep Date: | 06/16/15 | Expiration Date: | 12/16/15 |
| Prep: | Into a 500 mL volumetric flask, partially filled with milli-Q $H_2O$, dissolved **60 g** NaCl M12270 and **60 g** hydroxylamine sulfate M11798 and brought up to volume. | | |

| | | Instrument: | CETAC |
|---|---|---|---|
| Standard Log #: | M12534 | Standard: | Hg ICAL |
| Analyst: | LJF | Concentrations: | 10,000, 100, 0.5, 1, 2, 4, 5, 10 ug/L |
| Prep Date: | 06/15/15 | Expiration Date: | 02/26/16 |
| Prep: | Using 100 mL volumetric flasks, pipetted the following and brought up to volume using milli-Q $H_2O$. ($0.2\%\ HNO_3$, 0.2% HCl)<br>*10,000 ug/L Std.* - **1 mL** Hg (1000 mg/L) M12179<br>*100 ug/L Std.* - **1 mL** Hg (*10,000 ug/L*)<br>*0.5 ug/L Std.* - **0.5 mL** Hg (*100 ug/L*)<br>*1 ug/L Std.* - **1 mL** Hg (*100 ug/L*)<br>*2 ug/L Std.* - **2 mL** Hg (*100 ug/L*)<br>*4 ug/L Std.* - **4 mL** Hg (*100 ug/L*)<br>*5 ug/L Std.* - **5 mL** Hg (*100 ug/L*)<br>*10 ug/L Std.* - **10 mL** Hg *(100 ug/L)* | | |

| | | Instrument: | CETAC |
|---|---|---|---|
| Standard Log #: | M12535 | Standard: | Alt. Source Working Std. |
| Analyst: | LJF | Concentrations: | 10,000 and 100 ug/L |
| Prep Date: | 06/15/15 | Expiration Date: | 06/30/16 |
| Prep: | Into two, 100 mL volumetric flasks, pipetted the following and brought up to volume using Milli-Q $H_2O$.<br>($0.2\%\ HNO_3$, 0.2% HCl)<br>*10,000 ug/L Std.* - **1 mL** of Hg (1000 mg/L) M12532<br>*100 ug/L Std.* - **1 mL** of Hg (*10,000 ug/L working Std.*) | | |

| | | Instrument: | CETAC |
|---|---|---|---|
| Standard Log #: | M12536 | Standard: | Hg ICV/LCS |
| Analyst: | LJF | Concentration: | 3 ug/L |
| Prep Date: | 06/15/15 | Expiration Date: | 06/30/16 |
| Prep: | Into a 100 mL volumetric flask, pipetted **3 mL** of Hg (*100 ug/L working Std.*) M12535 and brought up to volume using Milli-Q $H_2O$.<br>($0.2\%\ HNO_3$, 0.2% HCl) | | |

| | | Instrument: | CETAC |
|---|---|---|---|
| Standard Log #: | M12537 | Standard: | Hg CCV |
| Analyst: | LJF | Concentration: | 3.0 ug/L Hg |
| Prep Date: | 06/15/15 | Expiration Date: | 02/26/16 |
| Prep: | Using 100 mL volumetric flasks, pipetted the following and brought up to volume using milli-Q $H_2O$.<br>(0.2% $HNO_3$, 0.2% HCl)<br>*10,000 ug/L Std.* - **1 mL** Hg (1000 mg/L) M12179<br>*100 ug/L Std.* - **1 mL** Hg (*10,000 ug/L*)<br>*3.0 ug/L Std.* (CCV) - **3.0 mL** Hg (*100 ug/L*) | | |

| | | Instrument: | CETAC |
|---|---|---|---|
| Standard Log #: | M12538 | Standard: | Hg MRL |
| Analyst: | LJF | Concentration: | 0.2 ug/L Hg |
| Prep Date: | 06/15/15 | Expiration Date: | 06/30/16 |
| Prep: | Into a 100 mL volumetric flask, pipetted **0.2 mL** of Hg (*100 ug/L working std.*) M12535 and brought up to volume using Milli-Q $H_2O$.<br>(0.2% $HNO_3$, 0.2% HCl) | | |

| | | Instrument: | CETAC |
|---|---|---|---|
| Standard Log #: | M12539 | Reagent: | Hg Aqua Regia |
| Analyst: | LJF | | |
| Prep Date: | 06/15/15 | Expiration Date: | 02/01/17 |
| Prep: | Carefully mixed **3** parts HCl AB.600 with **1** part $HNO_3$ AB.561 in a hood. | | |

| | | Instrument: | CETAC |
|---|---|---|---|
| Standard Log #: | M12540 | Reagent: | Stannous Chloride Solution |
| Analyst: | LJF | | |
| Prep Date: | 06/15/15 | Expiration Date: | 10/23/15 |
| Prep: | Into a 1 L volumetric flask, partially filled with 400 mL milli-Q $H_2O$, added **70 mL** hydrochloric acid AB.600 and dissolved **100 g** Stannous chloride M12478 and brought up to volume. | | |

| | | | |
|---|---|---|---|
| Standard ID#: | M12529 | Vendor: | SPEX Certiprep |
| Analyst: | NAH | Chemical: | Interference-A |
| Date Received: | 06/04/2015 | Lot #: | 12-101YPX |
| Expiration Date (if any): | 06/30/2016 | Catelog #: | INT-A1 |

| | | | |
|---|---|---|---|
| Standard ID#: | M12530 | Vendor: | SPEX Certiprep |
| Analyst: | NAH | Chemical: | Custom Assurance STD (3) Ag,Be,Cd |
| Date Received: | 06/04/2015 | Lot #: | 30-152CR |
| Expiration Date (if any): | 06/30/2016 | Catelog #: | XCTWI-4-500 |

| | | | |
|---|---|---|---|
| Standard ID#: | M12531 | Vendor: | SPEX Certiprep |
| Analyst: | NAH | Chemical: | Custom Assurance STD (23) |
| Date Received: | 06/04/2015 | Lot #: | 30-153CR |
| Expiration Date (if any): | 06/30/2016 | Catelog #: | XCTWI-5-500 |

| | | | |
|---|---|---|---|
| Standard ID#: | M12532 | Vendor: | SPEX Certiprep |
| Analyst: | NAH | Chemical: | Mercury 1000 mg/L |
| Date Received: | 06/04/2015 | Lot #: | CL7-180HGY |
| Expiration Date (if any): | 06/30/2016 | Catelog #: | CLHG4-2Y |

| | | | |
|---|---|---|---|
| Standard ID#: | M12533 | Vendor: | CPI |
| Analyst: | NAH | Chemical: | Mn 10000 mg/L |
| Date Received: | 06/04/2015 | Lot #: | 15E180 |
| Expiration Date (if any): | 11/29/2016 | Catelog #: | P/N S4400-10M321 |

MRL BASE STD M12528 | Analyst NAH
Prep Date 06/02/2015

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L | Expiration Date |
|---|---|---|---|---|---|
| Ag | 20 | M11908 | 1000 | 1 | 09/2015 |
| Al | 400 | M12400 | 10000 | 2 | 07/2016 |
| Ba | 10 | M12473 | 1000 | 0.5 | 10/2016 |
| Be | 4 | M12006 | 1000 | 0.2 | 11/2015 |
| Cd | 5 | M12002 | 1000 | 0.25 | 11/2015 |
| Co | 10 | M12000 | 1000 | 0.5 | 11/2015 |
| Cr | 10 | M12470 | 10000 | 0.05 | 10/2016 |
| Cu | 10 | M12472 | 10000 | 0.05 | 10/2016 |
| Mg | 500 | M12314 | 10000 | 2.5 | 10/2016 |
| Mn | 10 | M11829 | 10000 | 0.05 | 07/2015 |
| Mo | 10 | M12008 | 1000 | 0.5 | 11/2015 |
| Ni | 10 | M12004 | 1000 | 0.5 | 11/2015 |
| Pb | 10 | M12313 | 10000 | 0.05 | 06/2016 |
| Sb | 20 | M11909 | 1000 | 1 | 09/2015 |
| V | 10 | M12009 | 1000 | 0.5 | 11/2015 |
| Zn | 10 | M12005 | 10000 | 0.05 | 11/2015 |
| K | 1000 | M12474 | 10000 | 5 | 10/2016 |
| Na | 1000 | M12010 | 10000 | 5 | 11/2015 |
| As | 20 | M12315 | 1000 | 1 | 06/2016 |
| Ca | 500 | M12310 | 10000 | 2.5 | 10/2016 |
| Fe | 300 | M12401 | 10000 | 1.5 | 10/2016 |
| Se | 20 | M11911 | 1000 | 1 | 09/2015 |
| Tl | 20 | M11997 | 1000 | 1 | 11/2015 |
| Si | 100 | M12007 | 1000 | 5 | 11/2015 |
| B | 20 | M12471 | 1000 | 1 | 10/2016 |
| Li | 20 | M11998 | 1000 | 1 | 11/2015 |
| W | 50 | M12001 | 1000 | 2.5 | 11/2015 |
| Ti | 10 | M12003 | 1000 | 0.5 | 11/2015 |
| Sr | 10 | M11999 | 1000 | 0.5 | 11/2015 |
| Sn | 50 | M11996 | 1000 | 2.5 | 11/2015 |
| S | 300 | M12350 | 10000 | 1.5 | 01/2016 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expiration Date: 07/2015

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|---|---|---|---|
| | | Instrument: | ICP 6500 |
| Standard Log #: | M12526 | Standard: | ICSA |
| Analyst: | NAH | Concentrations: | **500,000 ug/L** Al, Ca, Fe, Mg |
| Prep Date: | 06/01/2015 | Expiration Date: | 8/2015 |
| Prep: | Into a 500 mL volumetric flask, pipetted **50 mL** Interferents A Standard ((5000 mg/L Al, Ca, Mg) (2000 mg/L Fe)) M12164 and **15 mL** Fe (10000 mg/L) M12401 and brought up to volume with milli-Q $H_2O$. | | |

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|---|---|---|---|
| | | Instrument: | ICP 6500 |
| Standard Log #: | M12527 | Standard: | ICV Std. |
| Analyst: | NAH | Concentrations: | **12,000 mg/L** Al<br>**10,000 mg/L** Ca, Mg<br>**5000 mg/L** Fe<br>**2000 mg/L** As, Ba, Se, Tl<br>**500 mg/L** B, Co, Li, Mn, Mo, Ni, Pb, Sb, Sn, Sr, Ti, V, Zn<br>**250 mg/L** Cu<br>**200 mg/L** Cr<br>**50 mg/L** Ag, Be, Cd |
| Prep Date: | 06/01/2015 | Expiration Date: | 8/2015 |
| Prep: | Into a 1 L volumetric flask, pipetted the following and brought up to volume with milli-Q $H_2O$.<br>**10 mL** Custom Assurance Standard #18 ((200 mg/L Al, As, Ba, Se, Tl) (100 mg/L Fe) (50 mg/L Co, Mn, Ni, Pb, Sb, V, Zn) (25 mg/L Cu) (20 mg/L Cr) (5 mg/L Ag, Be, Cd)) M12502 , **2 mL** Interferents A Standard ((5000 mg/L Al, Ca, Mg) (2000 mg/L Fe)) M12164 , **0.5 mL** Mo (1000 mg/L) M12008 , **0.5 mL** B (1000 mg/L) M12471 , **0.5 mL** Sr (1000 mg/L) M11999 , **0.5 mL** Li (1000 mg/L) M11998 , **0.5 mL** Sn (1000 mg/L) M11996 and **0.5 mL** Ti (1000 mg/L) M12003 . | | |

| | | Instrument: | ICP 6500 |
|---|---|---|---|
| Standard Log #: | M12523 | Standard: | ICSAB |
| Analyst: | NAH | Concentrations: | **500,000 ug/L** Al, Ca, Fe, Mg<br>**500 ug/L** Ag, As, Ba, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Tl, V, Zn |
| Prep Date: | 06/01/2015 | Expiration Date: | 7/2015 |
| Prep: | Into a 500 mL volumetric flask, pipetted **50 mL** Interferents A Standard ((5000 mg/L Al, Ca, Mg) (2000 mg/L Fe)) M12164, **15 mL** Fe (10,000 mg/L) M12401, **2.5 mL** of Custom Assurance Std. #3 (100 mg/L Ag, Be, Cd) M12125 and **2.5 mL** Custom Assurance Std. #23 (100 mg/L Al, As, B, Ba, Ca, Co, Cr, Cu, Fe, Li, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Ti, Tl, V, Zn) M12374 and brought up to volume with milli-Q $H_2O$. | | |

| | | Instrument: | ICP 6500 |
|---|---|---|---|
| Standard Log #: | M12524 | Standard: | CCV1 |
| Analyst: | NAH | Concentrations: | **5000 µg/L** Al, As, B, Ba, Ca, Co, Cr, Cu, Fe, Li, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Ti, Tl, V, Zn<br>**500 µg/L** Ag, Be, Cd |
| Prep Date: | 06/01/2015 | Expiration Date: | 7/2015 |
| Prep: | Into a 1 L volumetric flask, pipetted **50 mL** Custom Assurance Standard #23 XCTWI-5-500 (100 mg/L Al, As, B, Ba, Ca, Co, Cr, Cu, Fe, Li, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Ti, Tl, V, Zn) M12374 and **5.0 mL** of Custom Assurance Std. #3 XCTWI-4-500 (100 mg/L Ag, Be, Cd) M12125 and brought up to volume with milli-Q $H_2O$. | | |

| | | Instrument: | ICP 6500 |
|---|---|---|---|
| Standard Log #: | M12525 | Standard: | CCV2 |
| Analyst: | NAH | Concentrations: | **500 µg/L** Al, As, B, Ba, Ca, Co, Cr, Cu, Fe, Li, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Ti, Tl, V, Zn<br>**50 µg/L** Ag, Be, Cd |
| Prep Date: | 06/01/2015 | Expiration Date: | 7/2015 |
| Prep: | Into a 1 L volumetric flask, pipetted **5 mL** Custom Assurance Standard #23 XCTWI-5-500 (100 mg/L Al, As, B, Ba, Ca, Co, Cr, Cu, Fe, Li, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Ti, Tl, V, Zn) M12374 and **0.5 mL** of Custom Assurance Std. #3 XCTWI-4-500 (100 mg/L Ag, Be, Cd) M12125 and brought up to volume with milli-Q $H_2O$. | | |

| | | | |
|---|---|---|---|
| | | Instrument: | ICP 6500 |
| Standard Log #: | M12522 | Standard: | ICAL |
| Analyst: | NAH | Concentrations: | 0.25, 0.5, 1, 5, 10, 20, 50, 100, 1000, 10,000, 100k, 100,000, 500,000 and 1000k (ug/L) |
| Prep Date: | 06/01/2015 | Expiration Date: | 7/30/2015 |
| Prep: | Using 1 L volumetric flasks, pipetted the following and brought up to volume using milli-Q $H_2O$. (5% $HNO_3$, 5% HCl)<br>*1000 ug/L Std.* - **10 mL** of Custom Assurance Std. #23 ( 100 mg/L Al, As, B, Ba, Ca, Co, Cr, Cu, Fe, Li, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Ti, Tl, V, Zn) M12374 , **10 mL** of Custom Assurance Std. #3 (100 mg/L Ag, Be, Cd) M12125 and **1 mL** of Si (1000 mg/L) M12007 .<br>*0.25 ug/L Std.* - **0.25 mL** of the 1000 ug/L Std.<br>*0.5 ug/L Std.* - **0.5 mL** of the 1000 ug/L Std.<br>*1 ug/L Std.* - **1 mL** of the 1000 ug/L Std.<br>*5 ug/L Std.* - **5 mL** of the 1000 ug/L Std.<br>*10 ug/L Std.* - **10 mL** of the 1000 ug/L Std.<br>*20 ug/L Std.* - **20 mL** of the 1000 ug/L Std.<br>*50 ug/L Std.* - **50 mL** of the 1000 ug/L Std.<br>*100 ug/L Std.* - **1 mL** of Custom Assurance Std. (CAS) #23 and **1 mL** of CAS #3<br>*10,000 ug/L Std.* - **100 mL** CAS #23, **100 mL** CAS #3 and **1 mL** of K (10,000 mg/L) M12474 .<br>*100k ug/L Std.* - **10 mL** of Cu (10,000 mg/L) M12472 , **10 mL** of Mn (10,000 mg/L) M11829 , **10 mL** of Cr (10,000 mg/L) M12470 , **10 mL** Pb (10,000 mg/L) M12313 , **10 mL** of Zn (10,000 mg/L) M12005 and **10 mL** of Na (10,000 mg/L) M12010 .<br>*100,000 ug/L Std.* - **10 mL** of Mg (10,000 mg/L) M12488 , **10 mL** of Fe (10,000 mg/L) M12489 , **10 mL** of Ca (10,000 mg/L) M12490 and **10 mL** Al (10,000 mg/L) M12400 .<br>*500,000 ug/L Std.* - **50 mL** of Mg (10,000 mg/L), **50 mL** of Fe (10,000 mg/L), **50 mL** of Ca (10,000 mg/L) and **50 mL** of Al (10,000 mg/L)<br>*1000k ug/L Std.* - **100 mL** of Mg (10,000 mg/L), **100 mL** of Fe (10,000 mg/L), **100 mL** of Ca (10,000 mg/L) and **100 mL** of Al (10,000 mg/L) | | |

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|---|---|---|---|
| Standard ID#: | M12518 | Vendor: | Alfa Aesar Specpure |
| Analyst: | MDS | Chemical: | GFAA Nickel Nitrate Modifier |
| Date Received: | 05/29/2015 | Lot #: | 785159H |
| Expiration Date (if any): | 11/30/2016 | Catelog #: | 39043 |

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|---|---|---|---|
| | | Instrument: | GFAA |
| Standard Log #: | M12519 | Standard: | Calibration Std. |
| Analyst: | MDS | Concentrations: | 25 ug/L (As, Pb, Sb, Se, Tl)<br>3.75 ug/L (Ag) |
| Prep Date: | 05/29/2015 | Expiration Date: | 06/01/2016 |
| Prep: | Into a 1 L volumetric flask, pipetted **0.25 mL** of GFAA Custom Stock Std. ((100 ug/mL As, Pb, Sb, Se, Tl) (15 ug/mL Ag)) M12504 and brought to volume with Milli-Q $H_2O$.<br>(1% $HNO_3$) | | |

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|---|---|---|---|
| | | Instrument: | GFAA |
| Standard Log #: | M12520 | Standard: | CCV Std. |
| Analyst: | MDS | Concentrations: | 10 ug/L (As, Pb, Sb, Se, Tl)<br>1.5 ug/L (Ag) |
| Prep Date: | 05/29/2015 | Expiration Date: | 06/01/2016 |
| Prep: | Into a 1 L volumetric flask, pipetted **0.1 mL** of GFAA Custom Stock Std. ((100 ug/mL As, Pb, Sb, Se, Tl) (15 ug/mL Ag)) M12504 and brought to volume with Milli-Q DI $H_2O$.<br>(1% $HNO_3$) | | |

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|---|---|---|---|
| | | Instrument: | GFAA |
| Standard Log #: | M12521 | Standard: | ICV/Spike Std. |
| Analyst: | MDS | Concentrations: | 10 ug/L (As, Pb, Sb, Se, Tl)<br>1.0 ug/L (Ag) |
| Prep Date: | 05/29/2015 | Expiration Date: | 06/01/2016 |
| Prep: | Into a 1 L volumetric flask, pipetted **1.0 mL** of GFAA Custom Stock Std. ((10 ug/mL As, Pb, Sb, Se, Tl) (1.0 ug/mL Ag)) M12505 and brought to volume with Milli-Q DI $H_2O$.<br>(1% $HNO_3$) | | |

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|---|---|---|---|
| Standard Log #: | M12515 | Reagent: | Potassium Permanganate Solution |
| Analyst: | LJF | | |
| Prep Date: | 05/28/15 | Expiration Date: | 10/28/15 |
| Prep: | Into a 1 L volumetric flask, partially filled with milli-Q $H_2O$, dissolved **50 g** potassium permanganate M11285 and brought up to volume. | | |

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|---|---|---|---|
| Standard Log #: | M12516 | Reagent: | NaCl Hydroxylamine Sulfate |
| Analyst: | LJF | | |
| Prep Date: | 05/28/15 | Expiration Date: | 10/28/15 |
| Prep: | Into a 500 mL volumetric flask, partially filled with milli-Q $H_2O$, dissolved **60 g** NaCl M12270 and **60 g** hydroxylamine sulfate M12096 and brought up to volume. | | |

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|---|---|---|---|
| Standard Log #: | M12517 | Reagent: | TCLP EXTRACTION FLUID #1 |
| Analyst: | MDS | pH: | 4.93 ± 0.05 |
| Prep Date: | 05/28/15 | Expiration Date: | 06/28/15 |
| Prep: | Into a 20 L carboy filled with 19 L of DI $H_2O$, add **114 mL** Glacial acetic acid AB.579 and **128.6 mL** 10N NaOH M12440. Dilute to 20 L and mix. | | |

| | | Instrument: | CETAC |
|---|---|---|---|
| Standard Log #: | M12512 | Standard: | Hg MRL |
| Analyst: | LJF | Concentration: | 0.2 ug/L Hg |
| Prep Date: | 05/27/15 | Expiration Date: | 02/26/16 |
| Prep: | Into a 100 mL volumetric flask, pipetted **0.2 mL** of Hg (*100 ug/L working std.*) M12509 and brought up to volume using Milli-Q $H_2O$. ($0.2\%\ HNO_3$, 0.2% HCl) | | |

| | | Instrument: | CETAC |
|---|---|---|---|
| Standard Log #: | M12513 | Reagent: | Hg Aqua Regia |
| Analyst: | LJF | | |
| Prep Date: | 05/27/15 | Expiration Date: | 11/30/16 |
| Prep: | Carefully mixed **3** parts HCl AB.597 with **1** part $HNO_3$ AB.599 in a hood. | | |

| | | Instrument: | CETAC |
|---|---|---|---|
| Standard Log #: | M12514 | Reagent: | Stannous Chloride Solution |
| Analyst: | LJF | | |
| Prep Date: | 05/27/15 | Expiration Date: | 10/23/15 |
| Prep: | Into a 1 L volumetric flask, partially filled with 400 mL milli-Q $H_2O$, added **70 mL** hydrochloric acid AB.597 and dissolved **100 g** Stannous chloride M12478 and brought up to volume. | | |

| | | Instrument: | CETAC |
|---|---|---|---|
| Standard Log #: | M12509 | Standard: | Alt. Source Working Std. |
| Analyst: | LJF | Concentrations: | 10,000 and 100 ug/L |
| Prep Date: | 05/27/15 | Expiration Date: | 02/26/16 |
| Prep: | Into two, 100 mL volumetric flasks, pipetted the following and brought up to volume using Milli-Q $H_2O$.<br>(0.2% $HNO_3$, 0.2% HCl)<br>*10,000 ug/L Std.* - **1 mL** of Hg (1000 mg/L) M11819<br>*100 ug/L Std.* - **1 mL** of Hg (*10,000 ug/L working Std.*) | | |

| | | Instrument: | CETAC |
|---|---|---|---|
| Standard Log #: | M12510 | Standard: | Hg ICV/LCS |
| Analyst: | LJF | Concentration: | 3 ug/L |
| Prep Date: | 05/27/15 | Expiration Date: | 02/26/16 |
| Prep: | Into a 100 mL volumetric flask, pipetted **3 mL** of Hg (*100 ug/L working Std.*) M12509 and brought up to volume using Milli-Q $H_2O$.<br>(0.2% $HNO_3$, 0.2% HCl) | | |

| | | Instrument: | CETAC |
|---|---|---|---|
| Standard Log #: | M12511 | Standard: | Hg CCV |
| Analyst: | LJF | Concentration: | 3.0 ug/L Hg |
| Prep Date: | 05/27/15 | Expiration Date: | 02/26/16 |
| Prep: | Using 100 mL volumetric flasks, pipetted the following and brought up to volume using milli-Q $H_2O$.<br>(0.2% $HNO_3$, 0.2% HCl)<br>*10,000 ug/L Std.* - **1 mL** Hg (1000 mg/L) M12179<br>*100 ug/L Std.* - **1 mL** Hg (*10,000 ug/L*)<br><br>*3.0 ug/L Std.* (CCV) - **3.0 mL** Hg (*100 ug/L*) | | |

| | | Instrument: | CETAC |
|---|---|---|---|
| Standard Log #: | M12507 | Standard: | Hg ICAL |
| Analyst: | LJF | Concentrations: | 10,000, 100, 0.5, 1, 2, 4, 5, 10 ug/L |
| Prep Date: | 05/27/15 | Expiration Date: | 02/26/16 |
| Prep: | Using 100 mL volumetric flasks, pipetted the following and brought up to volume using milli-Q $H_2O$. ($0.2\%$ $HNO_3$, $0.2\%$ HCl)<br>*10,000 ug/L Std.* - **1 mL** Hg (1000 mg/L) M12179<br>*100 ug/L Std.* - **1 mL** Hg (*10,000 ug/L*)<br>*0.5 ug/L Std.* - **0.5 mL** Hg (*100 ug/L*)<br>*1 ug/L Std.* - **1 mL** Hg (*100 ug/L*)<br>*2 ug/L Std.* - **2 mL** Hg (*100 ug/L*)<br>*4 ug/L Std.* - **4 mL** Hg (*100 ug/L*)<br>*5 ug/L Std.* - **5 mL** Hg (*100 ug/L*)<br>*10 ug/L Std.* - **10 mL** Hg *(100 ug/L)* | | |

| | | Instrument: | ICP 6000 |
|---|---|---|---|
| Standard Log #: | M12508 | Standard: | NaK ICSAB |
| Analyst: | MDS | Concentrations: | 500 mg/L (Al, Ca, Fe, Mg)<br>100 mg/L (Na, K) |
| Prep Date: | 05/27/2015 | Expiration Date: | 08/30/2015 |
| Prep: | Into a 250 mL volumetric flask, pipetted **25 mL** of Interferents A custom stock (5000 mg/L Al, Ca, Mg and 2000 mg/L Fe) M12164 , **2.5 mL** of K (10,000 mg/L) M12474 , **2.5 mL** of Na (10,000 mg/L) M12010 and **7.5 mL** of Fe (10,000 mg/L) M12401 and brought up to volume using Milli-Q $H_2O$.<br>($2\%$ $HNO_3$) | | |

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|---|---|---|---|
| Standard ID#: | M12504 | Vendor: | Inorganic Ventures |
| Analyst: | MDS | Chemical: | GFAA ICAL/CCV Standard |
| Date Received: | 05/26/2015 | Lot #: | J2-MEB581070 |
| Expiration Date (if any): | 06/01/2016 | Catelog #: | CTI-SPK-1 |

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|---|---|---|---|
| Standard ID#: | M12505 | Vendor: | Inorganic Ventures |
| Analyst: | MDS | Chemical: | GFAA ICV/Spiking Standard |
| Date Received: | 05/26/2015 | Lot #: | J2-MEB581069 |
| Expiration Date (if any): | 06/01/2016 | Catelog #: | CTI-GFCAL-1 |

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|---|---|---|---|
| Standard Log #: | M12503 | Reagent: | TCLP EXTRACTION FLUID #1 |
| Analyst: | LJF | pH: | 4.93 ± 0.05 |
| Prep Date: | 05/21/15 | Expiration Date: | 05/21/16 |
| Prep: | Into a 20 L carboy filled with 19 L of DI $H_2O$, add **114 mL** Glacial acetic acid AB.579 and **128.6 mL** 10N NaOH M12440. Dilute to 20 L and mix. | | |

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|---|---|---|---|
| Standard ID#: | M12502 | Vendor: | SpexCertiprep |
| Analyst: | NAH | Chemical: | Custum assurance standard |
| Date Received: | 05-19-2015 | Lot #: | 30-096CR |
| Expiration Date (if any): | 05-30-2016 | Catelog #: | XSPIKE-1-250 |

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|---|---|---|---|
| Standard Log #: | M12501 | Reagent: | Potassium Persulfate Solution |
| Analyst: | LJF | | |
| Prep Date: | 05/14/15 | Expiration Date: | 11/14/15 |
| Prep: | Into a 1 L volumetric flask, partially filled with milli-Q $H_2O$, dissolved **50 g** potassium persulfate M10987 and brought up to volume. | | |

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|---|---|---|---|
| | | Instrument: | ICP 6000 |
| Standard Log #: | M12500 | Standard: | Sulfur ICV |
| Analyst: | MDS | Concentrations: | 100,000 µg/L (S) |
| Prep Date: | 05/13/2015 | Expiration Date: | 08/13/2015 |
| Prep: | Into a 100 mL volumetric flask, pipetted **1.0 mL** of S (10,000 µg/mL) M12371 and brought up to volume using Milli-Q $H_2O$. | | |

#M12488 5-5-15 - Mg 10,000mg/L CPI Lot 15C248 ex 10/2016.

#M12489 5-5-15 - Fe 10,000mg/L CPI Lot 15C290 ex 10/16.

#M12490 5-5-15 Ca 10,000mg/L CPI Lot 15A007 ex 10/16.

#M12491 05/06/15 13F TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114mL Glacial Acetic Acid (AB 579) and 128.6mL of 10N NaOH (#M12292). Dilute to 20L w/D.I. H2O and mix. pH = 4.93 ± 0.05
Exp: 05/06/16

#M12492 05/06/15 13F SPLP Extraction Fluid #2 west: Fill a 20L Carboy with D.I. H2O and adjust pH to 5.00 ± 0.05 with (#M12457) 60/40 HNO3, H2SO4 mix w/ mix.
Exp: 05/06/16

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|---|---|---|
| #M12493 05/11/15 13F | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M12494 05/11/15 13F | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M12495 05/11/15 13F | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M12494) into 100ml = 3.0ug/L Hg |
| #M12496 05/11/15 13F | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M12497 05/11/15 13F | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 12494) into 100ml = 0.2ug/L Hg |
| #M12498 05/11/15 13F | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M12499 05/11/15 13F | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11299 in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M12475 04/27/15SF 1N HCl for TCLP: Into a 1L vol. flask partially filled with Milli-Q $H_2O$ add 83ml of conc. HCl (AB.597) and bring up to vol. with Milli-Q $H_2O$.
Exp: 04/27/16

#M12476 04/28/15SF TCLP Extraction Fluid #1: Fill a 20L carboy with 19L D.I. $H_2O$. Add 114ml Glacial Acetic Acid (AB579) and 128.6ml of 10N NaOH (#M12292). Dilute to 20L w/D.I. $H_2O$ and mix. pH=4.93±0.05
Exp: 04/28/16

#M12477 04/28/15SF TCLP Extraction Fluid #1: Fill a 20L Carboy w/19L D.I. $H_2O$. Add 114ml Glacial Acetic acid (AB.579) and 128.6ml of 10N NaOH (#M12292). Dilute to 20L w/D.I. $H_2O$ and mix. pH=4.93±0.05
Exp: 04/28/16

#M12478 04/29/15SF Stannous Chloride (Macron) Lot# 0000101329

#M12479 04/29/15SF TCLP Extraction Fluid #1: Fill a 20L Carboy w/19L D.I. $H_2O$. Add 114ml Glacial Acetic Acid (AB579) and 128.6ml of 10N NaOH (#M12292). Dilute to 20L w/D.I. $H_2O$ and mix. pH=4.93±0.05
Exp: 04/28/16

#M12480 ~~04~~ 04/29/15SF 04/29/15SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. $H_2O$. Add 114ml Glacial Acetic Acid (AB579) and 128.6ml of 10N NaOH (#M12292). Dilute to 20L w/D.I. $H_2O$ and mix. pH=4.93±0.05
Exp: 04/28/16

#M12481 05/04/15SF — Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12482 05/04/15SF — Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12483 05/04/15SF — Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 12482) into 100ml = 3.0ug/L Hg

#M12484 05/04/15SF — Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12485 05/04/15SF — Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 12482) into 100ml = 0.2ug/L Hg

#M12486 05/04/15SF — Hg Aqua Regia Reagent:
"Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12487 05/04/15SF — Stannous Chloride Reagent:
Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 12299) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water

#M12468
4/22/15
MDS

| | | Instrument: | ICP 6000 |
|---|---|---|---|
| Standard Log #: | M12468 | Standard: | Na,K ICVLL |
| Analyst: | MDS | Concentrations: | 3 mg/L (Na,K) |
| Prep Date: | 04/22/2015 | Expiration Date: | 11/8/2015 |
| Prep: | Into a 500 mL volumetric flask, pipetted **0.15 mL** of Na (10,000 µg/mL) M12010 and **0.15 mL** K (10,000 µg/mL) M12294 and brought to volume with Milli-Q $H_2O$. (2% $HNO_3$) | | |

#M12469
4/22/15
MDS

| | | Instrument: | ICP 6000 |
|---|---|---|---|
| Standard Log #: | M12469 | Standard: | Na,K MRL |
| Analyst: | MDS | Concentrations: | 1 mg/L (Na,K) |
| Prep Date: | 04/22/2015 | Expiration Date: | 04/29/2016 |
| Prep: | Into a 500 mL volumetric flask, pipetted **0.5 mL** of Na (1000 µg/mL) M12296 and **0.5 mL** K (1000 µg/mL) M12295 and brought to volume with Milli-Q $H_2O$. (2% $HNO_3$) | | |

# M12470 ZA 4-24-15 Cr 10,000 ~~mg~~ mg/L 4-24-15 CPI lot # 13D123. ex oct/2016

# M12471 ZA 4-24-15 Boron 1000 mg/L CPI lot # 15D007. ex oct/2016

# M12472 ZA Cu 10,000 mg/L CPI lot # 15B087. ex oct/2016

# M12473 ZA Ba 1000 mg/L CPI lot # 15C142. ex oct/2016

# M12474 ZA K 10,000 mg/L CPI lot # 15D114. ex oct/2016

#M12475
04/24/15
MDS

| Standard Log #: | M12475 | Instrument: | GFAA |
|---|---|---|---|
| Analyst: | MDS | Reagent: | Pd/Mg Matrix Modifier |
| Prep Date: | 04/24/2015 | Expiration Date: | 08/07/2015 |
| Prep: | Into a 50 mL volumetric flask, partially filled with milli-Q $H_2O$, pipetted **15 mL** Pd Modifier M12158 and **10 mL** Mg (10,000 mg/L) M12314 and brought up to volume. | | |

| | | |
|---|---|---|
| #M12459 04/20/15 LSF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M12460 04/20/15 LSF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M12461 04/20/15 LSF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 12460) into 100ml = 3.0ug/L Hg |
| #M12462 04/20/15 LSF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M12463 04/20/15 LSF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 12460) into 100ml = 0.2ug/L Hg |
| #M12464 04/20/15 LSF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M12465 04/20/15 LSF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 12299) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M12466 04/22/15 LSF NaCl Hydroxylamine Sulfate Reagent: Dissolve 60g NaCl (#M11799) and 60g hydroxylamine Sulfate (#M12096) in 500ml of Milli-Q $H_2O$.
Exp: 10/22/15

# M12467
04/22/15
MDS

| | | | |
|---|---|---|---|
| | | Instrument: | ICP 6000 |
| Standard Log #: | M12467 | Standard: | Na & K ICAL |
| Analyst: | MDS | Concentrations: | 0.5, 1, 5, 10, 50, 100, and 200 mg/L (Na,K) |
| Prep Date: | 04/22/2015 | Expiration Date: | 04/29/2016 |
| Prep: | Into seven, 200 mL volumetric flasks, pipetted the following from Na (1000 µg/mL) M12296 and K (1000 µg/mL) M12295 and brought up to volume using milli-Q $H_2O$. (2% $HNO_3$)<br>*0.5 mg/L std.* - **0.1 mL** of each<br>*1.0 mg/L std.* - **0.2 mL** of each<br>*5.0 mg/L std.* - **1.0 mL** of each<br>*10 mg/L std.* - **2.0 mL** of each<br>*50 mg/L std.* - **10 mL** of each<br>*100 mg/L std.* - **20 mL** of each, also used for Continuing Calibration Verification<br>*200 mg/L std.* - **40 mL** of each | | |

#M12453 04/07/15 L3F
LOQ Check
3050 QSM DOD

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| K | 2640 | M12294 | 10000 | 13.2 |
| Na | 960 | M12010 | 10000 | 4.8 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 8-Nov

#M12454 04/07/15 L3F
LOQ check
3050 QSM DOD

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| B | 52 | M11763 | 1000 | 2.6 |
| Si | 192 | M12007 | 1000 | 9.6 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 13-May

# M12455 4/8/15 JA Environmental Express Y, 10,000mg/L lot# 1418108.
expires. 10/16

#M12456 04/14/15 L3F potassium permanganate soln: 50g potassium permanganate (#M11285) dissolve into 1,000mL of D.I. $H_2O$.
Exp: 10/14/15

#M12457 04/15/15 L3F SPLP Ext. Fluid Acid mixture: Into a 200 mL Vol. Flask, add 12g $H_2SO_4$ (AB.598) and 8g conc. $HNO_3$ (AB.596). Bring up to volume with D.I. $H_2O$.
Exp: 04/15/16

#M12458 04/16/15 L3F SPLP Extraction Fluid West #2: Fill a 20L carboy with D.I. $H_2O$ and adjust pH to $5.00 \pm 0.05$ with (#M12457) 60/40 $HNO_3$, $H_2SO_4$ mix w/v mix.
Exp: 04/16/16

#M12449 04/07/15 13F
LOQ Check
3010 QSM DOD

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| B | 16 | M11763 | 1000 | 0.8 |
| Si | 200 | M12007 | 1000 | 10 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 13-May

#M12450 04/07/15 13F
LOQ Check
3050 QSM DOD

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Li | 14.4 | M11998 | 1000 | 0.72 |
| Sn | 20 | M11996 | 1000 | 1 |
| Sr | 3.2 | M11999 | 1000 | 0.16 |
| Ti | 9.6 | M12003 | 1000 | 0.48 |
| W | 24 | M12001 | 1000 | 1.2 |
| | | | | |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 8-Nov

#M12451 04/07/15 13F
LOQ Check
3050 QSM DOD

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 4 | M11908 | 1000 | 0.2 |
| Al | 9.6 | M12312 | 10000 | 0.048 |
| As | 32 | M12315 | 1000 | 1.6 |
| Ba | 2 | M11768 | 1000 | 0.1 |
| Be | 1.6 | M12006 | 1000 | 0.08 |
| Ca | 56 | M12310 | 10000 | 0.28 |
| Cd | 1.6 | M12002 | 1000 | 0.08 |
| Co | 9.6 | M1200 | 1000 | 0.48 |
| Cr | 5.6 | M11767 | 10000 | 0.028 |
| Cu | 16 | M11764 | 10000 | 0.08 |
| Fe | 72 | M1231 | 10000 | 0.36 |
| Mg | 32 | M12314 | 10000 | 0.16 |
| Mn | 6 | M11829 | 10000 | 0.03 |
| Mo | 9.6 | M12008 | 1000 | 0.48 |
| Ni | 4.8 | M12004 | 1000 | 0.24 |
| Pb | 10 | M12313 | 10000 | 0.05 |
| Sb | 32 | M11909 | 1000 | 1.6 |
| Se | 16 | M11911 | 1000 | 0.8 |
| Tl | 19 | M11997 | 1000 | 0.95 |
| V | 3.2 | M12009 | 1000 | 0.16 |
| Zn | 12 | M12005 | 10000 | 0.06 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 13-May

#M12452 04/07/15 13F
LOQ Check
3050 QSM DOD

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| S | 240 | M11679 | 10000 | 1.2 |
| | | | | |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

#M12447
MDS
04/07/15

| | | Instrument: | GFAA |
|---|---|---|---|
| Standard Log #: | M12447 | Standard: | LODW/LOQW Spiking Sol'n |
| Analyst: | MDS | Concentrations: | 150 ug/L (Sb)<br>100 ug/L (As)<br>200 ug/L (Se)<br>45 ug/L (Pb)<br>40 ug/L (Tl) |
| Prep Date: | 04/07/2015 | Expiration Date: | 9/18/2015 |
| Prep: | Into a 100 mL volumetric flask, pipetted the following and brought up to volume with Milli-Q $H_2O$.<br>**1.5 mL** of Sb (1000 mg/L) M11909<br>**1.0 mL** of As (1000 mg/L) M12315<br>**2.0 mL** of Se (1000 mg/L) M11911<br>**0.045 mL** of Pb (10,000 mg/L) M12313<br>**0.4 mL** of Tl (1000 mg/L) M11997<br>From this diluted standard solution, pipetted **10 mL** into a 1 L volumetric flask and brought up to volume with Milli-Q $H_2O$ to make the spiking solution.<br>(1% $HNO_3$)<br>*Pipette **1 mL** spiking solution into 50 mL $H_2O$ for LOD (*3 ug/L* Sb, *2 ug/L* As, *4 ug/L* Se, *0.9 ug/L* Pb, *0.8 ug/L* Tl) and **2 mL** spiking solution for LOQ (*6 ug/L* Sb, *4 ug/L* As, *8 ug/L* Se, *1.8 ug/L* Pb, *1.6 ug/L* Tl) | | |

#M12448
MDS
04/07/15

| | | Instrument: | GFAA |
|---|---|---|---|
| Standard Log #: | M12448 | Standard: | LODS/LOQS Spiking Sol'n |
| Analyst: | MDS | Concentrations: | 60 ug/L (Sb)<br>160 ug/L (As,Se)<br>40 ug/L (Pb)<br>50 ug/L (Tl) |
| Prep Date: | 04/07/2015 | Expiration Date: | 9/18/2015 |
| Prep: | Into a 200 mL volumetric flask, pipetted the following and brought up to volume with Milli-Q $H_2O$.<br>**1.2 mL** of Sb (1000 mg/L) M11909<br>**3.2 mL** of As (1000 mg/L) M12315<br>**3.2 mL** of Se (1000 mg/L) M11911<br>**0.08 mL** of Pb (10,000 mg/L) M12313<br>**1.0 mL** of Tl (1000 mg/L) M11997<br>From this diluted standard solution, pipetted **10 mL** into a 1 L volumetric flask and brought up to volume with Milli-Q $H_2O$ to make the spiking solution.<br>(1% $HNO_3$)<br>*Pipette **1 mL** spiking solution into 50 mL $H_2O$ for LOD (1.2 *ug/L* Sb, *3.2 ug/L* As, *3.2 ug/L* Se, *0.8 ug/L* Pb, *1 ug/L* Tl) and **2 mL** spiking solution for LOQ (2.4 *ug/L* Sb, *6.4 ug/L* As, *6.4 ug/L* Se, *1.6 ug/L* Pb, *2 ug/L* Tl) | | |

#M12445 04/06/15 LJF
LOQ Check
3010 GSM DoD

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Li | 10 | M11998 | 1000 | 0.5 |
| Sn | 10 | M11996 | 1000 | 0.5 |
| Sr | 2 | M11999 | 1000 | 0.1 |
| Ti | 8 | M12003 | 1000 | 0.4 |
| W | 36 | M12163 | 1000 | 1.8 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 8-Nov

#M12446 04/06/15 LJF
LOQ Check
3010 GSM DoD

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| K | 500 | M12294 | 10000 | 2.5 |
| Na | 600 | M12010 | 10000 | 3 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 8-Nov

| | | Instrument: | GFAA |
|---|---|---|---|
| Standard Log #: | M12442 | Standard: | CCV Std. |
| Analyst: | MDS | Concentrations: | 10 ug/L (As, Pb, Sb, Se, Tl)<br>1.5 ug/L (Ag) |
| Prep Date: | 04/02/2015 | Expiration Date: | 06/01/2015 |
| Prep: | Into a 1 L volumetric flask, pipetted **0.1 mL** of GFAA Custom Stock Std. ((100 ug/mL As, Pb, Sb, Se, Tl) (15 ug/mL Ag)) M11978 and brought to volume with Milli-Q DI $H_2O$. (1% $HNO_3$) | | |

#M12442
04/02/15
MDS

| | | Instrument: | GFAA |
|---|---|---|---|
| Standard Log #: | M12443 | Standard: | ICV/LCS Std. |
| Analyst: | MDS | Concentrations: | 10 ug/L (As, Pb, Sb, Se, Tl)<br>1.0 ug/L (Ag) |
| Prep Date: | 04/02/2015 | Expiration Date: | 06/01/2015 |
| Prep: | Into a 1 L volumetric flask, pipetted **1.0 mL** of GFAA Custom Stock Std. ((10 ug/mL As, Pb, Sb, Se, Tl) (1.0 ug/mL Ag)) M11979 and brought to volume with Milli-Q DI $H_2O$. (1% $HNO_3$) | | |

#M12443
04/02/15
MDS

#M12444 04/06/15 BF
LOQ check 3010 OSM DoD

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 4 | M11908 | 1000 | 0.2 |
| Al | 36 | M11914 | 10000 | 0.18 |
| As | 24 | M11912 | 1000 | 1.2 |
| Ba | 1.8 | M11768 | 1000 | 0.09 |
| Be | 0.6 | M12006 | 1000 | 0.03 |
| Ca | 100 | M11910 | 10000 | 0.5 |
| Cd | 2 | M12002 | 1000 | 0.1 |
| Co | 4 | M17000 | 1000 | 0.2 |
| Cr | 4 | M11767 | 10000 | 0.02 |
| Cu | 7 | M11764 | 10000 | 0.035 |
| Fe | 100 | M11915 | 10000 | 0.5 |
| Mg | 40 | M11976 | 10000 | 0.2 |
| Mn | 4 | M11829 | 10000 | 0.02 |
| Mo | 7 | M12008 | 1000 | 0.35 |
| Ni | 6 | M12004 | 1000 | 0.3 |
| Pb | 4 | M11682 | 10000 | 0.02 |
| Sb | 12 | M11682 | 1000 | 0.6 |
| Se | 13 | M11911 | 1000 | 0.65 |
| Tl | 15 | M11997 | 1000 | 0.75 |
| V | 5 | M12009 | 1000 | 0.25 |
| Zn | 10 | M12005 | 10000 | 0.05 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 13-May

#M12432 03/30/15 1Z# Potassium persulfate: 50g potassium persulfate (#M10987) dissolve into 1,000mL of D.I.H2O.
Exp: 09/30/15

#M12433 03/31/15 SF Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12434 03/31/15 SF Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12435 03/31/15 SF Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 12434) into 100ml = 3.0ug/L Hg

#M12436 03/31/15 SF Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12437 03/31/15 SF Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 12434) into 100ml = 0.2ug/L Hg

#M12438 03/31/15 SF Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12439 03/31/15 SF Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M12299) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M12440 03/31/15 SF 10N NaOH: Into 1 L flask, add 400g NaOH (#M11145) and bring up to volume with D.I.H2O.
Exp: 10/31/15 03/31/15 SF

#M12441
04/02/15
MDS

| | | Instrument: | GFAA |
|---|---|---|---|
| Standard Log #: | M12441 | Standard: | Calibration Std. |
| Analyst: | MDS | Concentrations: | 25 ug/L (As, Pb, Sb, Se, Tl)<br>3.75 ug/L (Ag) |
| Prep Date: | 04/02/2015 | Expiration Date: | 06/01/2015 |
| Prep: | Into a 1 L volumetric flask, pipetted **0.25 mL** of GFAA Custom Stock Std. ((100 ug/mL As, Pb, Sb, Se, Tl) (15 ug/mL Ag)) M11978 and brought to volume with Milli-Q $H_2O$. (1% $HNO_3$) | | |

#M12421 03/19/15 TCLP Extraction Fluid#1: Fill a 20L carboy w/19L D.I. H2O. Add 114mL Glacial Acetic Acid (AB579) and 128.6mL of 10N NaOH (#M12292). Dilute to 20L w/D.I. H2O and mix. pH=4.93± 0.05
Exp: 03/19/16

#M12422 03/20/15 SF NaCl Hydroxylamine Sulfate Reagent: Dissolve 60g NaCl (#M11799) and 60g hydroxylamine sulfate (#M12096) in 500mL of Milli-Q H2O.
Exp: 09/20/15

#M12423 MDS 03/24/15

| | | | |
|---|---|---|---|
| Standard Log #: | M12423 | Reagent: | TCLP EXTRACTION FLUID #1 |
| Analyst: | MDS | pH: | 4.93 ± 0.05 |
| Prep Date: | 03/24/2015 | Expiration Date: | 09/24/2015 |
| Prep: | Into a 20 L carboy filled with 19 L of DI $H_2O$, add **114 mL** Glacial acetic acid AB.579 and **128.6** mL 10N NaOH M12292 . Dilute to 20 L and mix. | | |

#M12424 03/24/15 SF — Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12425 03/24/15 SF — Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12426 03/24/15 SF — Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 12425) into 100ml = 3.0ug/L Hg

#M12427 03/24/15 SF — Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12428 03/24/15 SF — Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 12425) into 100ml = 0.2ug/L Hg

#M12429 03/24/15 SF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12430 03/24/15 SF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M12299) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M12431 03/25/15 SF potassium permanganate soln: 50g potassium permanganate (#M11785) dissolve into 1,000mL of D.I. H2O.
Exp: 09/25/15

| | | |
|---|---|---|
| #M12406 03/06/15 SF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M12407 03/06/15 SF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M12408 03/06/15 SF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 12407 ) into 100ml = 3.0ug/L Hg |
| #M12409 03/06/15 SF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M12410 03/06/15 SF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 12407 ) into 100ml = 0.2ug/L Hg |
| #M12411 03/06/15 SF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M12412 03/06/15 SF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M12299) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |
| #M12413 03/17/15 SF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M12414 03/17/15 SF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M12415 03/17/15 SF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 12414 ) into 100ml = 3.0ug/L Hg |
| #M12416 03/17/15 SF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M12417 03/17/15 SF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 12414 ) into 100ml = 0.2ug/L Hg |
| #M12418 03/17/15 SF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M12419 03/17/15 SF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M12299 ) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M12420 03/19/15 SF TCLP Extraction Fluid #1: fill a 20L carboy w/19L D.I. H2O. Add 114mL Glacial Acetic Acid (AB:579) and 128.6mL of 10N NaOH (#M12292). Dilute to 20L w/D.I. H2O and mix. pH = 4.93 ± 0.05
Exp: 03/19/16

#M12395
02/23/15 MOS

List 2 MRL/ICVLL Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

0.5% $HNO_3$
0.5% HCl

| Analyte | MRL (ug/L) | ICVLL (ug/L) | Std ID # | Std Conc (mg/L) | hount (mL) pipet into 1 | Expired Date |
|---|---|---|---|---|---|---|
| Li | 20 | 60 | M11998 | 1000 | 1 | 11/08/2015 |
| W | 100 | 300 | M12163 | 1000 | 5 | 02/06/2016 |
| Ti | 10 | 30 | M12003 | 1000 | 0.5 | 11/08/2015 |
| Sr | 10 | 30 | M11999 | 1000 | 0.5 | 11/08/2015 |
| Sn | 20 | 60 | M11996 | 1000 | 1 | 11/08/2015 |
| | | | | | | |

Pipette 10 mL into a 500 mL volumetric flask to create a [redacted] working MRL std. or 1 mL into a 50 mL digestion tube for a digested MRL working standard. Pipette 30 mL into 500mL For ICVLL Working

#M12396
02/23/15 MOS

List 2 MRL

Into a 500 mL volumetric flask, pipetted 10 mL of #M12395 and brought to volume with milli-Q H20.
Exp. 11/08/2015 0.5% HNO3, 0.5% HCl

#M12397
02/23/15 MOS

List 2 ICVLL

Into a 500 mL volumetric flask, pipetted 30 mL of #M12395 and brought to volume with milli-Q H20.
Exp. 11/08/2015 0.5% HNO3, 0.5% HCl

#M12398 02/23/15 JF NaCl Hydroxylaminesulfate Reagent: Dissolve 60g NaCl (#M11799) and 60g hydroxylamine sulfate (#M11798) in 500mL of milli-Q $H_2O$.
Exp: 08/23/15

#M12399 02/24/15 JF potassium permanganate soln: 50g potassium permanganate (#M11285) dissolve into 1,000 mL of D.I. $H_2O$.
Exp: 08/24/15

#M12400 2-25-15 Al 10,000 mg/L CPI Lot# 14K153. ex 7/2016

# M12401 2-25-15 Fe 10,000 mg/L CPI Lot# H5165, 7/2016

#M12402 02/26/15 JF Stannous Chloride (Macron) Lot# 0000096553

#M12403 02/26/15 JF Sodium Chloride (Fisher) Lot# 145475

#M12404 03/04/15 JF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. $H_2O$. Add 114mL Glacial Acetic Acid (AB5791) and 128.6mL of 10N NaOH (#M12292). Dilute to 20L w/D.I. $H_2O$ and mix.
pH = 4.93 ± 0.05

#M12405 03/04/15 JF TCLP Extraction Fluid #1: Fill a 20L Carboy w/19L D.I. $H_2O$. Add 114mL Glacial Acetic Acid (AB5791) and 128.6mL of 10N NaOH (#M12292). Dilute to 20L w/D.I. $H_2O$ and mix.
pH = 4.93 ± 0.05

#M12383 02/19/15 LSF TCLP Extraction Fluid #1: Fill a 20L Carboy w/ 19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB.579) and 1281.6mL of 1.0N NaOH (#M12292). Dilute to 20L w/ D.I. H2O and mix.
pH=4.93 ± 0.05

| | | |
|---|---|---|
| #M12384 02/19/15 LSF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M12385 02/19/15 LSF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M12386 02/19/15 LSF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 12385 ) into 100ml = 3.0ug/L Hg |
| #M12387 02/19/15 LSF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M12388 02/19/15 LSF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 12385 ) into 100ml = 0.2ug/L Hg |
| #M12389 02/19/15 LSF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M12390 02/19/15 LSF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 12299) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

## ICAP Working Standards List 2

.5% HNO3 .5%HCL

#M12391 02/23/15 MOS

| Standard name | Pipetted the following respectively: |
|---|---|
| 1 | 0.01mL of #M12316 and 0.001mL #M12001 into 1L = 1 ug/L |
| 10 | 0.10mL of #M12316 and 0.01mL #M12001 into 1L = 10 ug/L |
| 100 | 1mL of #M12316 and 0.1mL #M12001 into 1L = 100 ug/L |
| 1000 | 2 mL of #M12316 and 0.2 mL #M12001 into 200 mL = 1000 ug/L |
| 10000 | 20mL of #M12316 and 2mL #M12001 into 200mL = 10000 ug/L |

Brought up to mark with milli-Q H20 Exp. 11/08/2015

#M12392 02/23/15 MOS

Continuing Calibration Standard (CCV)

Into a 200mL volumetric flask pipetted 2mL of #M12316 and 0.2mL #M12001 = 1000 ug/L
Brought up to mark with milli-Q H20 Exp. 11/08/2015 0.5% HNO3, 0.5% HCl

#M12393 02/23/15 MOS

Initial Calibration Standard (ICV) List 2

Into a 1 liter volumetric flask pipetted 1mL of #M12003, M11999, M11996, M11998, M12163
Brought up to mark with milli-Q H20 Exp. 11/08/2015 0.5% HNO3, 0.5% HCl

#M12394 02/23/15 MOS

ICASB List 2

Into a 200 mL volumetric flask, pipetted 20 mL Interferents A #M12164, 6 mL Fe (10,000 µg/mL) #M12311, and 0.1 mL of 1000mg/L Ti, Sr, Sn, Li, and W #M12003, M11999, M11996, M11998, and M12001 respectively.
Brought up to mark with milli-Q H20 Exp. 08/30/2015 0.5% HNO3, 0.5% HCl

# M12378 2-10-15 K-1000mg/L CPI Lot# 14L175 ex 7/16.

| | | | |
|---|---|---|---|
| Standard Log #: | M12379 | Standard: | GFAA Instrument Check |
| Analyst: | MDS | Final Concentration: | 10 µg/L As<br>6 µg/L Pb<br>22 µg/L Tl<br>24 µg/L Sb, Se<br>0.8 µg/L Ag |
| Prep Date: | 02/17/2015 | Expiration Date: | 09/18/2015 |

#M12379
MDS
02/17/15

Into six, 100 mL volumetric flasks, add the following and bring up to volume with milli-Q $H_2O$.

| Element | Volume Pipetted (mL) | Standard Conc. (µg/mL) | Standard ID | New Conc. (µg/L) |
|---|---|---|---|---|
| As | 1 | 1000 | M12315 | 10,000 |
| Pb | 0.1 | 10,000 | M12313 | 10,000 |
| Tl | 1 | 1000 | M11997 | 10,000 |
| Se | 1 | 1000 | M11911 | 10,000 |
| Sb | 1 | 1000 | M11909 | 10,000 |
| Ag | 0.1 | 1000 | M11908 | 1000 |

Into a 1 L volumetric flask, add the following and bring up to volume with Milli-Q H20. (1% HNO3)

| Element | Volume Pipetted (mL) | Standard Conc. (µg/L) | Final Conc. (µg/L) |
|---|---|---|---|
| As | 1 | 10,000 | 10 |
| Pb | 0.6 | 10,000 | 6 |
| Tl | 2.2 | 10,000 | 22 |
| Se | 2.4 | 10,000 | 24 |
| Sb | 2.4 | 10,000 | 24 |
| Ag | 0.8 | 1000 | 0.8 |

#M12380 - Custom Assurance Std - Spex Certiprep
2-17-15

#M12381 02/17/15 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB579) and 128.6ml of 10N NaOH (#M12292). Dilute to 20L w/D.I. H2O and mix. pH = 4.93 ± 0.05
Exp: 02/17/16

#M12382 02/17/15 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB579) and 128.6ml of 10N NaOH (#M12292). Dilute to 20L w/D.I. H2O and mix. pH = 4.93 ± 0.05
Exp: 02/17/16

#M12364 02/04/15 LSF Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12365 02/04/15 LSF Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12366 02/04/15 LSF Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 12365) into 100ml = 3.0ug/L Hg

#M12367 02/04/15 LSF Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12368 02/04/15 LSF Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 12365) into 100ml = 0.2ug/L Hg

#M12369 02/04/15 LSF Hg Aqua Regia Reagent:
"Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12370 02/04/15 LSF Stannous Chloride Reagent:
Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M12371 2-5-15 ZA Sulfur 10,000mg/L SPC Science lot # S140717006. ex 4/16.

#M12372 02/05/15 LSF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB.579) and 128.6 ml of 10N NaOH (#M12292). Dilute to 20L w/D.I. H2O and mix. pH=4.93 ± 0.05
Exp: 02/05/16

#M12373 02/05/15 LSF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB.579) and 128.6ml of 10N NaOH (#M12297). Dilute to 20L w/D.I. H2O and mix. pH=4.93 ± 0.05
Exp: 02/05/16

#M12374 2/5/15 Custom Assurance Std 100ug/ml 23 lot# 8-91WL ex 1/16

#M12375 02/10/15 LSF 10N NaOH: Into a 1L flask, add 400g NaOH (#M11852) and bring up to volume with D.I. H2O.
Exp: 08/10/15

#M12376 02/10/15 LSF Potassium permanganate soln: 50g potassium permanganate (#M11785) dissolve into 1,000ml of D.I. H2O.
Exp: 08/10/15

#M12377 ZA 2-10-15 Na 1000mg/L CPI lot# 14L083. ex 7/16.

#M12352 01/20/15 13F potassium permanganate soln: 50g potassium permanganate (#M11285) dissolve into 1,000mL of D.I. $H_2O$
Exp: 07/20/15

#M12353 01-22-15 MOS . S ICAL - Into 4, 100 mL vol. Flasks, pipetted the following and brought up to volume with milli-Q $H_2O$. exp. 01-30-16

0.01mL S (10,000ug/mL) # M12350 = 1000ug/L S
0.1 mL S (10,000ug/mL) # M12350 = 10,000ug/L S
Used as CCV → 1.0 mL S (10,000ug/mL) # M12350 = 100,000ug/L S
10 mL S (10,000ug/mL) # M12350 = 1000K ug/L S

#M12354 01-22-15 MOS S ICV - Into a 100mL vol. flask, pipetted 1.0 mL S (10,000ug/mL) #M11828 and brought to volume with milli-Q $H_2O$. exp. 01-30-15

#M12355 01/27/15 13F Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12356 01/27/15 13F Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12357 01/27/15 13F Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M12356) into 100ml = 3.0ug/L Hg

#M12358 01/27/15 13F Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12359 01/27/15 13F Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M12356) into 100ml = 0.2ug/L Hg

#M12360 01/27/15 13F Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12361 01/27/15 13F Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M12362 01/27/15 13F NaCl Hydroxylamine Sulfate Reagent: Dissolve 60g NaCl (#M11799) and 60g hydroxylamine Sulfate (#M11798) in 500mL of Milli-Q $H_2O$.
Exp: 07/27/15

#M12363 01/30/15 13F TCLP Extraction Fluid #1: Fill a 20L carboy w/ 19L D.I. $H_2O$. Add 114mL Glacial Acetic Acid (AB. 579) and 128.6mL of ~~10N~~ 10N NaOH (#M12292). Dilute to 20L w/ D.I. $H_2O$ ~~and~~ and 01/30/15 13F mix. pH = 4.93 ± 0.05
Exp: 01/30/16

#M12340 1-9-15
5% HCL
5% HNO3

3050 MDL Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | MDL (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| K | 500 | #M12294 | 10000 | 2.5 |
| Na | 500 | #M12010 | 10000 | 2.5 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

EXPIRES 11/15

#M12341 01-14-15 MOS GFAA LOD/LOQ Check Water Working Std. (Ag Only) - Into a 100mL vol. Flask, pipetted 0.1mL Ag (1000ug/mL) #M11908 and brought up to volume using Milli-Q $H_2O$. exp. 09-18-15

#M12342 01-14-15 MOS GFAA LOD/LOQ Water Spiking Solution (Ag Only) - Into a 1L vol. Flask, pipetted 10mL #M12341 and brought up to volume using Milli-Q $H_2O$ (1% $HNO_3$) exp. 09-18-15

#M12343 01/19/15 SF Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12344 01/19/15 SF Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12345 01/19/15 SF Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 12344) into 100ml = 3.0ug/L Hg

#M12346 01/19/15 SF Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12347 01/19/15 SF Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 12344) into 100ml = 0.2ug/L Hg

#M12348 01/19/15 SF Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12349 01/19/15 SF Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M12350 1-19-15 Spex Certiprep S 10,000 mg/L Lot # AH15-85SY ex 1/16

#M12351 01/19/15 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/192 D.I. $H_2O$. Add 114ml Glacial Acetic Acid (AB. 579) and 128.6ml of 10N NaOH (#M12292). Dilute to 20L w/ D.I. $H_2O$ and mix. pH=4.93 ± 0.05
Exp: 01/19/16 01/19/15 SF

#M12334 01/08/15SF

Hg MRL: (0.2% HNO3, HCl) — 0.2ml of 100ug/L Hg (#M 17331) into 100ml = 0.2ug/L Hg

#M12335 01/08/15SF

Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12336 01/08/15SF

Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M12337 1-9-15 JA
5% HNO3
5% HCL

MDL Spiking Solution
Base SPIKE PREPARATION 50x B, Si, S

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | MDL (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| B | 20 | #M11763 | 1000 | 1 |
| Si | 100 | #M12007 | 1000 | 5 |
| S | 200 | #M11679 | 10000 | 1 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard. EXPIRES 5/15

#M12338 1-9-15 JA
5% HNO3
5% HCL

MDL Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | MDL (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 5 | #M11908 | 1000 | 0.25 |
| Al | 10 | #M12312 | 10000 | 0.05 |
| As | 20 | #M12315 | 1000 | 1 |
| Ba | 2 | #M11768 | 1000 | 0.1 |
| Be | 0.5 | #M12006 | 1000 | 0.025 |
| Ca | 50 | #M12310 | 10000 | 0.25 |
| Cd | 0.5 | #M12002 | 1000 | 0.025 |
| Co | 2.5 | #M12000 | 1000 | 0.125 |
| Cr | 50 | #M11767 | 10000 | 0.25 |
| Cu | 10 | #M11764 | 10000 | 0.05 |
| Fe | 40 | #M12311 | 10000 | 0.2 |
| Mg | 25 | #M12314 | 10000 | 0.125 |
| Mn | 5 | #M11829 | 10000 | 0.025 |
| Mo | 2.5 | #M12008 | 1000 | 0.125 |
| Ni | 5 | #M12004 | 1000 | 0.25 |
| Pb | 10 | #M12313 | 10000 | 0.05 |
| Sb | 20 | #M11909 | 1000 | 1 |
| Se | 20 | #M11911 | 1000 | 1 |
| Tl | 20 | #M11997 | 1000 | 1 |
| V | 5 | #M12009 | 1000 | 0.25 |
| Zn | 5 | #M12005 | 10000 | 0.025 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard. EXPIRES 15-Feb

#M12339 (1-9-15) JA
5% HNO3
5% HCL

MDL Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | MDL (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Li | 20 | #M11998 | 1000 | 1 |
| Sn | 20 | #M11996 | 1000 | 1 |
| Sr | 20 | #M11999 | 1000 | 1 |
| Ti | 20 | #M12003 | 1000 | 1 |
| W | 20 | #M11679 | 1000 | 1 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard. EXPIRES 5/15

#M12328 1-8-15
JY

Continuing Calibration Standard 2(CCV2)

Into a one liter volmetric flask pipet 5 mls of # M12316 (ex 12/15) and 0.5 ml of #M12125(ex 07/15).
ex 07/15
Bring up to mark with DI H2O

#M12329 - 1-8-15
JY
MRL Stock Std

MRL Std
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | MRL (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L | Expiration Date |
|---|---|---|---|---|---|
| Ag | 20 | #M11908 | 1000 | 1 | 9/15 |
| Al | 400 | #M12312 | 10000 | 2 | 6/16 |
| Ba | 10 | #M11768 | 1000 | 0.5 | 5/15 |
| Be | 4 | #M12006 | 1000 | 0.2 | 11/15 |
| Cd | 5 | #M12002 | 1000 | 0.25 | 11/15 |
| Co | 10 | #M12000 | 1000 | 0.5 | 11/15 |
| Cr | 10 | #M11767 | 10000 | 0.05 | 5/15 |
| Cu | 10 | #M11764 | 10000 | 0.05 | 5/15 |
| Mg | 500 | #M12314 | 10000 | 2.5 | 6/16 |
| Mn | 10 | #M11829 | 10000 | 0.05 | 7/16 |
| Mo | 10 | #M12008 | 1000 | 0.5 | 11/15 |
| Ni | 10 | #M12004 | 1000 | 0.5 | 11/15 |
| Pb | 10 | #M12313 | 10000 | 0.05 | 6/16 |
| Sb | 20 | #M11909 | 1000 | 1 | 8/15 |
| V | 10 | #M12009 | 1000 | 0.5 | 11/15 |
| Zn | 10 | #M12005 | 10000 | 0.05 | 11/15 |
| K | 1000 | #M12294 | 10000 | 5 | 4/16 |
| Na | 1000 | #M12010 | 10000 | 5 | 11/15 |
| As | 10 | #M12315 | 1000 | 0.5 | 6/16 |
| Ca | 500 | #M12310 | 10000 | 2.5 | 6/16 |
| Fe | 300 | #M12311 | 10000 | 1.5 | 6/16 |
| Se | 10 | #M11911 | 1000 | 0.5 | 9/15 |
| Tl | 20 | #M11997 | 1000 | 1 | 11/15 |
| Sr | 10 | #M11999 | 1000 | 0.5 | 11/15 |
| Ti | 10 | #M12003 | 1000 | 0.5 | 11/15 |
| Li | 20 | #M11998 | 1000 | 1 | 11/15 |
| Sn | 20 | #M11996 | 1000 | 1 | 11/15 |
| B | 20 | #M11763 | 1000 | 1 | 5/15 |
| Si | 100 | #M12007 | 1000 | 5 | 11/15 |
| W | 50 | #M11679 | 1000 | 2.5 | 5/15 |
| S | ~~5~~ 300 | #M11679 | 10000 | ~~2.5~~ 1.5 | 5/15 |

Of this Base standard pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

#M12330 01/08/15 JF 1-8-15
5% HCl
5% HNO3

MRL workingstd into 500 ml vol flask pipet 10 mls of #M12329 Bring up to mark with DI H2O.

#M12331 01/08/15 JF

Hg Working Stds:
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12331 01/08/15 JF

Hg Alt Source Working Std:
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12332 01/08/15 JF

Hg ICV / LCSW
(0.2% HNO3, HCl)

3.0ml of 100ug/L Hg (#M 12331) into 100ml = 3.0ug/L Hg

#M12333 01/08/15 JF

Hg CCV
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12324 01/07/15 SF Potassium persulfate: 50g potassium persulfate #M10987 dissolve into 1,000ml of D.I. H2O.
Exp: 07/07/15

#M12325 01-08-15 MOS

Spiking Solution calc
Base SPIKE PREPARATION 50x GFAA MDL Waters

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 0.2 | M11908 | 1000 | 0.01 |
| As | 2 | M11912 | 1000 | 0.1 |
| Pb | 2 | M12313 | 10000 | 0.01 |
| Sb | 2 | M11909 | 1000 | 0.1 |
| Se | 2 | M11911 | 1000 | 0.1 |
| Tl | 2 | M11997 | 1000 | 0.1 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires 09-18-15    2% HNO3

# M12326 1-8-15 JA

## ICAP Working Standards

5% HNO3 5%HCL

| Standard name | Std # | Pipet the following respectively: |
|---|---|---|
| 0.25 | 1 | 0.25 mls of standard 1000 ug/L into 1000 ml volumetric flask = 0.25 ug/L std |
| 0.5 | 2 | 0.50 mls of standard 1000 ug/L into 1000ml volumentric flask= 0.50 ug/L std |
| 1 | 3 | 1.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =1.00 ug/L std |
| 5 | 4 | 5.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =5.00 ug/L std |
| 10 | 5 | 10.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =10.0 ug/L std |
| 20 | 6 | 20.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =20.0 ug/L std |
| 50 | 7 | 50.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =50.0 ug/L std |
| 100 | 8 | 1.0 mls of #M12316(ex 12/15) and 1.0 mls of #M12125 (ex 07/15) into 1000 ml volumectric flask= 100 ug/L std |
| 1000 | 9 | 10.0 mls of #M12316(ex 12/15) and #M12125 (ex 07/15) and 1 mL of #M12007 Si into 1000 ml volumetric flask= 1000 ug/L std |
| 10,000 | 10 | 100 mls #M12316 (ex 12/15),100 mls #M12125 (ex 07/15) |
| 100k | 11 | 10 mls of #M11764 Cu (ex 5/15) , 10 mls of #M11829 Mn (ex 7/15) , 10 mls of #M11767 Cr (ex 5/15), 10 mls #M12313 Pb (ex 6-16), 10 mls zn #M12005(ex 8-15), 10 mls #M12010 Na (ex 11/15),10 mls = 100,000 ug/L - ~~As~~ 10mls #M12213 As(ex 5/16). |
| 100,000 | 12 | 10 mls of #M12314 Mg (ex 6/16) , 10 mls of #M121311 Fe (ex 06/16) ,10 mls of #M12310 Ca (ex 6/16),10 mls #M12312 AL (ex 6/16), 1.0 mls #12294 K (ex 4/16) into 1000 ml vol flask = 100,000 ug/l std |
| 500,000 | 13 | 50 mls of #M12314 Mg (ex 6/16) , 50 mls of #M121311 Fe (ex 6/16) ,50 mls of #M12310 Ca (ex 6/16), 50 mls #M12312 AL (ex 6/16) into 1000 ml vol flask = 500,000 ug/l std |
| 1000k | 14 | 100 mls of #M12314 Mg (ex 6/16) , 100 mls of #M121311 Fe (ex 6/16) ,100 mls of #M12310 Ca (ex 6/16),100 mls #M12312 AL (ex 6/16) into 1000 ml vol flask = 1,000,000 ug/l std |

Bring the 1000 ml volumetric up to mark with DI H2O

ex 05/15

#M12327 1-8-15 JA

Continuing Calibration Standard 1(CCV1)

Into a one liter volmetric flask pipet 50mls of # M12316 (ex 12/15)
and 5 ml of #M12125 (ex 07/15).
ex 07/15
Bring up to mark with DI H2O

#M12310 12-9-14 JA 10,000 mg/L Ca CPI Lot# 14K204 ex 6/16

#M12311 12-9-14 JA 10,000 mg/L Fe CPI Lot# 14J165 ex 6/16

#M12312 12-9-14 JA 10,000 mg/L Al CPI Lot #14H211 ex 6/16.

#M12313 12-9-14 JA 10,000 mg/L Pb CPI Lot #14D135 ex 6/16

#M12314 12-9-14 JA 10,000 mg/L Mg CPI Lot # 14K161 ex 6/16

#M12315 12-9-14 JA 1000 mg/L As CPI Lot #131194 ex 6/16

#M12316 12-9-14 JA Custom Assurance Std CPEx Centiprep lot 27-185CR ex 12/15

#M12317 12-09-14 MOS GFAA Se Spike (10ug/mL). Into a 100mL vol. Flask, pipetted 1.0mL Se (1000ug/mL) #M11811 + brought to volume with DI $H_2O$. ($3\% HNO_3$) exp. 09/18/15

#M12318 12/09/14 LSF TCLP Extraction Fluid#1: Fill a 20L carboy w/19L D.I. $H_2O$. Add 114mL Glacial Acetic Acid (AB579) and 128.6mL of 10N NaOH (#M12292). Dilute to 20L w/ D.I. $H_2O$ and mix.
Exp: 12/09/15
pH=4.93±0.05

#M12319 12/12/14 LSF potassium permanganate soln: 50g potassium permanganate (#M11285) dissolve into 1,000mL of D.I. $H_2O$.
Exp: 06/12/15

#M12320 JA 12-15-14 Custom Assurance Std Spex Centiprep lot 27-232CR
XCTWI-1-500

#M12321 JA 12-15-14 JA Custom Assurance Std ~~Spex~~ Centiprep lot 27-231CR
XSpike-1-250

#M12322 12/15/14 LSF TCLP Extraction Fluid #1: Fill a 20L Carboy w/19L D.I. $H_2O$. Add 114mL Glacial Acetic Acid (AB579) and 128.6mL of 10N NaOH (#M12292) Dilute to 20L with D.I. $H_2O$ and mix.
Exp: 12/15/15
pH=4.93±0.05

#M12323 12-22-14 MOS GFAA Pd/Mg Matrix Modifier - Into a 50mL vol. flask, pipetted 15.0mL of Pd Modifier #M12158 + 10mL of Mg (10,000ug/mL) #M12113 + brought up to volume using milli-Q $H_2O$. ($2\% HNO_3$) exp. 8/7/15

#M12295 JJ 11-21-14 K 1000ug/ml CPI Lot 14H165 Exp 4/16

#M12296 JJ 11-21-14 Na 1000ug/L CPI Lot 141167 ex 4/16

#M12297 11/21/14 13F Potassium permanganate soln: 50g potassium permanganate (#M11285) dissolve into 1,000mL of D.I. $H_2O$. Exp: 05/21/15

#M12298 11/24/14 13F Stannous Chloride (Macron) Lot# 0000082282

#M12299 11-25-14 JJ ICV 1 As + Pb. Into 1 Liter vol flask pipet 5mls #M11912, 0.5mls #M11682. Bring up to mark w/ DI $H_2O$.

~~#M12299~~ 12300 11/25/14 13F 11/25/14 13F Stannous Chloride (Macron) lot# 0000090643

#M12301 12/02/14 13F TCLP Extraction Fluid #1: Fill a 20L carboy w/ 19L D.I. $H_2O$. Add 114mL Glacial Acetic Acid (AB.579) and 128.6mL of 10N NaOH (#M12292). Dilute to 20L with D.I. $H_2O$ and mix pH = 4.93 ± 0.05 Exp: 12/02/15

| | | |
|---|---|---|
| #M12302 12/05/14 13F | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M12303 12/05/14 13F | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M12304 12/05/14 13F | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 12303) into 100ml = 3.0ug/L Hg |
| #M12305 12/05/14 13F | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M12306 12/05/14 13F | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 12303 ) into 100ml = 0.2ug/L Hg |
| #M12307 12/05/14 13F | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M12308 12/05/14 13F | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

~~#M12501~~ 12309 12/09/14 13F NaCl Hydroxylamine Sulfate Reagent: Dissolve 60g NaCl (#M11999) and 60g hydroxylamine sulfate (#M11998) in 500mL of milli-Q $H_2O$. Exp: 06/09/15

#M12282
11-13-14 MASt

ICASB List 2

Into a 200 mL volumetric flask, pipetted 20 mL Interferents A #M12082 and 0.1 mL of 1000mg/L Ti, Sr, Sn, Li, and W #M12003, M11999, M11996, M11998, and M12001 respectively. Brought up to mark with milli-Q H20 Exp. 06/30/2015

#M12283 11-14-14 Yttrium 10,000 ug/mL Environmental Express Lot#1418108

#M12284 11/14/14 lSF Hg Working Stds: (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12285 11/14/14 lSF Hg Alt Source Working Std: (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12286 11/14/14 lSF Hg ICV / LCSW (0.2% HNO3, HCl)

3.0ml of 100ug/L Hg (#M 12285) into 100ml = 3.0ug/L Hg

#M12287 11/14/14 lSF Hg CCV (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12288 11/14/14 lSF Hg MRL: (0.2% HNO3, HCl)

0.2ml of 100ug/L Hg (#M 12285) into 100ml = 0.2ug/L Hg

#M12289 11/14/14 lSF Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12290 11/14/14 lSF Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M12291 11/15/14 lSF NaCl Hydroxylamine Sulfate Reagent: Dissolve 60g NaCl (#M 11799) and 60g hydroxylamine sulfate (#M11498) in 500mL of milli-Q H2O.
Exp: 05/15/15

#M12292 11/20/14 lSF 10N NaOH: Into a 1L flask, add 400g NaOH (#M11145) and bring up to volume with D.I. H2O.
Exp: 05/20/15

#M12293 11/20/14 lSF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB.579) and 128.6ml of 10N NaOH (#M12292). Dilute to 20L with D.I. H2O and mix pH = 4.93 ± 0.05
Exp: 11/20/15

# M12294 11-21-14 K 10,000 ug/ml CPI Lot 1462l3 ex 4/29/16
JH

11/04/14 JSF
#M12271 TCLP Extraction Fluid #1: Fill a 20L carboy w/ 19L D.I. H2O. Add 114mL Glacial Acetic Acid (AB.579) and 128.6mL 10N NaOH (#M11955).
Exp: 10/21/04/14 Dilute to 20L with D.I. H2O and mix. pH = 4.93 ± 0.05
11/04/14 JSF

#M12272 11/05/14 JSF — Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12273 11/05/14 JSF — Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12274 11/05/14 JSF — Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 12273) into 100ml = 3.0ug/L Hg

#M12275 11/05/14 JSF — Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12276 11/05/14 JSF — Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M12273 ) into 100ml = 0.2ug/L Hg

#M12277 11/05/14 JSF — Hg Aqua Regia Reagent:
"Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12276 11/05/14 JSF — Stannous Chloride Reagent:
Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11985) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M12277 11/07/14 JSF Potassium permanganate (Fisher) Lot# 138790A

#M12278 11/13/14 JSF potassium permanganate soln: 50g potassium permanganate (#M11285) dissolve into 1,000mL of D.I. H2O.
Exp: 05/13/15

## ICAP Working Standards List 2

#M12279 11-13-14 MOS

.5% HNO3 .5%HCL

| Standard name | Pipetted the following respectively: |
|---|---|
| 1 | 0.01mL of #M12165 and 0.001mL #M12001 into 1L = 1 ug/L |
| 10 | 0.10mL of #M12165 and 0.01mL #M12001 into 1L = 10 ug/L |
| 100 | 1mL of #M12165 and 0.1mL #M12001 into 1L = 100 ug/L |
| 1000 | 2mL of #M12165 and 0.2mL #M12001 into 200mL = 1000 ug/L |
| 10000 | 20mL of #M12165 and 2mL #M12001 into 200mL = 10000 ug/L |

Brought up to mark with milli-Q H20 Exp. 08/30/2015

#M12280 11-13-14 MOS

Continuing Calibration Standard (CCV)

Into a 200mL volumetric flask pipetted 2mL of #M12165 and 0.2mL #M12001 = 1000 ug/L
Brought up to mark with milli-Q H20 Exp. 08/30/2015

#M12281 11-13-14 MOS

Initial Calibration Standard (ICV) List 2

Into a 1 liter volumetric flask pipetted 1mL of #M12003, M11999, M11996, M11998 and M12163
Brought up to mark with milli-Q H20 Exp. 11/08/2015

#M12258 10/22/14 LSF potassium permanganate soln: 50g potassium permanganate (#M 1128?)
Exp: 04/22/15 dissolve into 1,000ml of D.I. H2O.

#M12259 10/27/14 LSF stannous chloride (Macron) Lot# 0000087461

# M12260 10/28/14 ICV/LCS boron and silicon

Into a one liter volmetric flask pipet 10ml of #M12165 and 1.0 ml #M11919

Bring up to mark with DI H2O

| | | |
|---|---|---|
| #M12261 10/28/14 LSF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M12262 10/28/14 LSF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M12263 10/28/14 LSF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M12262) into 100ml = 3.0ug/L Hg |
| #M12264 10/28/14 LSF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M12265 10/28/14 LSF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M12262) into 100ml = 0.2ug/L Hg |
| #M12266 10/28/14 LSF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M12267 10/28/14 LSF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11795) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M12268 10/29/14 LSF potassium permanganate soln: 50g potassium permanganate (#M12285) dissolve into
Exp: 04/29/15 1,000ml of D.I. H2O.

#M12269 10/29/14 LSF NaCl Hydroxylamine sulfate Reagent: Dissolve 60g NaCl (#M 11799) and 60g hydroxylamine
Exp: 04/29/14 sulfate (#M11798) in 500ml of milli-Q H2O.

#M12270 11/04/14 LSF Sodium Chloride (Fisher) lot# 142463

#M12244 13F 10/13/14 13F Hg MRL: (0.2% HNO3, HCl) — 0.2ml of 100ug/L Hg (#M 12241) into 100ml = 0.2ug/L Hg

#M12245 13F 10/13/14 13F Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12246 13F 10/13/14 13F Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M12247 13F 10/16/14 Potassium persulfate: 50g potassium persulfate (#M10987) dissolve into 1,000 mL of D.I. $H_2O$.
#10/16/14 13F Exp: 04/16/15

#M12248 10/16/14 13F Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12249 10/16/14 13F Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12250 10/16/14 13F Hg ICV / LCSW (0.2% HNO3, HCl) — 3.0ml of 100ug/L Hg (#M 12249) into 100ml = 3.0ug/L Hg

#M12251 10/16/14 13F Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12252 10/16/14 13F Hg MRL: (0.2% HNO3, HCl) — 0.2ml of 100ug/L Hg (#M 12249) into 100ml = 0.2ug/L Hg

#M12253 10/16/14 13F Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12254 10/16/14 13F Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M12255 10/16/14 13F NaCl Hydroxylamine Sulfate Reagent: Dissolve 60g NaCl (#M11799) and 60g hydroxylamine sulfate (#M11798) in 500mL of Milli-Q $H_2O$.
Exp: 04/16/15

#M12256 10/16/14 MDS TCLP Extraction Fluid #1: Fill a 20L carboy with 19L DI$H_2O$. Add 114mL Glacial Acetic Acid AB 579 and 128.6mL 10N NaOH #M11955. Dilute to 20L with DI $H_2O$ + Mix. pH = 4.93
exp. 10/29/14

#M12257 10/21/14 MDS GFAA As Spike (10ug/mL) - Into a 100mL volumetric flask, pipetted 1.0mL As (1000ug/mL) # M11912 + brought up to volume using milli-Q $H_2O$. (3% $HNO_3$) exp. 9/18/15

#M12235 LOQ ✓
10-9-14 3050
DOD
QSM

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| S | 240 | M11679 | 10000 | 1.2 |
| | | | | |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 15-May

#M12236 LOQ ✓
10-9-14 DOD
QSM

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| S | 200 | M11679 | 10000 | 1 |
| | | | | #VALUE! |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 15-May

#M12237 MDS 10-09-14 GFAA Base Std (25ug/L) - Into a 1L vol. Flask, pipetted 0.25mL #M11978 and brought up to vol. using milli-Q $H_2O$. (1% $HNO_3$) exp 06/01/15

#M12238 MDS 10-09-14 GFAA CCV (10ug/L) - Into a 1L vol. Flask, pipetted 0.10mL #M11978 and brought up to volume using milli-Q $H_2O$. (1% $HNO_3$) exp 06/01/15

#M12239 MDS 10-09-14 GFAA ICV (10ug/L) - Into a 1L vol Flask, pipetted 1.0mL #M11979 and brought up to volume using milli-Q $H_2O$. (1% $HNO_3$) exp. 06/01/15

#M12240 LSF 10/13/14 LSF

Hg Working Stds:
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12241 LSF 10/13/14 LSF

Hg Alt Source Working Std:
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12242 LSF 10/13/14 LSF

Hg ICV / LCSW
(0.2% HNO3, HCl)

3.0ml of 100ug/L Hg (#M12241) into 100ml = 3.0ug/L Hg

#M12243 LSF 10/13/14 LSF

Hg CCV
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12231
10-9-14 LOQ✓
3050 QSM
DOD

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| K | 2640 | M12011 | 10000 | 13.2 |
| Na | 960 | M12010 | 10000 | 4.8 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 15-Feb

#M12232
10-9-14 ~~3050~~
LOQ✓ QSM DOD
3010

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| K | 500 | M12011 | 10000 | 2.5 |
| Na | 600 | M12010 | 10000 | 3 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 15-Feb

#M12233
10-9-14 3050
LOQ✓
QSM
DOD

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| B | 52 | M11763 | 1000 | 2.6 |
| Si | 192 | M12007 | 1000 | 9.6 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 15-Feb

#M12234
10-9-14 3010
LOQ✓ QSM
DOD

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| B | 16 | M11763 | 1000 | 0.8 |
| Si | 200 | M12007 | 1000 | 10 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 15-Feb

\# M12228 LOQ check
10-9-14 3010 QSM
DOD

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 4 | M11908 | 1000 | 0.2 |
| Al | 36 | M11914 | 10000 | 0.18 |
| As | 24 | M11912 | 1000 | 1.2 |
| Ba | 1.8 | M11768 | 1000 | 0.09 |
| Be | 0.6 | M12006 | 1000 | 0.03 |
| Ca | 100 | M11910 | 10000 | 0.5 |
| Cd | 2 | M12002 | 1000 | 0.1 |
| Co | 4 | M17000 | 1000 | 0.2 |
| Cr | 4 | M11767 | 10000 | 0.02 |
| Cu | 7 | M11764 | 10000 | 0.035 |
| Fe | 100 | M11915 | 10000 | 0.5 |
| Mg | 40 | M11976 | 10000 | 0.2 |
| Mn | 4 | M11829 | 10000 | 0.02 |
| Mo | 7 | M12008 | 1000 | 0.35 |
| Ni | 6 | M12004 | 1000 | 0.3 |
| Pb | 4 | M11682 | 10000 | 0.02 |
| Sb | 12 | M11682 | 1000 | 0.6 |
| Se | 13 | M11911 | 1000 | 0.65 |
| Tl | 15 | M11997 | 1000 | 0.75 |
| V | 5 | M12009 | 1000 | 0.25 |
| Zn | 10 | M12005 | 10000 | 0.05 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 15-Feb

\# M12229 A
10-9-14
LOQ check
QSM
DOD
3010

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Li | 10 | M11998 | 1000 | 0.5 |
| Sn | 10 | M11996 | 1000 | 0.5 |
| Sr | 2 | M11999 | 1000 | 0.1 |
| Ti | 8 | M12003 | 1000 | 0.4 |
| W | 36 | M12001 | 1000 | 1.8 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 15-Feb

\# M12230 A
10-9-14 3050
LOQ Check
QSM

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Li | 14.4 | M11998 | 1000 | 0.72 |
| Sn | 20 | M11996 | 1000 | 1 |
| Sr | 3.2 | M11999 | 1000 | 0.16 |
| Ti | 9.6 | M12003 | 1000 | 0.48 |
| W | 24 | M12001 | 1000 | 1.2 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 15-Feb

#M12224 10-7-14 ZA

TCLP Extraction Fluid #1

Into a 20L carboy, pipetted the following respectively:

114.0 mls Glacial Acetic Acid (# AB586) and # 128.6 mls (#M11955) 10N NaOH bring up to 20L with DI H2O. pH 4.93 +/- 0.05

#M12225 10-7-14 ZA

TCLP Extraction Fluid #1

Into a 20L carboy, pipetted the following respectively:

114.0 mls Glacial Acetic Acid (# AB586) and # 128.6 mls (#M11955) 10N NaOH bring up to 20L with DI H2O. pH 4.93 +/- 0.05

#M12226 10-7-14 ZA

SPLP Extraction Fluid East #1

Fill a 20L carboy with DI and adjust pH to 4.20 +/- .05 with (#M10857) 60/40 HNO3, H2SO4 mix w/v mix.

#M12227 3050 LOQ
ZA 10-9-14 QSM
DOD

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 4 | M11908 | 1000 | 0.2 |
| Al | 9.6 | M11914 | 10000 | 0.048 |
| As | 32 | M11912 | 1000 | 1.6 |
| Ba | 2 | M11768 | 1000 | 0.1 |
| Be | 1.6 | M12006 | 1000 | 0.08 |
| Ca | 56 | M11910 | 10000 | 0.28 |
| Cd | 1.6 | M12002 | 1000 | 0.08 |
| Co | 9.6 | M17000 | 1000 | 0.48 |
| Cr | 5.6 | M11767 | 10000 | 0.028 |
| Cu | 16 | M11764 | 10000 | 0.08 |
| Fe | 72 | M11915 | 10000 | 0.36 |
| Mg | 32 | M11976 | 10000 | 0.16 |
| Mn | 6 | M11829 | 10000 | 0.03 |
| Mo | 9.6 | M12008 | 1000 | 0.48 |
| Ni | 4.8 | M12004 | 1000 | 0.24 |
| Pb | 10 | M11682 | 10000 | 0.05 |
| Sb | 32 | M11682 | 1000 | 1.6 |
| Se | 16 | M11911 | 1000 | 0.8 |
| Tl | 19 | M11997 | 1000 | 0.95 |
| V | 3.2 | M12009 | 1000 | 0.16 |
| Zn | 12 | M12005 | 10000 | 0.06 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 15-Feb

#M12210 10/02/14 BSF TCLP Extraction Fluid #1: Fill ~~Into~~ a 20L carboy w/ 192 D.I. $H_2O$. Add 114ml Glacial Acetic Acid (AB: 599) and 128.6ml 10N NaOH (#M11955). Dilute to 20L w/ D.I. $H_2O$ and mix pH = 4.93 ± 0.05
Exp: 10/02/15

#M12211 10/6/14 Custom Assurance std Spex Certiprep lot # 26-201CR ex 9/15

# M12212 10/6/14 Potassium 10,000 CPI Lot# 14G213 exp 3/16

# M12213 10/6/14 Arsenic 10,000 CPI Lot# 13L089 ex 3/16

| | | |
|---|---|---|
| #M12214 10/06/14 BSF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M12215 10/06/14 BSF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M12216 10/06/14 BSF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 12215) into 100ml = 3.0ug/L Hg |
| #M12217 10/06/14 BSF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M12218 10/06/14 BSF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 12215) into 100ml = 0.2ug/L Hg |
| #M12219 10/06/14 BSF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M12220 10/06/14 BSF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M12221 10/06/14 BSF Potassium permanganate soln: 50g potassium permanganate (#M11285) dissolve into 1000mL of D.I. $H_2O$.
Exp: 04/06/15

#M12222 10/06/14 mos GFAA LOD/LOQ Check Water Working Std (Ag Only) - Into a 100mL vol. Flask, pipetted 0.1mL Ag (1000ug/mL) # M11908 and brought up to volume using milli-Q $H_2O$. (1% $HNO_3$) exp. 09/18/15

# M12223 10/06/14 mos GFAA LOD/LOQ Water Spiking Sol'n (Ag only) - Into a 1L vol. flask, pipetted 10mL #M12222 and brought up to volume using milli-Q $H_2O$ (1% $HNO_3$) exp. 09/18/15

#M12200 cont. Into a 1L volumetric Flask, pipetted 1mL As (10mg/L), 0.6mL Pb (10mg/L), 2.4mL Se (10mg/L), 2.4mL Sb (10mg/L), 2.2mL Tl (10mg/L) and 0.8mL Ag (1mg/L) ~~to~~ and brought up to volume using milli-Q $H_2O$. (1% $HNO_3$) exp 2/15/15

Concentrations: 10ug/L As, 6ug/L Pb, 24ug/L Se, 24ug/L Sb, 22ug/L Tl, 0.8ug/L Ag

#M12201 MDS 09-24-14 GFAA ICV (10ug/L) - Into a 100mL volumetric Flask, pipetted the following:

1mL As (1000ug/mL) # M11912 = 10ug/mL As
0.1mL Pb (10,000ug/mL) # M11682 = 10ug/mL Pb
1mL Tl (1000ug/mL) # M11997 = 10ug/mL Tl
1mL Se (1000ug/mL) # M11911 = 10ug/mL Se
1mL Sb (1000ug/mL) # M11909 = 10 ug/mL Sb
0.1mL Ag (1000 ug/mL) # M11908 = 1ug/mL Ag

and brought up to volume with milli-Q $H_2O$. From this mix, pipetted 1mL into a 1L volumetric Flask and brought up to volume using milli-Q $H_2O$. Final ICV concentrations are 10ug/L As, Pb, Tl, Se, Sb and 1ug/L Ag. (1% $HNO_3$) exp. 2/15/15

# M12202 MDS 09-25-14 GFAA As/Se Spike (10ug/mL) - Into a 100mL vol. flask, pipetted 1mL As (1000ug/mL) # M11912 and 1mL Se (1000ug/mL) # M11911 and brought to volume using milli-Q $H_2O$. (3% $HNO_3$) exp. 9/18/15

| | | |
|---|---|---|
| #M12203 09/26/14 SF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M12204 09/26/14 SF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M12205 09/26/14 SF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M12204) into 100ml = 3.0ug/L Hg |
| #M12206 09/26/14 SF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M12207 09/26/14 SF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M12204) into 100ml = 0.2ug/L Hg. |
| #M12208 09/26/14 SF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M12209 09/26/14 SF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M12188 09/16/14 LSF — Hg Working Stds: (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12189 09/16/14 LSF — Hg Alt Source Working Std: (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12190 09/16/14 LSF — Hg ICV / LCSW (0.2% HNO3, HCl)

3.0ml of 100ug/L Hg (#M 12189 ) into 100ml = 3.0ug/L Hg

#M12191 09/16/14 LSF — Hg CCV (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12192 09/16/14 LSF — Hg MRL: (0.2% HNO3, HCl)

0.2ml of 100ug/L Hg (#M 12189 ) into 100ml = 0.2ug/L Hg

#M12193 09/16/14 LSF — Hg Aqua Regia Reagent:

"Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12194 09/16/14 LSF — Stannous Chloride Reagent:

Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M12195 09/17/14 LSF NaCl Hydroxylamine Sulfate Reagent: Dissolve 60g NaCl (#M11799) and 60g hydroxylamine sulfate (#M11798) in 500ml of Milli-Q $H_2O$.

Exp: 03/17/15

#M12196 09/19/14 MDS — GFAA Pd/Mg Matrix Modifier – Into a 50 mL vol. Flask, pipetted 15mL of # M11843 + 10mL # M11976 + brought to volume with milli-Q $H_2O$. (2% $HNO_3$) expires: 01/28/15

#M12197 09-23-14 MDS — GFAA Base Std (25ug/L) – Into a 1L vol. Flask, pipetted 0.25mL M11978 and brought to volume using milli-Q $H_2O$ (1% $HNO_3$) exp 06/15

#M12198 09-23-14 MDS — GFAA CCV (10ug/L) – Into a 1L volumetric Flask, pipetted 0.1 mL M11978 and brought to volume using milli-Q $H_2O$. (1% $HNO_3$) exp. 06/15

# M12199 09-23-14 MDS — GFAA ICV (10ug/L) – Into a 1L vol. flask, pipetted 1.0 mL M11979 and brought to volume using Milli-Q $H_2O$. (1% $HNO_3$) exp. 06/15

# M12200 09-24-14 MDS — GFAA Instrument Check – Into 100mL vol. flasks, pipetted the following + brought to volume using milli-Q $H_2O$.

1.0 mL As (1000 ug/mL) # M11912 = 10mg/L As
0.1 mL Pb (10000 ug/mL) # M11682 = 10 mg/L Pb
1.0 mL Tl (1000 ug/mL) # M11997 = 10mg/L Tl
1.0 mL Se (1000ug/mL) # M11911 = 10 mg/L Se
1.0 mL Sb (1000ug/mL) # M11909 = 10mg/L Sb
0.1 mL Ag (1000ug/mL) # M11908 = 1mg/L Ag

~~#M12149 08/28/14 ISF Stannous chloride lot#~~ ~~08/28/14 ISF~~ 08/28/14 ISF

#M12179 9-4-15 Hg 1000 ug/mL CPI lot# 14F110.

| | | |
|---|---|---|
| #M12180 09/04/14 ISF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M12181 09/04/14 ISF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M12182 09/04/14 ISF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M12181) into 100ml = 3.0ug/L Hg |
| #M12183 09/04/14 ISF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M12184 09/04/14 ISF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M12181) into 100ml = 0.2ug/L Hg |
| #M12185 09/04/14 ISF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M12186 09/04/14 ISF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M12185 09/05/14 ISF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. $H_2O$. Add 114ml Glacial Acetic Acid (AB: 579) and 128.6ml 10N NaOH (#M11955). Dilute to 20L with D.I. $H_2O$ and mix. pH = 4.93 ± 0.05

Exp: 09/05/15

#M12186 9-9-14 StablCal Standard 200 ntu turbidity Hach lot #A4216 exp 8/16
JT

#M12187 9-9-14 Turbity Working Stds → into 3 Hach vials →
JT

~~pipet 1, 5~~ JT 9-9-14

~~1mls → 9mls DH~~ JT 9-9-14

1ml #M12186 → 9mls DI $H_2O$ = 20 ntu

5mls M12186 → 5 mls DI $H_2O$ = 100 ntu

10 ~~0~~ JT 9-9-14 mls M12186 → 0 ml DI $H_2O$ = 200 ntu

| | | |
|---|---|---|
| #M12166 08/15/14 SF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M12167 08/15/14 SF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M12168 08/15/14 SF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M12167) into 100ml = 3.0ug/L Hg |
| #M12169 08/15/14 SF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M12170 08/15/14 SF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M12167) into 100ml = 0.2ug/L Hg |
| #M12171 08/15/14 SF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M12172 08/15/14 SF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M12173 08/18/14 SF potassium persulfate: 50g potassium persulfate (#M10987) dissolve into 1,000ml of D.I. $H_2O$.
Exp: 02/18/15

#M12174 08-22-14 MOS GFAA Base Std. (1% $HNO_3$) - Into a 1L volumetric Flask, pipetted 0.25mL of #M11978 and brought to volume with milli-Q $H_2O$. Exp. 06/15

#M12175 08-22-14 MOS GFAA CCV (1% $HNO_3$) - Into a 1L volumetric Flask, pipetted 0.1mL of #M11978 and brought to volume with milli-Q $H_2O$ Exp. 06/15

#M12176 08-22-14 MOS GFAA ICV (1% $HNO_3$) - Into a 1L volumetric flask, pipetted 1.0mL #M11979 and brought to volume with milli-Q $H_2O$ Exp. 06/15

#M12177 08/27/14 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/ 19L D.I. $H_2O$. Add 114ml Glacial Acetic Acid (AB579) and 128.6ml 1N NaOH pH=4.93±0.05 (#M11955). Dilute to 20L with D.I. $H_2O$ and mix.
Exp: 08/27/15

#M12178 08/27/14 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/ 19L D.I. $H_2O$. Add (08/27/14 SF) 114ml Glacial Acetic Acid (AB579) and 128.6ml 1N NaOH (#M11955). Dilute to 20L with D.I. $H_2O$ and mix. pH=4.93±0.05
Exp: 08/27/15

#M12157 MOS
08-06-14

## ICAP Working Standards Boron & Silicon

| Standard name | Into a 1L volumetric flask, pipetted the following respectively: |
|---|---|
| 50 | 0.05mL of #M11763 and 0.05mL #M12007 = 50 ug/L |
| 200 | 0.2mL of #M11763 and 0.2mL #M12007 = 100 ug/L |
| 1000 | 1.0mL of #M11763 and 1.0mL #M12007 = 1000 ug/L |
| 2000 | 2.0mL of #M11763 and 2.0mL #M12007 = 1000 ug/L |
| 10000 | 10.0mL of #M11763 and 10.0mL #M12007 = 10000 ug/L |

Expires: 05/13/2015

Continuing Calibration Standard (CCV)

Into a 1L volumetric flask, pipetted 1.0mL of #M11763 and 1.0mL #M12007 = 1000 ug/L
Brought up to volume with DI H20. Expires 05/13/2015

#M12158 MOS 08/11/14 : 1% Pd GFAA matrix modifier. Environmental Express Lot# 1421912
Expires: 08/07/15

#M12159 MOS 08/11/14 : 1% Nickel Nitrate GFAA matrix Modifier. Alfa Aesar Lot# H-55 3987D

#M12160 08/12/14 JSF Friscolyt (Mettler Toledo) Lot# 1Z134C

#M12161 08/12/14 JSF TCLP Extraction Fluid #1: Into a 20L Carboy w/19L D.I. H2O. Add 114mL Glacial Acetic Acid (AB579) and 128.6mL 10N NaOH (#M11955). Dilute to 20L with D.I. H2O and mix pH = 4.93 ± 0.05
Exp: 08/12/15

# M12162 8-13-14 JB Potassium 1000 mg/L CPI Lot# 14F193 ex 2/16

# M12163 8-13-14 JB Tungsten Std. CPI Lot# 14F230 ex 2/16

# M12164 8-13-14 JB Interference A Spex Certiprep Lot# 11-384PX ex 8/15

#M12165 8-13-14 JB Custom Assurance Std Spex Certiprep Lot #7-93WL ex 8/15

#M12149
5% HCL 5% HNO3
8-1-14

Initial Calibration Standard (ICV) Alt source

Into one liter volumetric flask pipet 10 mls of M12020 ( ex 5/15)
2.0 mls of #m12082 (ex 6/15) and 0.5 mls #M12008 Mo (ex11/15) and 0.5 mls
of #M11763 B (ex 5/15), 0.5 #m11999 Sr (ex 11/15), 0.5 #m11998 mls Li (ex 11/15),
0.5 mls sn # m11996 (ex 11/15),0.5 mls ti #m12003 (ex 11/15) and bring up to mark with DI H2O
ex 5/15

#M12150
5% HCL, 5% HNO3
8-1-14

Continuing Calibration Standard 3(CCV3)

Into a one liter volmetric flask pipet 10 mls of # M119531 (ex 4/15)
and 1.0 ml of #M11585 (ex 07/15).
ex. 04/15
Bring up to mark with DI H2O

#M12151
5% HCL, 5% HNO3
8-1-14

Interfering element check std. (Icsab)

Into 500 ml volumetric flask pipet 50 mls of #M12082 (ex 6/15), 15 mls #m11915 (ex8/15),
2.5 mls #M1215 (ex 7/15) and 2.5 mls #M11953 (ex 4/15) bring up to mark with DI H20.
ex 4/15

#M12152 8-5-14. Hydroxylamine Solution. Onto 200 ml val flask dissolve 24.0 g Hydroxylamine hydrochloric ($NH_2OH \cdot HCL$) #M12060. in DI $H_2O$. Bring up to mark with DI $H_2O$.

#M12153 8-5-14 Stannous Chloride Soln. 10 ml HCL (AB-583) is Added to 400 mls DI $H_2O$ in a 1 Liter vol. flask then dissolve 20 g of Stannous Chloride (M11995) in the flask. Bring up to mark with DI $H_2O$.

#M12154 8-5-14 1:1 HCL Onto 1 Liter Val flask pour 500 ml HCL (#AB-583) & Bring up to mark

#M12155 08/06/14 LSF potassium permanganate soln: 50g potassium permanganate (#M11285) dissolve into 1,000ml of D.I H2O.
Exp: 02/06/15

#M12156 08/06/14 LSF NaCl Hydroxylamine Sulfate Reagent: Dissolve 60g NaCl (#M11799) and 60g hydroxylamine sulfate (#M11798) in 500ml of milli-Q H2O.
Exp: 02/06/15

| | | |
|---|---|---|
| #M12142 07/30/14 LSF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M12139) into 100ml = 0.2ug/L Hg |
| #M12143 07/30/14 LSF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M12144 07/30/14 LSF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M12145 07/31/14 LSF TCLP Extraction Fluid #1: Into a 20L carboy w/ 19L D.I. $H_2O$. Add 114mL Glacial Acetic Acid (~~#M~~ AB.579) and 128.6mL 10N NaOH (#M 11955). Dilute to 20L with D.I. $H_2O$ and mix. pH = 4.93 ± 0.05

Exp: 07/31/15

#M12146 JA
8/1/14 ICP working stds

## ICAP Working Standards

5% HNO3 5%HCL

| Standard name | Std # | Pipet the following respectively: |
|---|---|---|
| 0.25 | 1 | 0.25 mls of standard 1000 ug/L into 1000 ml volumetric flask = 0.25 ug/L std |
| 0.5 | 2 | 0.50 mls of standard 1000 ug/L into 1000ml volumentric flask= 0.50 ug/L std |
| 1 | 3 | 1.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =1.00 ug/L std |
| 5 | 4 | 5.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =5.00 ug/L std |
| 10 | 5 | 10.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =10.0 ug/L std |
| 20 | 6 | 20.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =20.0 ug/L std |
| 50 | 7 | 50.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =50.0 ug/L std |
| 100 | 8 | 1.0 mls of #M11953(ex 05/15) and 1.0 mls of #M12125 (ex 07/15) into 1000 ml volumectric flask= 100 ug/L std |
| 1000 | 9 | 10.0 mls of #M11953(ex 05/15) and #M11585 (ex 07/15) and 1 mL of #M12007 Si into 1000 ml volumetric flask= 1000 ug/L std |
| 10,000 | 10 | 100 mls #M11953 (ex 05/15),100 mls #M11585 (ex 07/15), 1.0 mls (K) # M12011 ex 11/15 |
| 100k | 11 | 10 mls of #M11764 Cu (ex 5/15) , 10 mls of #M11829 Mn (ex 7/15) , 10 mls of #M11767 Cr (ex 5/15), 10 mls #M11682 Pb (ex 2-15), 10 mls zn #M12005(ex 8-15), 10 mls #M12010 Na (ex 11/15),10 mls = 100,000 ug/L |
| 100,000 | 12 | 10 mls of #M11976 Mg (ex 10/15) , 10 mls of #M11915 Fe (ex 09/15) ,10 mls of #M11910 Ca (ex 9/15),10 mls #M11914 AL (ex 9/15) , into 1000 ml vol flask = 100,000 ug/l std |
| 500,000 | 13 | 50 mls of #M11976 Mg (ex 10/15) , 50 mls of #M11915 Fe (ex 9/15) ,50 mls of #M11910 Ca (ex 9/15), 50 mls #M11914 AL (ex 9/15) into 1000 ml vol flask = 500,000 ug/l std |
| 1000k | 14 | 100 mls of #M11976 Mg (ex 10/15) , 100 mls of #M11915 Fe (ex 9/15) ,100 mls of #M11910 Ca (ex 9/15),100 mls #M11914 AL (ex 9/15) into 1000 ml vol flask = 1,000,000 ug/l std |

Bring the 1000 ml volumetric up to mark with DI H2O

ex 2/15

#M12147 JA
5% HCL, 5% $HNO_3$
8-1-14

Continuing Calibration Standard 1(CCV1)

Into a one liter volmetric flask pipet 50mls of # M11953 (ex 4/15)
and 5 ml of #M12125 (ex 07/15).
ex. 04/15
Bring up to mark with DI H2O

#M12148 JA
8-1-14
5% HCL, 5% $HNO_3$

Continuing Calibration Standard 2(CCV2)

Into a one liter volmetric flask pipet 5 mls of # M11953 (ex 04/15)
and 0.5 ml of #M12125(ex 07/15).
ex. 4/15
Bring up to mark with DI H2O

#M12134 MOS
07-21-14

Working Standards for Sodium and Potassium - Into seven, 200 mL volumetric flasks, pipetted the following from #M11719 and #M11722 and brought up to volume using milli-Q $H_2O$. (2% $HNO_3$)

0.5 mg/L std - 0.1 mL of each
1.0 mg/L std - 0.2 mL of each
5.0 mg/L std - 1.0 mL of each
10.0 mg/L std - 2.0 mL of each
50.0 mg/L std -10 mL of each
100 mg/L std - 20 mL of each, used for Continuing Calibration Standard (CCV)
200 mg/L std - 40 mL of each

Expires: 04/24/15

#M12135 MOS
07-21-14

Initial Calibration Standard (ICV) - Into a 250 mL volumetric flask, pipetted 2.5 mL of #M12010 and #M12011 and brought up to volume using milli-Q $H_2O$. (2% $HNO_3$)
Expires: 11/08/2015

#M12136 MOS
07-21-14

ICAP 6000 ICSAB Standard for Sodium and Potassium – Into a 250 mL volumetric flask, pipetted 25 mL of #M11776 and 2.5 mL of each #M12010 & #M12011 and 7.5mL of #M11915 brought to volume using milli-Q $H_2O$. (2% $HNO_3$)
Expires: 12/30/14

#M12137 MOS
07-22-14

TCLP Extraction Fluid #1 - Into a 20L Carboy, added 114mL Glacial Acetic acid #AB586 + 128.6mL 10N NaOH #M12086 + brought to volume w/ D.I $H_2O$. Mix. pH = 4.93 ± 0.05

#M12138 07/30/14 SF

Hg Working Stds:
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12139 07/30/14 SF

Hg Alt Source Working Std:
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12140 07/30/14 SF

Hg ICV / LCSW
(0.2% HNO3, HCl)

3.0ml of 100ug/L Hg (#M12139) into 100ml = 3.0ug/L Hg

#M12141 07/30/14 SF

Hg CCV
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

~~#M12113~~ 07/15/14 LSF Potassium permanganate soln: 50g potassium permanganate (#M11285) dissolve into
#M12121 Exp: 01/15/15 1,000mL of D.I. $H_2O$.

#M12122 07-16-14 MDS GFAA Base Std (25ug/L) - Into a 1L vol. Flask, pipetted 0.25mL of M11978 + brought
exp. 06/01/15 to volume with mili-Q $H_2O$. (1% $HNO_3$)

#M12123 07-16-14 MDS GFAA CCV (10ug/L) - Into a 1L vol. Flask, pipetted 0.1mL of M11978 + brought to volume
exp. 06/01/15 with mili-Q $H_2O$ (1% $HNO_3$)

#M12124 07-16-14 MDS GFAA ICV (10ug/L) - Into a 1L vol. Flask, pipetted 1.0mL of M11979 + brought to
exp 06/01/15 volume with mili-Q $H_2O$. (1% $HNO_3$)

#M12125 7-17-14 ZA SpexCertiprep lot # 11-124P (Custom Assurance Std)
XCTWI-4-500

#M12126 7-17-14 ZA Spex Certiprep lot# 11-111YP (Custom Assurance Std)
XSpike-1-500

#M12127 07/18/14 LSF Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12128 07/18/14 LSF Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12129 07/18/14 LSF Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 12128 ) into 100ml = 3.0ug/L Hg

#M12130 07/18/14 LSF Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12131 07/18/14 LSF Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 12128 ) into 100ml = 0.2ug/L Hg

#M12132 07/18/14 LSF Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12133 07/18/14 LSF Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M12105 07/08/14 SF
Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12106 07/08/14 SF
Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12107 07/08/14 SF
Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M12106) into 100ml = 3.0ug/L Hg

#M12108 07/08/14 SF
Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12109 07/08/14 SF
Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M12106) into 100ml = 0.2ug/L Hg

#M12110 07/08/14 SF
Hg Aqua Regia Reagent:
"Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12111 07/08/14 SF
Stannous Chloride Reagent:
Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M12112 7-10-14 Ca 10,000 mg/L CPI Lot # 14D176 ex 1/16
D

#M12113 7-10-14 Mg 10,000 mg/L CPI Lot # 14F190 ex 1/16

#M12114 07/11/14 SF
Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12115 07/11/14 SF
Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12116 07/11/14 SF
Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M12115) into 100ml = 3.0ug/L Hg

#M12117 07/11/14 SF
Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12118 07/11/14 SF
Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M12115) into 100ml = 0.2ug/L Hg

#M12119 07/11/14 SF
Hg Aqua Regia Reagent:
"Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12120 07/11/14 SF 07/11/14 SF
Stannous Chloride Reagent:
Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M[illegible]) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M12099 7-1-14 MRL Into 500ml vol flask pipet 10 mls #M 12098 bring up to mark w/DI $H_2O$ ex 2/15.
5% HCL
5% $HNO_3$

#M12100 7-1-14 ICVLL Into 500 ml vol flask pipet 30mls #M12098 Bring up to mark w/ DI $H_2O$ ex 2/15
5% HCL
5% $HNO_3$

#M12101 7-1-14 ICSAB Into 500ml vol flask piped 50mls #M12082 15mls #M11915 2.5mls #M11953 2.5 mls M11585, Bring up to mark w/DI $H_2O$. ex 7/15.
5% HCL
5% $HNO_3$

#M12102 7-1-14

## ICAP Working Standards

5% HNO3 5%HCL

| Standard name | Pipet the following respectively: |
|---|---|
| 0.25 | 0.25 mls of standard 1000 ug/L into 1000 ml volumetric flask = 0.25 ug/L std |
| 0.5 | 0.50 mls of standard 1000 ug/L into 1000ml volumentric flask= 0.50 ug/L std |
| 1 | 1.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =1.00 ug/L std |
| 5 | 5.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =5.00 ug/L std |
| 10 | 10.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =10.0 ug/L std |
| 20 | 20.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =20.0 ug/L std |
| 50 | 50.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =50.0 ug/L std |
| 100 | 1.0 mls of #M11953(ex 05/15) and 1.0 mls of #M11585 (ex 07/14) into 1000 ml volumectric flask= 100 ug/L std |
| 1000 | 10.0 mls of #M11953(ex 05/15) and #M11585 (ex 07/14) and 1 mL of #M12007 Si into 1000 ml volumetric flask= 1000 ug/L std |
| 10,000 | 100 mls #M11953 (ex 05/15),100 mls #M11585 (ex 07/14), 1.0 mls (K) # M12011 ex 11/15 |
| 100k | 10 mls of #M11764 Cu (ex 5/15) , 10 mls of #M11829 Mn (ex 7/15) , 10 mls of #M11767 Cr (ex 5/15), 10 mls #M11682 Pb (ex 2-15), 10 mls zn #M12005(ex 8-15), 10 mls #M12010 Na (ex 11/15),10 mls = 100,000 ug/L |
| 100,000 | 10 mls of #M11976 Mg (ex 10/15) , 10 mls of #M11915 Fe (ex 09/15) ,10 mls of #M11910 Ca (ex 9/15),10 mls #M11914 AL (ex 9/15) , into 1000 ml vol flask = 100,000 ug/l std |
| 500,000 | 50 mls of #M11976 Mg (ex 10/15) , 50 mls of #M11915 Fe (ex 9/15) ,50 mls of #M11910 Ca (ex 9/15), 50 mls #M11914 AL (ex 9/15) into 1000 ml vol flask = 500,000 ug/l std |
| 1000k | 100 mls of #M11976 Mg (ex 10/15) , 100 mls of #M11915 Fe (ex 9/15) ,100 mls of #M11910 Ca (ex 9/15),100 mls #M11914 AL (ex 9/15) into 1000 ml vol flask = 1,000,000 ug/l std |

Bring the 1000 ml volumetric up to mark with DI H2O

ex 7/14

#M12103 07/03/14 LSF NaCl Hydroxylamine Sulfate Reagent: Dissolve 60g NaCl (#M11799) and 60g hydroxylamine Sulfate (#M11798) in 500ml of milli-Q $H_2O$.
Exp: 01/03/15

#M12104 07/07/14 LSF TCLP Extraction Fluid #1: Fill a 20L carboy w/ 19L D.I. $H_2O$. Add 114ml Glacial Acetic Acid (AB5791) and 128.6ml 10N NaOH (#M11955). Dilute to 20L with D.I. $H_2O$ and mix pH=4.93 ± 0.05
Exp: 07/07/15

#M12088 06/25/14 SF — Hg Working Stds: (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12089 06/25/14 SF — Hg Alt Source Working Std: (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12090 06/25/14 SF — Hg ICV / LCSW (0.2% HNO3, HCl)

3.0ml of 100ug/L Hg (#M 12089) into 100ml = 3.0ug/L Hg

#M12091 06/25/14 SF — Hg CCV (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12092 06/25/14 SF — Hg MRL: (0.2% HNO3, HCl)

0.2ml of 100ug/L Hg (#M 12089) into 100ml = 0.2ug/L Hg

#M12093 06/25/14 SF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12094 06/25/14 SF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M12095 06/27/14 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/ 19L D.I. H2O. Add 114mL Glacial Acetic Acid (AB:579) and 128.6mL 10N NaOH (#M11955). Dilute to 20L with D.I. H2O and mix, pH=4.93±0.05
Exp: 06/27/15

#M12096 06/27/14 SF Hydroxylamine Sulfate (Fisher) Lot #134692A

#M12097 06/30/14 SF Stannous Chloride (Macron) Lot #0000079133

#M12098 7-1-14 Into 1 Liter volumetric pipet →

5% HCl
5% HNO3

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 20 | M11908 | 1000 | 1 |
| Al | 400 | M11914 | 10000 | 2 |
| Ba | 10 | M11768 | 1000 | 0.5 |
| Be | 4 | M12006 | 1000 | 0.2 |
| Cd | 5 | M12002 | 1000 | 0.25 |
| Co | 10 | M17000 | 1000 | 0.5 |
| Cr | 10 | M11767 | 10000 | 0.05 |
| Cu | 10 | M11764 | 10000 | 0.05 |
| Mg | 500 | M11976 | 10000 | 2.5 |
| Mn | 10 | M11829 | 10000 | 0.05 |
| Mo | 10 | M12008 | 1000 | 0.5 |
| Ni | 10 | M12004 | 1000 | 0.5 |
| Pb | 10 | M11682 | 10000 | 0.05 |
| Sb | 20 | M11909 | 1000 | 1 |
| V | 10 | M12009 | 1000 | 0.5 |
| Zn | 10 | M12005 | 10000 | 0.05 |

| | | | | |
|---|---|---|---|---|
| K | 1000 | M12011 | 10000 | 5 |
| Na | 1000 | M12010 | 10000 | 5 |
| As | 20 | M11912 | 1000 | 1 |
| Ca | 500 | M11910 | 10000 | 2.5 |
| Fe | 300 | M11915 | 10000 | 1.5 |
| Se | 20 | M11911 | 1000 | 1 |
| Tl | 20 | M11997 | 1000 | 1 |
| Si | 100 | M12007 | 1000 | 5 |
| B | 20 | M11763 | 1000 | 1 |
| Li | 20 | M11998 | 1000 | 1 |
| W | 50 | M12001 | 1000 | 2.5 |
| Ti | 10 | M12003 | 1000 | 0.5 |
| Sr | 10 | M11999 | 1000 | 0.5 |
| Sn | 50 | M11996 | 1000 | 2.5 |
| S | 100 | M11679 | 10000 | 0.5 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

er 2/15

#M12079 06/18/14 LSF NaCl Hydroxylamine sulfate Reagent: Dissolve 60g NaCl (#M11799) and 60g hydroxylamine sulfate (#M11798) in 500mL of milli-Q $H_2O$
Exp: 12/18/14

## ICAP Working Standards W Only

.5% HNO3 .5%HCL

#M12080 06/19/14 MDS

Standard name — Pipetted the following respectively:

100 — 0.1mL #M12001 into 1L = 100 ug/L
1000 — M12080 — 1mL #M12001 into 1L = 1000 ug/L
10000 — 10mL #M12001 into 1L = 10000 ug/L
Bring up to mark with milli-Q H20 Exp. 11/08/15

Continuing Calibration Standard (CCV) M12080
Into a 1L volumetric flask pipetted 1mL #M12001 = 1000 ug/L
Bring up to mark with milli-Q H20 Exp. 11/08/15

#M12081 06/19/14 MDS

Initial Calibration Standard (ICV) W Only M12081
Into a 1 liter volumetric flask pipetted 1mL of #M11365
Bring up to mark with milli-Q H20 Exp. ~~04/23/15~~ 08/20/14
MDS 06/19/14

#M12082 6-23-14 JA Spex Certiprep INT-A lot # 11-384PX exp 6/15

#M12083 JA 6-23-14 Spex Certiprep Cust. Assurance Std T Hardness + Na exp 6/15.

#M12084 JA 6-23-14 TCLP Extraction fluid into 20 ~~liter~~ carboy, Add 114ml Glacial acetic Acid (AB-586) + 128.6 mls 10N NaOH #M11955 Dilute up to 20L with DI $H_2O$ + mix pH=4.93 ± .05

#M12085 JA 6-23-14 TCLP Extraction fluid into 20 Liter carboy add 114ml Glacial acetic Acid (AB 586), + 128.6 mls 10N NaOH #M11955 Dilute up to 20L with DI $H_2O$ + mix ph=4.93±.05

#M12086 JA 6-23-14 10N NaOH into 1 Liter vol dissolve 400g Sodium Hydroxide #M11145 Bring up to mark w/DI $H_2O$ exp 6-23-15.

#M12087 LSF 06/25/14 LSF Potassium permanganate soln: 50g potassium permanganate (#M11785) dissolve into 1,000mL of D.I. $H_2O$.
Exp: 12/25/14

#M12067 06/11/14 SF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12068 06/11/14 SF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

06/18/14 SF
#M12068 9 06/12/14 SF potassium permanganate soln: 50g potassium permanganate (#M11785) dissolve into 1,000ml of D.I. $H_2O$.
Exp: 12/12/14

06/18/14 SF
#M12069 70 06/18/14 SF — Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

06/18/14 SF
#M12070 1 06/18/14 SF — Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

06/18/14 SF
#M12071 2 06/18/14 SF — Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 12071) into 100ml = 3.0ug/L Hg

06/18/14 SF
#M12072 3 06/18/14 SF — Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

4 06/18/14 SF
#M12073 06/18/14 SF — Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 12071) into 100ml = 0.2ug/L Hg

06/18/14 SF
#M12074 5 06/18/14 SF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12076 06/18/14 SF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11995) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M12077 06/18/14 mos

## ICAP Working Standards List 2

.5% HNO3 .5%HCL

| Standard name | | Pipetted the following respectively: |
|---|---|---|
| 1 | | 0.01mL of #M11953 and 0.001mL #M11365 into 1L = 1 ug/L |
| 10 | | 0.10mL of #M11953 and 0.01mL #M11365 into 1L = 10 ug/L |
| 100 | M12077 | 1mL of #M11953 and 0.1mL #M11365 into 1L = 100 ug/L |
| 1000 | | 2mL of #M11953 and 0.2mL #M11365 into 200mL = 1000 ug/L |
| 10000 | | 20mL of #M11953 and 2mL #M11365 into 200mL = 10000 ug/L |

Bring up to mark with milli-Q H20 Exp. 08/20/2014

Continuing Calibration Standard (CCV) M12077
Into a 200mL volumetric flask pipetted 2mL of #M11953 and 0.2mL #M11365 = 1000 ug/L
Bring up to mark with milli-Q H20 Exp. 08/20/2014

#M12078 06/18/14 mos

Initial Calibration Standard (ICV) List 2 M12078
Into a 1 liter volumetric flask pipetted 1mL of #M11999, M11364, M11362, M11359 and M11826.
Bring up to mark with milli-Q H20 Exp. 08/20/2014

| | | |
|---|---|---|
| #M12053 06/04/14LSF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M12054 06/04/14 LSF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M12055 06/04/14 LSF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M ) into 100ml = 3.0ug/L Hg |
| #M12056 06/04/14LSF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M12057 06/04/14LSF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M ) into 100ml = 0.2ug/L Hg |
| #M12058 06/04/14LSF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M12059 06/04/14LSF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M ) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M12060 6/11/14 Hydroxylamine hydrochloride Alpha Aesar lot# F212025.

#M12061 6/11/14 Hydroxylamine hydrochloride soln. Hg. Into 100 ml vol flask dissolve 12g $NH_2OH \cdot HCL$ #M12060. Bring up to mark with DI $H_2O$.

| | | |
|---|---|---|
| #M12062 06/11/14LSF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M12063 06/11/14LSF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M12064 06/11/14LSF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M12063) into 100ml = 3.0ug/L Hg |
| #M12065 06/11/14LSF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M12066 06/11/14LSF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M12063) into 100ml = 0.2ug/L Hg |

#M12046 06/02/14 mos GFAA LOD/LOQ Soil Working Std: Into a 200mL vol. Flask, pipetted the Following and brought (1% $HNO_3$) exp. 02/15/15 the volume up using milli-Q $H_2O$.

1.2mL Sb 1000ug/mL (M11909) = 6,000ug/L Sb
3.2mL As 1000ug/mL (M11912) = 16,000ug/L As
3.2mL Se 1000ug/mL (M11911) = 16,000ug/L Se
0.08mL Pb 10,000ug/mL (M11682) = 4000ug/L Pb
1.0mL Tl 1000ug/mL (M11997) = 5000ug/L Tl

#M12047 06/02/14 mos GFAA LOD/LOQ Soil Spiking Soln: Into a 1L vol. Flask, pipetted 10mL of #M12046 + brought (1% $HNO_3$) exp. 02/15/15 to volume using milli-Q $H_2O$.

#M12048 06/02/14 mos GFAA LOD/LOQ Water Working Std: Into a 100mL vol. Flask, pipetted the Following + brought to (1% $HNO_3$) exp. 02/15/15 volume using milli-Q $H_2O$.

1.5mL Sb 1000ug/mL (M11909) = 15,000ug/L Sb
1.0mL As 1000ug/mL (M11912) = 10,000ug/L As
2.0mL Se 1000ug/mL (M11911) = 20,000ug/L Se
0.045mL Pb 10,000ug/mL (M11682) = 4500 ug/L Pb
0.4mL Tl 1000ug/mL (M11997) = 4000 ug/L Tl
0.1mL Ag 1000ug/mL (M11908) = 1000 ug/L Ag

#M12049 06/02/14 mos GFAA LOD/LOQ Water Spiking Soln: Into a 1L vol. Flask, pipetted 10mL of #M12048 (1% $HNO_3$) exp 02/15/15 + brought to volume with milli-Q $H_2O$.

#M12050 06/02/14 LSF TCLP Extraction Fluid #1: Fill a 20L carboy with 19L D.I. $H_2O$. Add 114mL Glacial Acetic Acid (AB.579) and 128.6mL 10N NaOH (#M11955). Dilute to 20L with D.I. $H_2O$ and mix.
Exp: 06/02/15
pH = 4.93 ± 0.05

#M12051 06/02/14 LSF TCLP Extraction Fluid #1: Fill a 20L carboy with 19L D.I. $H_2O$. Add 114mL Glacial Acetic Acid (AB579) and 128.6mL 10N NaOH (#M11955). Dilute to 20L with D.I. $H_2O$ and mix. pH = 4.93 ± 0.05
Exp: 06/02/15

#M12052 06/03/14 LSF Potassium persulfate: 50g potassium persulfate (#M10987) dissolve into 1000mL D.I. $H_2O$.
Exp: 12/03/14

#M12032 05/27/14 ISF — Hg Working Stds: (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12033 05/27/14 ISF — Hg Alt Source Working Std: (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12034 05/27/14 ISF — Hg ICV / LCSW (0.2% HNO3, HCl)

3.0ml of 100ug/L Hg (#M12033) into 100ml = 3.0ug/L Hg

#M12035 05/27/14 ISF — Hg CCV (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12036 05/27/14 ISF — Hg MRL: (0.2% HNO3, HCl)

0.2ml of 100ug/L Hg (#M12033) into 100ml = 0.2ug/L Hg

#M12037 05/27/14 ISF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12038 05/27/14 ISF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11799) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M12039 05-27-14 MOS — GFAA Base STD (25ug/L) - Into a 1L vol. Flask, pipetted 0.25mL of M11978 + brought to volume with milli-Q $H_2O$. (1% $HNO_3$) exp 06/01/15

#M12040 05-27-14 MOS — GFAA CCV (10ug/L) - Into a 1L vol. Flask, pipetted 0.1mL of M11978 + brought to volume with milli-Q $H_2O$. (1% $HNO_3$) exp 06/01/15

#M12041 05-27-14 MOS — GFAA ICV (10ug/L) - Into a 1L vol. Flask, pipetted 1.0mL of M11979 + brought to volume with milli-Q $H_2O$. (1% $HNO_3$) exp. 06/01/15

#M12042 05/28/14 ISF Potassium Permanganate soln: 50g potassium permanganate (#M11285) dissolve into 1,000mL of D.I. $H_2O$.
Exp: 11/28/14

#M12043 05/28/14 ISF NaCl Hydroxylamine Sulfate Reagent: Dissolve ~~into~~ 60g NaCl (#M11799) and 60g hydroxylamine Sulfate (#M11798) in 500mL Milli-Q $H_2O$. 05/28/14 ISF
Exp: 11/28/14

#M12044 06/02/14 MOS GFAA LOD/LOQ Soil Ag Working Std: Into a 200mL vol. Flask, pipetted 0.12 mL Ag 1000mg/L (M11908) + brought to volume using milli-Q $H_2O$ to ~~give~~ make 600ug/L Ag.
(1% $HNO_3$) exp. 09/18/15

#M12045 06/02/14 MOS GFAA LOD/LOQ Soil Spiking Soln: Into a 1L vol. Flask, pipetted 10mL of #M12044 + brought to volume using milli-Q $H_2O$.
(1% $HNO_3$) exp. 09/18/15

#M12020 5-19-14 Spex Certiprep Custom Assurance Std " ex 5/2015

| | | |
|---|---|---|
| #M12021 05/20/14 JSF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M12022 05/20/14 JSF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M12023 05/20/14 JSF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 12022) into 100ml = 3.0ug/L Hg |
| #M12024 05/20/14 JSF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M12025 05/20/14 JSF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 12022) into 100ml = 0.2ug/L Hg |
| #M12026 05/20/14 JSF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M12027 05/20/14 JSF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11779) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M12028 5-20-14 Potassium Bromide Alfa Aesar Lot# 10175161. ex 5/15

#M12029 5-20-14 Potassium Bromate Alfa Aesar Lot# F27X076. ex 5/15

#M12030 5-21-14 into 500ml vol flask dissolve 2.78g $KBrO_3$ + 11.90g KBr bring up to mark with DI $H_2O$. ex 5/15

~~#M12031 JSF 05/22/14 Stannous Chloride (Macron) Lot# 00000~~ 05/22/14 JSF

# M12031 5-23-14 Mercury stock soln 1.0ug/ml Teledyne Leeman Lot# 1358601 ex 4/15

#M12002 05/13/14 LSF Cadmium 1,000mg/L CPI Lot#14A402 Exp: 11/08/15

#M12003 05/13/14 LSF Titanium 1,000mg/L CPI Lot#13H001 Exp: 11/08/15

#M12004 05/13/14 LSF Nickel 1,000mg/L CPI Lot# 14D214 Exp: 11/08/15

#M12005 05/13/14 LSF Zinc ~~1,000~~ 10,000 05/13/14 LSF mg/L CPI Lot#14A199 Exp: 11/08/15

#M12006 05/13/14 LSF Beryllium 1,000mg/L CPI Lot#14D241 Exp: 11/08/15

#M12007 05/13/14 LSF Silicon 1,000mg/L CPI Lot#13L019 Exp: 11/08/15

#M12008 05/13/14 LSF Molybdenum 1,000mg/L CPI Lot# 14B183 Exp: 11/08/15

#M12009 05/13/14 LSF Vanadium 1,000mg/L CPI Lot# 14A107 Exp: 11/08/15

#M12010 05/13/14 LSF Sodium 10,000mg/L CPI Lot#14B243 Exp: 11/08/15

#M12011 05/13/14 LSF Potassium 10,000mg/L CPI Lot#14C131 Exp: 11/08/15

#M12012 05/14/14 LSF Potassium permanganate soln: 50g potassium permanganate (#M11285) dissolve into 1,000mL of D.I. H2O.
Exp: 11/14/14

#M12013 05/14/14 LSF Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M12014 05/14/14 LSF Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M12015 05/14/14 LSF Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 12014) into 100ml = 3.0ug/L Hg

#M12016 05/14/14 LSF Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M12017 05/14/14 LSF Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 12014) into 100ml = 0.2ug/L Hg

#M12018 05/14/14 LSF Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M12019 05/14/14 LSF Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11779) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M 11986 05/08/14 LSF NaCl Hydroxylamine Sulfate Reagent: Dissolve into 60g NaCl (#M11499) and 60g hydroxylamine sulfate (#M11498) in 500mL Milli-Q $H_2O$.
Exp: 11/08/14

#M11987 05/09/14 LSF Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11988 05/09/14 LSF Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11989 05/09/14 LSF Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 11988 ) into 100ml = 3.0ug/L Hg

#M11990 05/09/14 LSF Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11991 05/09/14 LSF Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 11988 ) into 100ml = 0.2ug/L Hg

#M11992 05/09/14 LSF Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11993 05/09/14 LSF Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11749 in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11994 05/12/14 LSF TCLP Extraction Fluid #1: Fill a 20L carboy w/ 19L D.I. $H_2O$. Add 114mL Glacial Acetic Acid (AB.579) and 128.6mL 10 N NaOH (#M11955). Dilute to 20L with D.I. $H_2O$ and mix.
Exp: 05/12/15
05/12/14 LSF pH = ~~4.~~ 4.93 ± 0.05

#M11995 05/13/14 LSF Stannous Chloride (Macron) lot #0000096357 Exp: 02/14/15

#M11996 05/13/14 LSF Tin 1,000 mg/L CPI lot# 13H238 Exp: 11/08/15

#M11997 05/13/14 LSF Thallium 1,000mg/L CPI lot# 13I105 Exp: 11/08/15

#M11998 05/13/14 LSF Lithium 1,000 mg/L CPI lot# 14E049 Exp: 11/08/15

#M11999 05/13/14 LSF Strontium 1,000mg/L CPI lot# 14C002 Exp: 11/08/15

#M12000 05/13/14 LSF Cobalt 1,000mg/L CPI lot# 14D005 Exp: 11/08/15

#M12001 05/13/14 LSF Tungsten 1,000mg/L CPI lot# 13H199 Exp: 11/08/15

# M11980 05-06-14 GFAA Base STD (25ug/L) - Into a 1L vol. Flask, pipetted 0.25mL of M11978 + brought
MOS to volume with milli-Q $H_2O$. (1% $HNO_3$) exp. 06/01/15

# M11981 05-06-14 GFAA CCV (10ug/L) - Into a 1L vol. Flask, pipetted 0.1mL of M11978 + brought
MOS to volume with milli-Q $H_2O$. (1% $HNO_3$) exp. 06/01/14

# M11982 05-06-14 GFAA ICV (10ug/L) - Into a 1L vol. Flask, pipetted 1.0mL of M11979 + brought
MOS to volume with milli-Q $H_2O$. (1% $HNO_3$) exp 06/01/15

# M11983 5-7-14
JA
Stock MRL
5% HCL
5% HNO3

Spiking Solution calc
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 20 | m11908 | 1000 | 1 |
| Al | 400 | m11914 | 10000 | 2 |
| Ba | 10 | m11768 | 1000 | 0.5 |
| Be | 4 | m11239 | 1000 | 0.2 |
| Cd | 5 | m11242 | 1000 | 0.25 |
| Co | 10 | m11355 | 1000 | 0.5 |
| Cr | 10 | m11767 | 10000 | 0.05 |
| Cu | 10 | m11764 | 10000 | 0.05 |
| Mg | 500 | m11976 | 10000 | 2.5 |
| Mn | 10 | m11829 | 10000 | 0.05 |
| Mo | 10 | m11357 | 1000 | 0.5 |
| Ni | 10 | m11358 | 1000 | 0.5 |
| Pb | 10 | m11682 | 10000 | 0.05 |
| Sb | 20 | m11909 | 1000 | 1 |
| V | 10 | m11241 | 1000 | 0.5 |
| Zn | 10 | m11240 | 10000 | 0.05 |
| K | 1000 | m11765 | 10000 | 5 |
| Na | 1000 | m11366 | 10000 | 5 |
| As | 20 | m11912 | 1000 | 1 |
| Ca | 500 | m11910 | 10000 | 2.5 |
| Fe | 300 | m11915 | 10000 | 1.5 |
| Se | 20 | m11911 | 1000 | 1 |
| Tl | 20 | m11361 | 1000 | 1 |
| Si | 100 | m11919 | 1000 | 5 |
| B | 20 | m11763 | 1000 | 1 |
| Li | 20 | m11362 | 1000 | 1 |
| W | 50 | m11826 | 1000 | 2.5 |
| Ti | 10 | m11364 | 1000 | 0.5 |
| Sr | 10 | m11360 | 1000 | 0.5 |
| Sn | 50 | [ | 1000 | 2.5 |
| S | 100 | m11679 | 10000 | 0.5 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

ex 6/14

# M11984 5-7-14 Into 500 ml Vol flask pipet 10 mls #M11983.
JA Working MRL Bring up to Mark with DI $H_2O$. ex 6/14
5% HCL
5% HNO3

# M11985 5-7-14 Into 500 ml Vol flask pipet 30 mls #M11983.
JA LL ICV Bring up to mark with DI $H_2O$ ex 6/14
5% HCL
5% HNO3

#M11967 04/30/14 SF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11968 04/30/14 SF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 1444) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11969 05-02-14 MOS — GFAA Base STD (25ug/L)(NoAg) - Into a 1L volumetric flask, pipetted 0.25mL of M11752 + brought to volume with milli-Q $H_2O$. exp. 11-30-14, (1% $HNO_3$)

#M11970 05-02-14 MOS — GFAA CCV (10ug/L)(NoAg) - Into a 1L vol. Flask, pipetted 0.10mL M11752 + brought to volume with milli-Q $H_2O$. exp. 11-30-14 (1% $HNO_3$)

#M11971 05-02-14 MOS — GFAA ICV (10ug/L Pb, Sb 40ug/L As, Se, Tl + 1ug/L Ag) - Into a 1L vol. Flask, pipetted 0.2 ml M11827 + brought to volume with milli-Q $H_2O$. exp. 01-30-15 (1% $HNO_3$)

#M11972 05-02-14 MOS — GFAA ICV (10ug/L As, Se, Tl) - Into a 100mL vol. flask, pipetted 25.0 mL M11971 + brought to volume with milli-Q $H_2O$. exp. 01-30-15 (1% $HNO_3$)

MOS 05-05-14

#M11973 05-05-14 MOS — GFAA Mixed STD (10mg/mL) - Into a 100mL vol. flask, pipetted 1.0mL ~~of the~~ M11361, M11911, M11912, M11708, + M11909 brought to volume with milli-Q $H_2O$. (2% $HNO_3$) exp. 08/20/14

#M11974 05-05-14 MOS — GFAA Base STD (25ug/L) - Into a 1L vol. flask, pipetted 2.5mL of M11973 + brought to volume with milli-Q $H_2O$. (1% $HNO_3$) exp. 08/20/14

#M11975 05-05-14 MOS — GFAA CCV (10ug/L) - Into a 1L vol. Flask, pipetted 1.0mL M11973 + brought to volume with milli-Q $H_2O$. (1% $HNO_3$) exp. 08/20/14

#M11976 5-6-14 — Mg 10,000 mg/L CPI international Lot # 14A231 ex 11/15

#M11977 5-6-14 — 5% HCL, 5% HNO3 — Initial Calibration Standard (ICV)
Into one liter volumetric flask pipet 10 mls of M11827 ( ex 1/15) 2.0 mls of #m11776 (ex 12/14) and 0.5 mls #M11357 Mo (ex 08/14) and 0.5 mls of #M11763 B (ex 5/15), 0.5 #m11360 Sr (ex 8/14), 0.5 #m11362 mls Li (ex 8/14), 0.5 mls sn # m11359 (ex 8/14),0.5 mls ti #m11364 (ex 8/14) and bring up to mark with DI H2O

#M11978 05-06-14 MOS — Custom Solution Inorganic Ventures Lot# H2-MEB527024 exp. 06/01/15

#M11979 05-06-14 MOS — Custom Solution Inorganic Ventures Lot# H2-MEB527023 exp 06/01/15

4-24-14
#M11959
JA

# ICAP Working Standards
5% HNO3 5%HCL

| Standard name | Pipet the following respectively: |
|---|---|
| 0.25 | 0.25 mls of standard 1000 ug/L into 1000 ml volumetric flask = 0.25 ug/L std |
| 0.5 | 0.50 mls of standard 1000 ug/L into 1000ml volumentric flask= 0.50 ug/L std |
| 1 | 1.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =1.00 ug/L std |
| 5 | 5.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =5.00 ug/L std |
| 10 | 10.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =10.0 ug/L std |
| 20 | 20.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =20.0 ug/L std |
| 50 | 50.0 mls of standard 1000ug/L into 1000 ml volumentrc flask =50.0 ug/L std |
| 100 | 1.0 mls of #M11752(ex 11/14) and 1.0 mls of #M11585 (ex 07/14) into 1000 ml volumectric flask= 100 ug/L std |
| 1000 | 10.0 mls of #M11752(ex 11/14) and #M11585 (ex 07/14) and 1 mL of #M11356 Si into 1000 ml volumetric flask= 1000 ug/L std |
| 10,000 | 100 mls #M11752 (ex 11/14),100 mls #M11585 (ex 07/14), |
| 100k | 10 mls of #M11764 Cu (ex 5/15) , 10 mls of #M11829 Mn (ex 7/15) , 10 mls of #M11767 Cr (ex 5/15), 10 mls #M11682 Pb (ex 2-15), 10 mls zn #M11240(ex 6-14), 10 mls #M11366 Na (ex 8/14), ~~10 mls #M11512 As (ex 9/15)~~ JA 4-29-14 100,000 ug/L |
| 100,000 | 10 mls of #M11771 Mg (ex 5/15) , 10 mls of #M11724 Fe (ex 4/15) ,10 mls of #M11766 Ca (ex 5/15),10 mls #M11769 AL (ex 5/15) , into 1000 ml vol flask = 100,000 ug/l std |
| 500,000 | 50 mls of #M1171 Mg (ex 5/15) , 50 mls of #M11724 Fe (ex 4/15) ,50 mls of #M11766 Ca (ex 5/15), 50 mls #M11769 AL (ex 5/15) into 1000 ml vol flask = 500,000 ug/l std |
| 1000k | 100 mls of #M11771 Mg (ex 5/15) , 100 mls of #M11724 Fe (ex 4/15) ,100 mls of #M11766 Ca (ex 5/15),100 mls #M11769 AL (ex 5/15) into 1000 ml vol flask = 1,000,000 ug/l std |
| | Bring the 1000 ml volumetric up to mark with DI H2O |

ex 6/14

#M11960
4-29-14 ICV B, Si into 500 ml vol flask pipet 25mls M11252
JA & 2.5mls M11919 bring up to mark with
DI $H_2O$ ex 11/14

#M11961 ICSAB B, Si Into 500 ml vol flask pipet 0.25mls of
4-29-14 +50mls #M11776 # M11356 + # ~~M11...~~ M11763 Bring up to Mark w/ DI $H_2O$. ex 8/14.
JA +15mls #M11724
JA 4-29-14

#M11962 04/30/14 SF

Hg Working Stds:
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11963 04/30/14 SF

Hg Alt Source Working Std:
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11964 04/30/14 SF

Hg ICV / LCSW
(0.2% HNO3, HCl)

3.0ml of 100ug/L Hg (#M 11963) into 100ml = 3.0ug/L Hg

#M11965 04/30/14 SF

Hg CCV
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11966 04/30/14 SF

Hg MRL:
(0.2% HNO3, HCl)

0.2ml of 100ug/L Hg (#M 11963) into 100ml = 0.2ug/L Hg

 4-30-14

#M11946 04/21/14 LSF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1 part HNO3 (AB: 554)

#M11947 04/21/14 LSF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11490) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11948 04/21/14 LSF potassium permanganate soln: 50g potassium permanganate (#M11285) dissolve into 1000ml of D.I. H2O.
Exp: 10/21/14

#M11949 4/22/14 Yttrium 10,000 Environmental Express lot # 1401501
ex 10/15

#M11950 MOS 04/22/14 GFAA Base STD (25ug/L) (1% HNO3) - Into a 1L vol. flask, pipetted 0.25mL of #M11430 + bring to volume with milli-Q H2O. Exp 05/01/14

#M11951 MOS 04/22/14 GFAA CCV STD (10ug/L) (1% HNO3) - Into a 1L vol. flask, pipetted 0.10 mL of #M11430 + brought to volume with milli-Q H2O. Exp 05/01/14

#M11952 MOS 04/22/14 GFAA ICV (alt. source, 10ug/L) (1% HNO3) - Into a 1L vol. flask, pipetted 1.0mL #M11431 + brought to volume with milli-Q H2O. Exp. 05/14 ← 05/01/14

#M11953 JL 4-24-14 Custom Assurance Std 100mg/L Spex Certiprep lot # 6-404WL
ex April 30 2015.

#M11954 LSF 04/25/14 LSF 1N HCl for TCLP: Into a 1L Vol. flask partially filled with Milli-Q H2O add 83ml of conc. HCl (AB.583) and bring up to volume with Milli-Q H2O.
Exp: 04/25/15

#M11955 LSF 04/29/14 LSF 10 N NaOH: Into a 1L flask, add 400g NaOH (#M11145) and bring up to volume with D.I. H2O.
Exp: 10/29/14

#M11956 LSF 04/29/14 LSF TCLP Extraction Fluid #1: Fill a 20L carboy with 19Liters of D.I. H2O. Add 114ml Glacial Acetic Acid (AB.579) and 128.6ml 10N NaOH (#M11839). Dilute to 20L with D.I. H2O and mix. pH=4.93 ± 0.05
Exp: 04/29/15

#M11957 LSF 04/29/14 LSF TCLP Extraction Fluid #1: Fill a 20L carboy with 19Liters of D.I. H2O. Add 114ml Glacial Acetic Acid (AB.579) and 128.6ml 10N NaOH (#M11839). Dilute to 20L with D.I. H2O and mix. pH=4.93 ± 0.05
Exp: 04/29/15

#M11958 4-29-14 JL CCV3 into 1000ml vol flask pipet 10mls #M11752 10mls #M11585 bring up to mark with DI H2O.
ex 7/14.

#M11932 04/11/14SF — Hg ICV / LCSW (0.2% HNO3, HCl): 3.0ml of 100ug/L Hg (#M11931) into 100ml = 3.0ug/L Hg

#M11933 04/11/14SF — Hg CCV (0.2% HNO3, HCl):
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11934 04/11/14SF — Hg MRL: (0.2% HNO3, HCl): 0.2ml of 100ug/L Hg (#M11931) into 100ml = 0.2ug/L Hg

#M11935 04/11/14SF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11936 04/11/14SF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11790) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11937 04/14/14 mas — GFAA working Stds – (1% HNO3):
0.05mL of M11431 (GFAA multi spike) into 100mL = 5ug/L As, Pb, Se, Tl, Sb + 0.75ug/L Ag
0.10 mL of M11431 into 100mL = 10ug/L As, Pb, Se, Tl, Sb + 1.5ug/L Ag
0.15 mL of M11431 into 100mL = 15ug/L As, Pb, Se, Tl, Sb + 2.25ug/L Ag
0.20 mL of M11431 into 100mL = 20ug/L As, Pb, Se, Tl, Sb + 3.0 ug/L Ag
0.25 mL of M11431 into 100mL = 25ug/L As, Pb, Se, Tl, Sb + 3.75 ug/L Ag
0.50 mL of M11431 into 100mL = 50 ug/L As, Pb, Se, Tl, Sb + 7.5ug/L Ag

#M11938 04/14/14 mas — GFAA CCV (10ug/L) - (1% HNO3): 0.10mL of M11431 into 100mL of mili-Q H2O = 10ug/L As, Pb, Se, Tl, Sb + 1.5ug/L Ag

#M11939 04/14/14 mas — GFAA ICV (alt. Source 10ug/L) - (1% HNO3): 0.1mL of M11430 (100ug/L As, Pb, Se, Tl, Sb + 15ug/L Ag) into a 1L volumetric flask + brought to volume with mili-Q H2O.

#M11940 04/15/14SF Exp: 04/15/15 — TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB 579) and 128.6ml 10 N NaOH (#M11839). Dilute to 20L with D.I. H2O. pH = 4.93 ± 0.05

#M11941 04/21/14SF — Hg Working Stds: (0.2% HNO3, HCl):
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11942 04/21/14SF — Hg Alt Source Working Std: (0.2% HNO3, HCl):
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11943 04/21/14SF — Hg ICV / LCSW (0.2% HNO3, HCl): 3.0ml of 100ug/L Hg (#M11942) into 100ml = 3.0ug/L Hg

#M11944 04/21/14SF — Hg CCV (0.2% HNO3, HCl):
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11945 04/21/14SF — Hg MRL: (0.2% HNO3, HCl): 0.2ml of 100ug/L Hg (#M11942) into 100ml = 0.2ug/L Hg

#M11917 S ICV(AH) ent 100 ml vol flask pipet From M11079 10mls = 100,000
4-1-14 =100,000ug/L S. ex 5/15

#M11918 04/02/14 SF Potassium permanganate soln: 50g potassium permanganate (#M11285) dissolve into 1,000ml of D.I. $H_2O$.
Exp: 10/02/14 04/02/14 SF

# M11919 4-2-14 Si 1000 mg/L Std Fisher Lot # 141902 ex 3/16

# M11920 4-2-14 AMCO Clear turbity Std 20 ntu ex Lot# C4674660 ex 3/15.

#M11921 04/03/14 SF Potassium persulfate: 50g potassium persulfate (#M10987) dissolve into 1,000 ml of D.I. $H_2O$.
Exp: 10/03/14 04/03/14 SF

#M11922 04/04/14 SF

Hg Working Stds:
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11923 04/04/14 SF

Hg Alt Source Working Std:
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11924 04/04/14 SF

Hg ICV / LCSW
(0.2% HNO3, HCl)

3.0ml of 100ug/L Hg (#M11923 ) into 100ml = 3.0ug/L Hg

#M11925 04/04/14 SF

Hg CCV
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11926 04/04/14 SF

Hg MRL:
(0.2% HNO3, HCl)

0.2ml of 100ug/L Hg (#M 11923 ) into 100ml = 0.2ug/L Hg

#M11927 04/04/14 SF

Hg Aqua Regia Reagent:
"Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11928 04/04/14 SF

Stannous Chloride Reagent:
Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11990) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11929 04/10/14 SF NaCl Hydroxylamine Sulfate Reagent: Dissolve into 60g NaCl (#M11799) and 60g hydroxylamine Sulfate (#M11798) in 500ml Milli-Q
Exp: 10/10/14

#M11930 04/11/14 SF 04/11/14 SF

Hg Working Stds:
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11931 04/11/14 SF

Hg Alt Source Working Std:
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

| | | |
|---|---|---|
| #M11900 03/25/14 LSF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11901 03/25/14 LSF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M11902 03/25/14 LSF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 11901 ) into 100ml = 3.0ug/L Hg |
| #M11903 03/25/14 LSF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M11904 03/25/14 LSF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 11901 ) into 100ml = 0.2ug/L Hg |
| #M11905 03/25/14 LSF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M11906 03/25/14 LSF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11790) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M11907 03/27/14 LSF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114mL Glacial Acetic Acid (AB 579) and 128.6mL 10N NaOH (#M118 37), Dilute to 20L with D.I. H2O. pH = 4.93 ± 0.05
Exp: 03/27/15

#M11908 04/01/14 LSF Silver 1,000mg/L CPI Lot # 13J247 Exp: 09/18/15

#M11909 04/01/14 LSF Antimony 1,000mg/L CPI Lot# 13F111 Exp: 09/18/15

#M11910 04/01/14 LSF Calcium 10,000mg/L CPI Lot# 13J146 Exp: 09/18/15

#M11911 04/01/14 LSF Selenium 1,000mg/L CPI Lot# 13J044 Exp: 09/18/15

#M11912 ~~04/01/14~~ 04/02/14 LSF Arsenic 1,000mg/L CPI Lot# 14B013 Exp: 09/18/15

#M11913 04/01/14 LSF Silver 10,000mg/L CPI Lot# 10F108 Exp: 09/18/15

#M11914 04/01/14 LSF Aluminum 10,000mg/L CPI Lot# 14A005 Exp: 09/18/15

#M11915 04/01/14 LSF Iron 10,000mg/L CPI Lot# 14B014 Exp: 09/18/15

#M11916 4/1/14 S Working Stds. into 4 100ml vol flasks pipet respectively from #M 11828 S 10,000 mg/L
0.01 mls → = 1000 ug/L S, 0.1 mls → = 10,000 ug/L S
1.0 mls → = 100,000 ug/L S, 10 mls → = 1000 K ug/L S bring up to mark with DI H2O. ex 1/15

#M11891 3-7-14 
1% HNO3
% HCl

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 4 | M11780 | 1000 | 0.2 |
| Al | 9.6 | M11769 | 10000 | 0.048 |
| As | 32 | M11173 | 1000 | 1.6 |
| Ba | 2 | M11768 | 1000 | 0.1 |
| Be | 1.6 | M11239 | 1000 | 0.08 |
| Ca | 56 | M11766 | 10000 | 0.28 |
| Cd | 1.6 | M11242 | 1000 | 0.08 |
| Co | 9.6 | M11355 | 1000 | 0.48 |
| Cr | 5.6 | M11767 | 10000 | 0.028 |
| Cu | 16 | M11764 | 10000 | 0.08 |
| Fe | 72 | M11723 | 10000 | 0.36 |
| Mg | 32 | M11771 | 10000 | 0.16 |
| Mn | 6 | M11829 | 10000 | 0.03 |
| Mo | 9.6 | M11357 | 1000 | 0.48 |
| Ni | 4.8 | M11358 | 1000 | 0.24 |
| Pb | 10 | M11708 | 10000 | 0.05 |
| Sb | 32 | M11172 | 1000 | 1.6 |
| Se | 16 | M11171 | 1000 | 0.8 |
| Tl | 19 | M11361 | 1000 | 0.95 |
| V | 3.2 | M11241 | 1000 | 0.16 |
| Zn | 12 | M11240 | 10000 | 0.06 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 14-Apr

#M11892 03/07/14 SF — Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11893 03/07/14 SF — Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11894 03/07/14 SF — Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M ) into 100ml = 3.0ug/L Hg

#M11895 03/07/14 SF — Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11896 03/07/14 SF — Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M ) into 100ml = 0.2ug/L Hg

7 03/07/14 SF
#M11897 03/07/14 SF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11898 03/05/14 SF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M ) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11899 03/10/14 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB 579) and 128.6ml 10N NaOH (#M... ) Dilute to 20L with D.I. H2O. pH=4.93 ± 0.05
Exp: 03/10/15

[illegible] JSF NaCl Hydroxylamine Sulfate Reagent: Dissolve into 60g NaCl (#M11797) and 60g hydroxylamine sulfate (#M11798) in 500ml Milli-Q $H_2O$

Exp: 09/03/14

#M11887 03/07/14 JSF Potassium Permanganate soln: 50g potassium permanganate (#M11785) dissolve into 1,000ml of D.I. $H_2O$

Exp: 09/07/14

# M11888 3-7-14
JD
1% HCL
1% HNO3

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 4 | M11760 | 1000 | 0.2 |
| Al | 36 | M11769 | 10000 | 0.18 |
| As | 24 | M11173 | 1000 | 1.2 |
| Ba | 1.8 | M11768 | 1000 | 0.09 |
| Be | 0.6 | M11239 | 1000 | 0.03 |
| Ca | 100 | M11766 | 10000 | 0.5 |
| Cd | 2 | M11242 | 1000 | 0.1 |
| Co | 4 | M11355 | 1000 | 0.2 |
| Cr | 4 | M11767 | 10000 | 0.02 |
| Cu | 7 | M11764 | 10000 | 0.035 |
| Fe | 100 | M11723 | 10000 | 0.5 |
| Mg | 40 | M11771 | 10000 | 0.2 |
| Mn | 4 | M11829 | 10000 | 0.02 |
| Mo | 7 | M11357 | 1000 | 0.35 |
| Ni | 6 | M11358 | 1000 | 0.3 |
| Pb | 4 | M11708 | 10000 | 0.02 |
| Sb | 12 | M11172 | 1000 | 0.6 |
| Se | 13 | M11171 | 1000 | 0.65 |
| Tl | 15 | M11361 | 1000 | 0.75 |
| V | 5 | M11241 | 1000 | 0.25 |
| Zn | 10 | M11240 | 10000 | 0.05 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 14-Apr

# M11889 3-7-14
1% HCL JD
1% HNO3

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Li | 10 | M11362 | 1000 | 0.5 |
| Sn | 10 | M11359 | 1000 | 0.5 |
| Sr | 2 | M11360 | 1000 | 0.1 |
| Ti | 8 | M11364 | 1000 | 0.4 |
| W | 36 | M11826 | 1000 | 1.8 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 14-Apr

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

# M11890 3-7-14
1% HCL JD
1% HNO3

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Li | 14.4 | M11362 | 1000 | 0.72 |
| Sn | 20 | M11359 | 1000 | 1 |
| Sr | 3.2 | M11360 | 1000 | 0.16 |
| Ti | 9.6 | M11364 | 1000 | 0.48 |
| W | 24 | M11826 | 1000 | 1.2 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

stock
#M11881 3-3-14 MRL std
ZA

Spiking Sol'n

Spiking Solution calc
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 20 | m11708 | 1000 | 1 |
| Al | 400 | m11769 | 10000 | 2 |
| Ba | 10 | m11768 | 1000 | 0.5 |
| Be | 4 | m11239 | 1000 | 0.2 |
| Cd | 5 | m11242 | 1000 | 0.25 |
| Co | 10 | m11355 | 1000 | 0.5 |
| Cr | 10 | m11767 | 10000 | 0.05 |
| Cu | 10 | m11764 | 10000 | 0.05 |
| Mg | 500 | m11771 | 10000 | 2.5 |
| Mn | 10 | m11829 | 10000 | 0.05 |
| Mo | 10 | m11357 | 1000 | 0.5 |
| Ni | 10 | m11358 | 1000 | 0.5 |
| Pb | 10 | m11708 | 1000 | 0.5 |
| Sb | 20 | m11172 | 1000 | 1 |
| V | 10 | m11241 | 1000 | 0.5 |
| Zn | 10 | m11240 | 10000 | 0.05 |
| K | 1000 | m11765 | 10000 | 5 |
| Na | 1000 | m11366 | 10000 | 5 |
| As | 20 | m11173 | 1000 | 1 |
| Ca | 500 | m11766 | 10000 | 2.5 |
| Fe | 300 | m11723 | 10000 | 1.5 |
| Se | 20 | m11171 | 10000 | 0.1 |
| Tl | 20 | m11361 | 1000 | 1 |
| Si | 100 | m11356 | 1000 | 5 |
| B | 20 | m11763 | 1000 | 1 |
| Li | 20 | m11362 | 1000 | 1 |
| W | 50 | m11826 | 1000 | 2.5 |
| Ti | 10 | m11364 | 1000 | 0.5 |
| Sr | 10 | m11360 | 1000 | 0.5 |
| Sn | 50 | m11359 | 1000 | 2.5 |
| S | 100 | m11828 | 1000 | 5 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

#M11882 3-3-14 MRL working Std:
%1 HCL ZA Into 500 ml vol flask piped 10
%1 HNO3 mls of #M11881. Bring up to mark w/DI H2O.

#M11883 3-3-14 ICV LL std Into 500 ml vol flask pipet 30m
1% HNO3 ZA of #M11881 (MRL stock std) Bring up to mark w/ DI H2O
% HCL

#M11884 ZA 3-3-14 ICSA Into 500 ml vol flask piped 50mls. #M117
1% HCL & 15mls #M11724 bring up to mark w/DI H2O
1% HNO3

#M11885 ZA 3-3-14 ICSAB Into 500 ml vol flask piped 50 mls #M11776
1% HCL 15mls #M11724 & 2.5 mls M11752 &
1% HNO3 2.5 mls #M11585 bring up to mark with DI H2O

| | |
|---|---|
| Hg MRL: (0.2% HNO3, ~~HCl~~) | 0.2ml of 100ug/L Hg (#M)1571 ) into 100ml = 0.2ug/L Hg |
| Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11790) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

M11877
3-3-14

## ICAP Working Standards

### 5% HNO3 5%HCL

| Standard name | Pipet the following respectively: |
|---|---|
| 0.25 | 0.25 mls of standard ~~100~~ *1 ug/L into 1000 ml volumetric flask = 0.25 ug/L std |
| 0.5 | 0.50 mls of standard ~~100~~ *1 ug/L into 1000ml volumentric flask= 0.50 ug/L std |
| 1 | 1.0 mls of standard ~~100~~ *1 ug/L into 1000 ml volumentrc flask =1.00 ug/L std |
| 5 | 5.0 mls of standard ~~100~~ *1 ug/L into 1000 ml volumentrc flask =5.00 ug/L std |
| 10 | 10.0 mls of standard ~~100~~ *1 ug/L into 1000 ml volumentrc flask =10.0 ug/L std |
| 20 | 20.0 mls of standard ~~100~~ *1 ug/L into 1000 ml volumentrc flask =20.0 ug/L std |
| 50 | 50.0 mls of standard ~~100~~ *1 ug/L into 1000 ml volumentrc flask =50.0 ug/L std |
| 100 | 1.0 mls of #M11752(ex 11/14) and 1.0 mls of #M11585 (ex 07/14) into 1000 ml volumectric flask= 100 ug/L std |
| 1000 | 10.0 mls of #M11752(ex 11/14) and #M11585 (ex 07/14) and 1 mL of #M11356 Si into 1000 ml volumetric flask= 1000 ug/L std |
| 10,000 | 100 mls #M11752 (ex 11/14),100 mls #M11585 (ex 07/14), |
| 100k | 10 mls of #M11764 Cu (ex 5/15) , 10 mls of #M11829 Mn (ex 7/15) , 10 mls of #M11767 Cr (ex 5/15), 10 mls #M11682 Pb (ex 2-15), 10 mls zn #M11240(ex 6-14), 10 mls #M11366 Na (ex 8/14),10 mls #M11173 As (ex 4/14)= 100,000 ug/L |
| 100,000 | 10 mls of #M11771 Mg (ex 5/15) , 10 mls of #M11724 Fe (ex 4/15) ,10 mls of #M11766 Ca (ex 5/15),10 mls #M11769 AL (ex 5/15) , into 1000 ml vol flask = 100,000 ug/l std |
| 500,000 | 50 mls of #M1171 Mg (ex 5/15) , 50 mls of #M11724 Fe (ex 4/15) ,50 mls of #M11766 Ca (ex 5/15), 50 mls #M11769 AL (ex 5/15) into 1000 ml vol flask = 500,000 ug/l std |
| 1000k | 100 mls of #M11771 Mg (ex 5/15) , 100 mls of #M11724 Fe (ex 4/15) ,100 mls of #M11766 Ca (ex 5/15),100 mls #M11769 AL (ex 5/15) into 1000 ml vol flask = 1,000,000 ug/l std |
| | Bring the 1000 ml volumetric up to mark with DI H2O |

ex 4/14

#M11878 Continuing Calibration Standard 1(CCV1)
3-~~8~~-14
3 ⊅

Into a one liter volmetric flask pipet 50mls of # M11752 (ex 11/14)
and 5 ml of #M11585 (ex 07/14).
ex. 07/14
Bring up to mark with DI H2O

11879 Continuing Calibration Standard 2(CCV2)
3-~~8~~-14
3 ⊅

Into a one liter volmetric flask pipet 5 mls of # M11752 (ex 11/14)
and 0.5 ml of #M11585 (ex 07/14).
ex. 7/14
Bring up to mark with DI H2O

M11880 Initial Calibration Standard (ICV)
3-3-14
⊅

Into one liter volumetric flask pipet 10 mls of M11827 ( ex 1/15)
2.0 mls of #m11776 (ex 12/14) and 0.5 mls #M11357 Mo (ex 08/14) and 0.5 mls
of #M11763 B (ex 5/15), 0.5 #m11360 Sr (ex 8/14), 0.5 #m11362 mls, Li (ex 8/14) and bring up to mark with DI H2O

*1 ⊅ 4-14-14

#M11860 02/19/14 SF — TCLP Extraction Fluid #1: Fill a 20L carboy w/ 19L D.I. $H_2O$. Add 114ml Glacial Acetic Acid (AB-579) and ~~128~~ 128.6ml 10N NaOH (#M11839). Dilute to 20L with D.I. $H_2O$. pH = 4.93 ± 0.05 (02/19/14 SF)

Exp: 02/19/15

#M11861 02/22/14 SF — TCLP Extraction Fluid #1: Fill a 20L carboy w/ 19L D.I. $H_2O$. Add 114ml Glacial Acetic Acid (AB-579) and 128.6ml 10N NaOH (#M11839). Dilute to 20L with D.I. $H_2O$ ~~.93~~ (02/22/14 SF)
pH = 4.93 ± 0.05

#M11862 02/24/14 SF — Hg Working Stds: (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11863 02/24/14 SF — Hg Alt Source Working Std: (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11864 02/24/14 SF — Hg ICV / LCSW (0.2% HNO3, HCl)

3.0ml of 100ug/L Hg (#M 11863 ) into 100ml = 3.0ug/L Hg

#M11865 02/24/14 SF — Hg CCV (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11866 02/24/14 SF — Hg MRL: (0.2% HNO3, HCl)

0.2ml of 100ug/L Hg (#M11863 ) into 100ml = 0.2ug/L Hg

#M11867 02/24/14 SF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11868 02/24/14 SF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11490) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11869 2-24-14 DA Spex Certiprep ~~Hg mg/L~~ 2-25-14 Hg 1000 mg/L Lot # CL6-66 HGY

#M11870 03/03/14 SF — Hg Working Stds: (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11871 03/03/14 SF — Hg Alt Source Working Std: (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11872 03/03/14 SF — Hg ICV / LCSW (0.2% HNO3, HCl)

3.0ml of 100ug/L Hg (#M 11871 ) into 100ml = 3.0ug/L Hg

#M11873 03/03/14 SF — Hg CCV (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

[illegible] 2-26-14 Plasma Pure Teledyne Leeman Labs loamy sand 4 Lot# 020829 exp none

| | | |
|---|---|---|
| #M118[illegible] 02-11-14 MOS | Hg Working Stds: (0.2% $HNO_3$, HCl) | 1.0mL of 1000mg/L Hg (#M11409) into 100mLs = 10 mg/L Hg |
| | | 1.0mL of 10mg/L Hg into 100mLs = 100ug/L Hg |
| | | 0.5mL of 100ug/L Hg into 100mLs = 0.5ug/L Hg |
| | | 1.0mL of 100ug/L Hg into 100mLs = 1.0ug/L Hg |
| | | 2.0mL of 100ug/L Hg into 100mLs = 2.0ug/L Hg |
| | | 4.0mL of 100ug/L Hg into 100mLs = 4.0ug/L Hg |
| | | 10.0mL of 100ug/L Hg into 100mLs = 10.0ug/L Hg |
| | | 12.5mL of 100ug/L Hg into 25mL = 50.0ug/L Hg |
| #M11848 02-11-14 MOS | Hg Alt. Source Working Std: (0.2% $HNO_3$, HCl) | 1.0mL of 100ug/mL Hg (#M11845) into 10mL = 10ug/mL = 10mg/L |
| | | 0.1mL of 10mg/L Hg into 10mLs = 100ug/L Hg |
| #M11849 02-11-14 MOS | Hg ICV/LCSW: (0.2% $HNO_3$, HCl) | 6.0mL of 100ug/L Hg (#M11848) into 200mL = 3.0ug/L Hg |
| #M11850 02-11-14 MOS | Hg CCV: (0.2% $HNO_3$, HCl) | 1.0mL of 1000mg/L Hg (#M11409) into 100mL = 10mg/L Hg |
| | | 1.0mL of 10mg/L Hg into 100mL = 100ug/L Hg |
| | | 6.0mL of 100ug/L Hg into 200mL = 3.0ug/L Hg |
| #M11851 02-11-14 MOS | Hg MRL: (0.2% $HNO_3$, HCl) | 0.2mL of 100ug/L (#M11848) into 100mL = 0.2ug/L Hg |

#M11852 2-14-14 Sodium hydroxide fisher Lot# B7159 exp 2-14-15

| | | |
|---|---|---|
| #M11853 02/17/14 SF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg |
| | | 1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg |
| | | 0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg |
| | | 1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg |
| | | 2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg |
| | | 4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg |
| | | 5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg |
| | | 10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11854 02/17/14 SF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg |
| | | 1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M11855 02/17/14 SF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 11854 ) into 100ml = 3.0ug/L Hg |
| #M11856 02/17/14 SF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg |
| | | 1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg |
| | | 3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M11857 02/17/14 SF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 11854 ) into 100ml = 0.2ug/L Hg |
| #M11858 02/17/14 SF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M11859 02/17/14 SF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 1190 ) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M11831 01-27-14 MOS - GFAA Nickel Nitrate Matrix Modifier Alpha Aesar Lot# 41-53086 6E

#M11832 01/27/14 LSF Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11833 01/27/14 LSF Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11834 01/27/14 LSF Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 11833) into 100ml = 3.0ug/L Hg

#M11835 01/27/14 LSF Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11836 01/27/14 LSF Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 11833 ) into 100ml = 0.2ug/L Hg

#M11837 01/27/14 LSF Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11838 01/27/14 LSF Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11790) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11839 02-03-14 MOS 10N NaOH - Into a 1L flask, add 400g NaOH (M11145) + bring to volume w/ DI

#M11840 02-03-14 MOS TCLP Extraction Fluid #1: Fill a 20L carboy w/ 19L DI water. Add 114mL Glacial Acetic acid (AB579) and 128.6 mL 10N NaOH (M11839). Dilute to 20L with DI water. pH 4.93±0.05
Exp: 02/03/15

#M11841 02/05/14 LSF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB.579) and 128.6mL 10N NaOH (#M11839). Dilute to 20L with D.I. H2O. pH=4.93±0.05
Exp: 02/05/15

#M11842 02/06/14 LSF potassium permanganate Soln: 50g potassium permanganate (#M11285) dissolve into 1,000mL of D.I. H2O.
Exp: 08/06/14

#M11843 02-06-14 MOS 1% Pd Matrix Modifier (GFAA) Lot # 1234818 (Environmental Express)
exp. 01-28-15

#M11844 2-9-14 2-6-14 D Diatomaceous Earth Leeman Labs lot# 1347503 ex 1/15

#M11845 2-9-14 Plasma Pure Teledyne Leeman Labs 100 ug/ml lot 1347501 ex 1/16

#M11815 MOS 01/15/14 GFAA Base Std (25ug/L): Into a 1 Liter volumetric Flask, pipet 0.25mL of M11430 + bring up to volume w/ DI
exp. 05/01/14 1% HNO3

# M11816 MOS 01/15/14 - GFAA CCV - Into a 1L vol. Flask, pipet 0.1mL M11430 + bring up to volume w/ DI
exp. 05/01/14 1% HNO3

#M11817 MOS 01/15/14 - GFAA ICV - Into a 1L vol. Flask, pipet 1mL M11431 + bring up to volume w/ DI water
exp 05/14 1% HNO3

| | | |
|---|---|---|
| #M11818 LSF 01/16/14 | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11819 LSF 01/16/14 | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M11820 LSF 01/16/14 01/16/14 LSF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 11819) into 100ml = 3.0ug/L Hg |
| #M11821 LSF 01/16/14 | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M11822 LSF 01/16/14 | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 11819 ) into 100ml = 0.2ug/L Hg |
| #M11823 LSF 01/16/14 | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M11824 LSF 01/16/14 | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11790) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M11825 DF 01/23/14 LSF NaCl Hydroxylamine Sulfate Reagent: Dissolve into 60g NaCl (#M11799) and 60g hydroxylamine Sulfate (#M11798) in 500mL Milli-Q H2O.
Exp: 07/23/14

#M11826 1-23-14 Tungsten 1000mg/L SPC Science Lot # 5130819014 ex 1/15

#M11827 1-23-14 Custom Assurance Std Lot 22-13 CR ex 1/15

#M11828 1-23-14 Sulfur 10,000 mg/L lot AF14-16354 (Spex Certiprep) ex 1/15

#M11829 1-23-14 Mn 10,000 mg/L lot 132091 (CPI) July/2015

LSF TCLP Extraction fluid #1: Fill a 20L ~~Carboy~~ Carboy 1/27/14 LSF with 19L D.I. H2O. Add 114mL Glacial Acetic Acid (AB 579) and 128.6mL 10N NaOH (#M11502) Dilute to 20L with D.I. H2O and mix.
Exp: 01/27/15

#M11811 1-13-14

MDL Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | MDL (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| K | 500 | m11765 | 10000 | 2.5 |
| Na | 500 | m11366 | 10000 | 2.5 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

EXPIRES 14-Aug

#M 11812
1-13-14

MDL Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | MDL (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Li | 5 | m11362 | 1000 | 0.25 |
| Sn | 5 | m11359 | 1000 | 0.25 |
| Sr | 5 | m11360 | 1000 | 0.25 |
| Ti | 5 | m11364 | 1000 | 0.25 |
| W | 10 | m11365 | 1000 | 0.5 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

EXPIRES 8/14

#M 11813
1-13-14

MDL Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | MDL (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| B | 20 | m11763 | 1000 | 1 |
| Si | 100 | m11356 | 1000 | 5 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

EXPIRES 14-Aug

#M11814 GFAA MDL Spiking Soln
MDS
01/14/14

Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 0.2 | M11170 | 1000 | 0.01 |
| Pb | 2 | M11708 | 1000 | 0.1 |
| Sb | 2 | M11172 | 1000 | 0.1 |
| As | 2 | M11173 | 1000 | 0.1 |
| Se | 2 | M11171 | 1000 | 0.1 |
| Tl | 2 | M11361 | 1000 | 0.1 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

EXPIRES: 04/24/2014

#M11806 01/08/14 LSF Potassium permanganate soln: 50g Potassium permanganate (#M11785) dissolve into 1,000mL of D.I. H2O.
Exp: 07/08/14

M11807 01/10/14

## ICAP Working Standards List 2

.5% HNO3 .5%HCL

| Standard name | Pipet the following respectively: |
|---|---|
| 1 | 0.01 mls of #M11752 and .001mls #M11365 = 1 ug/L |
| 10 | 0.10 mls of #M11752 and .01mls #M11365 = 10 ug/L |
| 100 | 1 mls of #M11752 and 0.1mls #M11365 = 100 ug/L |
| 1000 | 10 mls of #M11752 and 1.0mls #M11365 = 1000 ug/L |
| 10000 | 100 mls of #M11752 and 10mls #M11365 = 10000 ug/L |

ex-8-14

#M11808 01/10/14

Initial Calibration Standard (ICV) List 2
Into 1 liter vol flsk pipet 1 ml of #M11360,M11364,M11362,M11359, and M11056 bring up to mark with DI H2O ex 8/14

Continuing Calibration Standard (CCV) (#M11807) 1000 std
Into 1 liter vol flask pipet 10 mls of #M11752 and 1.0mls #M11365 = 1000 ug/L bring up to mark with DI H20 ex 8-14

#M11809 1/10/14 Into 500 ml vol flask pipet 50mls #M11776 and 50mls #M11366 & 5.0 #M11765 bring up to mark with DI H2O

#M11810
1-13-14

MDL Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | MDL (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 5 | m11170 | 1000 | 0.25 |
| Al | 10 | m11769 | 10000 | 0.05 |
| As | 20 | m11173 | 1000 | 1 |
| Ba | 2 | m11768 | 1000 | 0.1 |
| Be | 0.5 | m11239 | 1000 | 0.025 |
| Ca | 50 | m11766 | 10000 | 0.25 |
| Cd | 0.5 | m11242 | 1000 | 0.025 |
| Co | 2.5 | m11355 | 1000 | 0.125 |
| Cr | 5 | m11767 | 10000 | 0.025 |
| Cu | 10 | m11764 | 10000 | 0.05 |
| Fe | 20 | m11724 | 10000 | 0.1 |
| Mg | 25 | m11771 | 10000 | 0.125 |
| Mn | 5 | m11054 | 10000 | 0.025 |
| Mo | 2.5 | m11357 | 1000 | 0.125 |
| Ni | 5 | m11358 | 1000 | 0.25 |
| Pb | 10 | m11682 | 10000 | 0.05 |
| Sb | 20 | m11172 | 1000 | 1 |
| Se | 20 | m11171 | 1000 | 1 |
| Tl | 20 | m11361 | 1000 | 1 |
| V | 5 | m11241 | 1000 | 0.25 |
| Zn | 5 | m11240 | 10000 | 0.025 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard. EXPIRES 14-Feb

#M11794 01/03/13 14 SF 01/05/14 SF Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11795 01/03/13 14 SF 01/03/14 SF Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11750) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11796
MDS
1/6/14

Working Standards for Sodium and Potassium; into seven, 500 ml volumetric flasks pipette from #M11621 and #M11720.

For the 0.5 mg/L std– 0.25 mls of each
1.0 mg/L std – 0.50 mls of each
5.0 mg/L std – 2.5 mls of each
10.0 mg/L std – 5.0 mls of each
50.0 mg/L std – 25.0 mls of each
100 mg/L std –50.0 mls each also used for Continuing Calibration Standard (CCV)
200 mg/L std -100.0 mls of each
Bring up to mark with DI H2O. Expires April 24, 2015.

#M11797 Intal Calibration Standard (ICV) - Into a 500 mL Volumetric Flask pipet 5mLs of
MDS
1/6/14 #M11366 + #M11765 + bring up to volume with DI $H_2O$.
exp 8/20/14

#M11798 01/06/13 14 01/06/14 SF Hydroxylamine Sulfate (Fisher) Lot# 134692

#M11799 01/06/14 SF Sodium chloride (Fisher) Lot #132895

#M11800 01/07/14 SF TCLP Extraction Fluid #1: Fill a 20L carboy with 19L D.I. $H_2O$. Add 114mL Glacial Acetic Acid (AB.579) and 128.6mL 10N NaOH (#M11507).
Exp: 01/07/15 Dilute to 20L with D.I. $H_2O$ and mix. pH=4.93 ± 0.05

#M11801 01/08/14 SF Potassium persulfate: 50g potassium persulfate (#M10987) dissolve into 1,000mL of D.I. $H_2O$.
Exp: 07/08/14

#M11802 01/08/14 MDS GFAA LOD/LOQ Soil Ag Working Std: Into a 200 mL vol. Flask, partially filled with D.I. water,
(1% $HNO_3$) pipet 0.12 mL Ag (1000mg/L) #M11170 = (600 µg/L) + bring up
ex 4/24/14 to volume with D.I.

#M11803 01/08/14 MDS GFAA LOD/LOQ Soil Ag Spiking Soln: Into a 1L vol. Flask partially filled w/ D.I. water,
(1% $HNO_3$) pipet 10 mL of #M11802 + bring up to volume.
ex 4/24/14

#M11804 01/08/14 MDS GFAA LOD/LOQ Water Working Std Ag only: Into a 100mL vol. Flask partially filled w/ D.I. water,
(1% $HNO_3$) pipet 0.1 mL Ag (1000mg/L) #M11170 = 1000µg/L + bring
ex 4/24/14 up to volume with D.I.

#M11805 01/08/14 MDS GFAA LOD/LOQ Water Spiking Soln Ag only: Into a 1L vol. Flask, pipet 10mL #M11804 + bring up to volume
ex 4/24/14 (1% $HNO_3$)

#M11781 12/18/13 LSF — Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11782 12/18/13 LSF — Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11783 12/18/13 LSF — Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M11782) into 100ml = 3.0ug/L Hg

#M11784 12/18/13 LSF — Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11785 12/18/13 LSF — Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 11782) into 100ml = 0.2ug/L Hg

#M11786 12/18/13 LSF — Hg Aqua Regia Reagent:
"Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11786 12/18/13 LSF — Stannous Chloride Reagent:
Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11780) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11787 12/18/13 LSF TCLP Extraction Fluid#1: Fill a 20L carboy w/19L D.I. H2O. Add 114ml Glacial Acetic acid (AB. 579) and 128.6mL 10N NaOH (#M11507). Dilute to 20L w/D.I. H2O and mix. pH= 4.93 ± 0.05
Exp: 12/18/14

#M11788 12/18/13 LSF NaCl Hydroxylamine sulfate Reagent: Dissolve into 60g NaCl (#M9574) and 60g Hydroxylamine Sulfate (#M11376) in 500mL Milli-Q H2O.
Exp: 06/18/14

#M11489 01/03/14 LSF — Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

[illegible] 01/03/14 LSF — Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

[illegible] 01/03/14 LSF — Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M11490) into 100ml = 3.0ug/L Hg

[illegible] 01/03/14 LSF — Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

[illegible] 01/03/14 LSF — Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 11490) into 100ml = 0.2ug/L Hg

#M11761 12/03/13SF Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11762 12/03/13SF Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11450) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11763 12/03/13SF Boron 1,000mg/L CPI Lot# 13I130 Exp: 05/13/15

#M11764 12/03/13SF Copper 10,000mg/L CPI Lot# 13B062 Exp: 05/13/15

#M11765 12/03/13SF Potassium 10,000mg/L CPI Lot# 13I116 Exp: 05/13/15

#M11766 12/03/13SF Calcium 10,000mg/L CPI Lot# 13I209 Exp: 05/13/15

#M11767 12/03/13SF Chromium 10,000mg/L CPI Lot# 13D123 Exp: 05/13/15

~~#M~~ 12/03/13SF

#M11768 12/03/13SF Barium 1,000mg/L CPI Lot# 13I127 Exp: 05/13/15

#M11769 12/03/13SF Aluminum 10,000mg/L CPI Lot# 13I229 Exp: 05/13/15

#M11770 12/03/13SF Iron 10,000mg/L CPI Lot# 13I037 Exp: 05/13/15

#M11771 12/03/13SF Magnesium 10,000mg/L CPI Lot# 13H220 Exp: 05/13/15

#M11772 12/06/13SF Spex ~~Certiprep~~ Certiprep 12/06/13SF Lot# 4-356NY Custom Assurance Std Exp: 12/30/14

#M11773 12/10/13 mos Alpha Aesar Specpure 1% Nickel Nitrate Matrix modifier (GFAA) Lot. 33-457692B

#M11774 12/11/13SF Stannous chloride (Macron) Lot# 0000064492

#M11775 12/12/13SF Potassium Permanganate Soln: 50g potassium permanganate (#M11285) dissolve into 1,000mL of D.I. $H_2O$.
Exp: 06/12/14

#M11776 12/17/13 mos Spex Certiprep Interferents A Lot# 10-54YPX Exp. 12/30/14

#M11777 12/17/13 mos GFAA Base Std (50ug/L) Into a 1L vol. flask, pipet 0.50mL M11430 + bring up to volume w/ D.I

#M11778 12/17/13 mos GFAA ICV (alt source) (20ug/L) Into a 500mL vol. flask, pipet 1mL #M11431 + Bring to volume with DI water.

#M11779 12/17/13 mos GFAA CCV (20ug/L) Into a 500mL vol. flask, pipet 0.1mL # M11430 + Bring to vol. w/ DI

#M11780 12/18/13 mos GFAA Base Std (25ug/L) Into a 1L vol. flask, pipet 0.25mL M11430 + bring to volume w/ DI water.

#M11746 11/19/13SF Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11747 11/19/13SF Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11558) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11748 11/19/13SF Potassium persulfate (Fisher) lot#132059

#M11749 11/19/13SF NaCl Hydroxylamine Sulfate Reagent: Dissolve 60g NaCl (#M9574) and 60g hydroxylamine sulfate (#M11376) in 500mL Milli-Q $H_2O$.
Exp: 05/19/14

#M11750 11/22/13SF Stannous Chloride (Macron) lot#0000055565

#M11751 11/22/13 mos GFAA Base Std. Into a 1L vol. flask, pipet 0.25mL M11430 and bring up to volume with DI.
Exp 05/01/14

#M11752 11-25-13 [illegible] Custum Assurance Std Spex Certiprep lot#4-311GNY
ex Nov 30, 2014

#M11753 12-02-13 mos GFAA ICV (alt. source) Into a 1Liter vol flask, pipet 1ml #M11431 + bring up to volume w/ DI
exp. 05/14

#M11754 12/02/13SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. $H_2O$. Add 114mL Glacial Acetic acid (AB:579) and 128.6mL 10N NaOH (#M11567). Dilute to 20L w/D.I. $H_2O$ and mix. pH=4.93 ± 0.05
Exp: 12/02/14

#M11755 12/02/13 mos GFAA CCV - Into a 1L vol. flask, pipet 0.1ml # M11430 + bring to volume.
exp. 05/14

#M11756 12/03/13SF Hg Working Stds: (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11757 12/03/13SF Hg Alt Source Working Std: (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11758 12/03/13SF Hg ICV / LCSW (0.2% HNO3, HCl)

3.0ml of 100ug/L Hg (#M11757) into 100ml = 3.0ug/L Hg

#M11759 12/03/13SF Hg CCV (0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11760 12/03/13SF Hg MRL: (0.2% HNO3, HCl)

0.2ml of 100ug/L Hg (#M 11757) into 100ml = 0.2ug/L Hg

4/20-14 ~~T~~

#M11736a 11/11/13 SF potassium permanganate soln: 50g potassium permanganate (#M11785) dissolve into 1,000ml of D.I. $H_2O$.
Exp 05/11/14 ~~3~~ 11-13-13

M11737a 11-13-13 a

## ICAP Working Standards Boron & Silicon

| Standard name | Into 1 liter Pipet the following respectively: |
|---|---|
| 50 | 0.05 mls of #M11205 and .05mls #M11356 = 50 ug/L |
| 100 | .1 mls of #M11205 and 0.1mls #M11356 = 100 ug/L |
| 1000 | 1.0 mls of #M11205 and 1.0mls #M11356 = 1000 ug/L |
| 2000 | 2.0 mls of #M11205 and 2.0mls #M11356 = 1000 ug/L |
| 10000 | 10.0 mls of #M11205 and 10mls #M1356 = 10000 ug/L |

ex 5/14

#M11738a 11-13-13

Initial Calibration Standard (ICV) B, SI
Into 1 liter vol flsk pipet 1 ml of #M10860,10 mls m11584b
bring up to mark with DI H2O ex 12/13

m11737
Continuing Calibration Standard (CCV)
Into 1 liter vol flask pipet 1.0 mls of #M11205 and 1.0mls #M11356 = 1000 ug/L
bring up to mark with DI H20 ex 5-14

#M11739a 11/14/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/ 19L D.I. $H_2O$. Add 114ml Glacial Acetic acid (AB5??), and 128.6ml 10N NaOH (#M11507). Dilute to 20L w/ D.I. $H_2O$ and mix. pH = 4.93 ± 0.05
Exp: 11/14/14

#M11740a 11/18/13 Spex Certiprep Custom Assurance Std. Lot #4-286NY
exp NOV 2014

#M11741a 11/19/13 SF a

Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11742a 11/19/13 SF a

Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11743a 11/19/13 SF a

Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M11742) into 100ml = 3.0ug/L Hg

#M11744a 11/19/13 SF a

Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11745 11/19/13 SF

Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 11742) into 100ml = 0.2ug/L Hg

#M11746 11/19/13 SF

#M11747 11/19/13 SF

#M11748 11/19/13 SF

#M11749 11/19/13 SF N

#M11750 11/22/13 SF Std

#M11751 11/22/13 mos
Exp 05/01/14

M11752 11-25-13

#M11753 12-02-13 mos
exp. 05/14

#M11754 12/02/13 SF TCl
Exp: 12/0

#M11755 12/02/13 mos
exp. 05/14

#M11756 12/03/13 SF

M11757 12/03/13 SF

M11758 12/03/13 SF

M11759 12/03/13 SF

M11760 12/03/13 SF

[illegible]11
11-5-13

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 4 | M11170 | 1000 | 0.2 |
| Al | 9.6 | M11363 | 10000 | 0.048 |
| As | 32 | M11173 | 1000 | 1.6 |
| Ba | 2 | M11052 | 1000 | 0.1 |
| Be | 1.6 | M11239 | 1000 | 0.08 |
| Ca | 56 | M11539 | 10000 | 0.28 |
| Cd | 1.6 | M11242 | 1000 | 0.08 |
| Co | 9.6 | M11355 | 1000 | 0.48 |
| Cr | 5.6 | M11503 | 10000 | 0.028 |
| Cu | 16 | M11051 | 10000 | 0.08 |
| Fe | 72 | M11724 | 10000 | 0.36 |
| Mg | 32 | M11636 | 10000 | 0.16 |
| Mn | 6 | M11054 | 10000 | 0.03 |
| Mo | 9.6 | M11357 | 1000 | 0.48 |
| Ni | 4.8 | M11358 | 1000 | 0.24 |
| Pb | 10 | M11682 | 10000 | 0.05 |
| Sb | 32 | M11172 | 1000 | 1.6 |
| Se | 16 | M11171 | 1000 | 0.8 |
| Tl | 19 | M11361 | 1000 | 0.95 |
| V | 3.2 | M11241 | 1000 | 0.16 |
| Zn | 12 | M11240 | 10000 | 0.06 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 14-Feb

#M11742 JA
11-5-13

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Li | 14.4 | M11362 | 1000 | 0.72 |
| Sn | 20 | M11359 | 1000 | 1 |
| Sr | 3.2 | M11360 | 1000 | 0.16 |
| Ti | 9.6 | M11364 | 1000 | 0.48 |
| W | 24 | M11365 | 1000 | 1.2 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 14-Feb

#M11743 JA
11-5-13

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| B | 52 | M11205 | 1000 | 2.6 |
| Si | 192 | m11356 | 1000 | 9.6 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 14-Aug

#M11744 11/07/13 SF TCLP Extraction Fluid #1: Fill a 20L Carboy w/19L D.I. $H_2O$. Add 114 mL Glacial Acetic Acid (A3579) and 128.6 mL 10N NaOH (HM 11567). Dilute to 20L with D.I. $H_2O$ and mix. pH = 4.93 ± 0.05
Exp: 11/07/14

#M11736 11-5-13

JA

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| B | 16 | M11205 | 1000 | 0.8 |
| Si | 200 | m11356 | 1000 | 10 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 14-Aug

#M11737

JA

11-5-13

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Li | 10 | M11362 | 1000 | 0.5 |
| Sn | 10 | M11359 | 1000 | 0.5 |
| Sr | 2 | M11360 | 1000 | 0.1 |
| Ti | 8 | M11364 | 1000 | 0.4 |
| W | 36 | M11365 | 1000 | 1.8 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 14-Feb

#M11738

JA

11-5-13

3010

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| S | 200 | M11343 | 1000 | 10 |
| | | | | |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 14-Aug

JA 11-6-13

#M11738 ~~9~~

JA

11-5-13

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| S | 240 | M11343 | 1000 | 12 |
| | | | | |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 14-Aug

#M11740

11-5-13

JA

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| K | 2640 | M11623 | 10000 | 13.2 |
| Na | 960 | M11366 | 10000 | 4.8 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 14-Aug

#M11729 11/5/13 SF — Hg MRL: (0.2% HNO3, HCl) — 0.2ml of 100ug/L Hg (#M11726) into 100ml = 0.2ug/L Hg

#M11730 11/5/13 SF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11731 11/5/13 SF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11558) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11732 11/05/13 SF NaCl Hydroxylamine Sulfate Reagent: Dissolve into 60g NaCl (#M9574) and 60g Hydroxylamine Sulfate (#M11376) in 500mL Milli-Q H2O.
Exp: 05/05/14

#M11733 11-5-13 ~~Turbity~~ Turbidity working stds into 20 mls pipet from #M11115 (200 NTu)
11-5-13
Gel std = 4.30
= 48.1
= 513

2.0 ml into 18 mL D.I. $H_2O$ = 20 NTu
10.0 ml into 10 mL D.I. $H_2O$ = 100 NTU
20.0 ml into 0 mL D.I. $H_2O$ = 200 NTU
(exp Aug 2014)

#M11734
11-5-13

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 4 | M11170 | 1000 | 0.2 |
| Al | 36 | M11363 | 10000 | 0.18 |
| As | 24 | M11173 | 1000 | 1.2 |
| Ba | 1.8 | M11052 | 1000 | 0.09 |
| Be | 0.6 | M11239 | 1000 | 0.03 |
| Ca | 100 | M11539 | 10000 | 0.5 |
| Cd | 2 | M11242 | 1000 | 0.1 |
| Co | 4 | M11355 | 1000 | 0.2 |
| Cr | 4 | M11503 | 10000 | 0.02 |
| Cu | 7 | M11051 | 10000 | 0.035 |
| Fe | 100 | M11724 | 10000 | 0.5 |
| Mg | 40 | M11636 | 10000 | 0.2 |
| Mn | 4 | M11054 | 10000 | 0.02 |
| Mo | 7 | M11357 | 1000 | 0.35 |
| Ni | 6 | M11358 | 1000 | 0.3 |
| Pb | 4 | M11682 | 10000 | 0.02 |
| Sb | 12 | M11172 | 1000 | 0.6 |
| Se | 13 | M11171 | 1000 | 0.65 |
| Tl | 15 | M11361 | 1000 | 0.75 |
| V | 5 | M11241 | 1000 | 0.25 |
| Zn | 10 | M11240 | 10000 | 0.05 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 14-Feb

M11735
11-5-13

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| K | 500 | M11623 | 10000 | 2.5 |
| Na | 600 | M11366 | 10000 | 3 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: ~~18-Apr~~ Aug/14

#M11715 10/29/13 SF Potassium permanganate Soln: 50g potassium permanganate (#M11...) dissolve into 1,000ml of D.I. H2O.
Exp: 04/29/14

#M11716 11/01/13 mos 1% Pd Matrix modifier. For GFAA. Environmental Express Lot# 1234818
exp: 10/25/14

#M11717 11/04/13 mos Yttrium (Y) 10,000ug/mL Env. Express Lot# 1311349
exp 4/17/2015

#M11718 11/04/13 mos Spex Certiprep Lot# 4-153NY Custom Assurance Std
exp. 10/30/2014

#M11719 11/04/13 mos Na 1000 ug/mL CPI Lot# 13E225
exp. 4/24/2015

#M11720 11/04/13 mos K 1000 ug/mL CPI Lot# 13E108
exp. 4/24/2015

#M11721 11/04/13 mos Na 1000 ug/mL CPI Lot# 13E225
exp. 4/24/2015

#M11722 11/04/13 mos K 1000 ug/mL CPI Lot# 13E108
exp. 4/24/2015

#M11723 11/04/13 mos Fe 10,000 ug/mL CPI Lot# 12J093
exp. 4/24/2015

#M11724 11/04/13 mos Fe 10,000 ug/mL CPI Lot# 12J093
exp. 4/24/2015

#M11725 11/05/13 SF — Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11726 11/05/13 SF — Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11727 11/05/13 SF — Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 11726) into 100ml = 3.0ug/L Hg

#M11728 11/05/13 SF — Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

spex certiprep Lot#18-131ASY ex 8/30/14

SPEX certiprep Lot# 19-01PBY ex: 8/30/14

luid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114mL Glacial Acetic Acid (AB.565) and 128.6mL 10N NaOH (#M11507). Dilute to 20L with D.I. H2O and mix. pH=4.93 ± 0.05

nganate soln: 50g potassium permanganate (#M11285) dissolve into 1,000mL of D.I. H2O.

spex Certiprep Lot# 18-131ASY Exp: 09/30/14

spex certiprep Lot# 19-61PBY Exp: 09/30/14

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

Std: 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

3.0ml of 100ug/L Hg (#M 11699) into 100ml = 3.0ug/L Hg

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

0.2ml of 100ug/L Hg (#M 11699 ) into 100ml = 0.2ug/L Hg

nt: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

agent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11558) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

: 50g potassium persulfate (#M10573) dissolve into 1,000mL of D.I. H2O.

Sulfate Reagent: Dissolve into 60g NaCl (#M9574) and 60g Exp: 03/14/14 Hydroxylamine Sulfate (#M11376) in 500mL Milli-Q H2O.

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#M11707 09/23/13 SF As 1000mg/L spex certiprep Lot# 18-131ASY Exp: 09/30/14

#M11708 09/23/13 SF Pb 1000mg/L spex certiprep lot# 19-61PBY Exp: 09/30/14

#M11709 10/02/13 SF Potassium permanganate soln: 50g potassium permanganate (#M11285) dissolve into 1,000mL of D.I. H2O. Exp: 04/02/14

#M11710 10/08/13 SF Stannous Chloride (Macron) - Lot. NO.0000052471

#M11711 10/10/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114mL Glacial Acetic Acid (AB.565) and 128.6mL 10N NaOH (#M11507) Dilute to 20L with D.I. H2O and mix. pH=4.93 ± 0.05 Exp: 10/10/14

#M11712 10/10/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114mL Glacial Acetic Acid (AB.565) and 128.6mL 10N NaOH (#M11507) Dilute to 20L with D.I. H2O and mix. pH=4.93 ± 0.05 Exp: 10/10/14

#M11713 10/14/13 SF Potassium permanganate soln: 50g potassium permanganate (#M11285) dissolve into 1,000mL of D.I. H2O. Exp: 04/14/14

#M11707 10/14/13 SF NaCl Hydroxylamine Sulfate Reagent: Dissolve into 60g NaCl (#M9574) and 60g hydroxylamine sulfate (#M11376) in 500mL Milli-Q H2O. Exp: 04/14/14

#M11708 10/14/13 SF — Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11709 10/14/13 SF — Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11710 10/14/13 SF — Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M11709 ) into 100ml = 3.0ug/L Hg

#M11711 10/14/13 SF — Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11712 10/14/13 SF — Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 11709 ) into 100ml = 0.2ug/L Hg

#M11713 10/14/13 SF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11714 10/14/13 SF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11558 in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11692 09/04/13 mos As 1000mg/L SPEX certiprep Lot#18-131ASY ex 8/30/14

#M11693 09/04/13 mos Pb 1000mg/L SPEX Certiprep Lot# 19-01PBY ex. 8/30/14

#M11694 09/05/13 ISF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. $H_2O$. Add 114ml Glacial Acetic Acid (AB.565) and ~~18~~ 128.6mL 10N Na (#M11507). Dilute to 20L with D.I. $H_2O$ and mix
Exp: 09/05/14 09/05/13 ISF
pH= 4.93 ± 0.05

#M11695 09/05/13 ISF Potassium permanganate soln: 50g potassium permanganate (#M10785) dissolve into 1,000mL of D.I. $H_2O$.
Exp: 03/05/14

#M11696 09/12/13 ISF AS 1000mg/L Spex Certiprep Lot# 18-131ASY Exp: 09/30/14

#M11697 09/12/13 ISF Pb 1000mg/L Spex Certiprep Lot# 19-01PBY Exp: 09/30/14

| | | |
|---|---|---|
| #M11698 09/17/13 ISF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11699 09/17/13 ISF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M11700 09/17/13 ISF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 11699) into 100ml = 3.0ug/L Hg |
| #M11701 09/17/13 ISF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M11702 09/17/13 ISF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 11699 ) into 100ml = 0.2ug/L Hg |
| #M11703 09/17/13 ISF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M11704 09/17/13 ISF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11558) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M11705 09/18/13 ISF Potassium persulfate: 50g potassium persulfate (#M10573) dissolve into 1,000mL of D.I. $H_2O$.
Exp: 03/18/14

#M11706 09/19/13 ISF NaCl Hydroxylamine Sulfate Reagent: Dissolve into 60g NaCl (#M9574) and 60g Hydroxylamine Sulfate (#M11396) in 500mL Milli-Q $H_2O$.
Exp: 03/19/14

#M11707 09/23/13 ISF AS 1000mg/L spex certiprep Lot# 18-131ASY

#M11708 09/23/13 ISF Pb 1000mg/L spex certiprep lot# 19-01PBY

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#M11677 8-20-13 As 1000mg/L Spex Certiprep lot # 18-131AS ex 8/30/14

#M11678 8-20-13 Pb 1000 mg/L Spex Certiprep lot# 19-01 PB ex. 8/30/18

#M11679 8-20-13 S 10,000 mg/L SPC Science lot# S130724021 ex 5/15

#M11680 08/22/13 SF (Fisher) Hydroxylamine Sulfate Lot#127466 Exp: 08/22/14

#M11681 8-22-13 Spex Certiprep lot # 4-20NY ex 8/14 (Custom Ass. Std)

#M11682 8-22-13 CPI Pb, 10,000 mg/L lot# 11J007 ex 2/15.

#M11683 08/22/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. $H_2O$. Add 114ml Glacial Acetic Acid (AB 565) and 128.6ml 10N NaOH (#M110507). Dilute to 20L with D.I. $H_2O$ and mix. pH=4.95±0.05 Exp: 08/22/14

#M11684 08/22/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. $H_2O$. Add 114ml Glacial Acetic Acid (AB 565) and 128.6ml 10N NaOH (#M110507). Dilute to 20L with D.I. $H_2O$ and mix. pH=4.95±0.05 Exp: 08/22/14

| | | | |
|---|---|---|---|
| #M11685 08/29/13 SF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg | |
| #M11686 08/29/13 SF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg | |
| #M11687 08/29/13 SF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M11686 ) into 100ml = 3.0ug/L Hg | |
| #M11688 08/29/13 SF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg | |
| #M11689 08/29/13 SF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 11686) into 100ml = 0.2ug/L Hg | |
| #M11690 08/29/13 SF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) | |
| #M11691 08/29/13 SF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11558) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. | |

Left margin (partial, from facing page): f the / et 10mls / w/ DI $H_2O$ / 8-19-13 / pipet 50mls / lask w/ DI $H_2O$. / 2/15 / 2/15 / 2/15 / 2/15 / amate (#M 11285) / of D.I. $H_2O$. / ((#M11493) and / M11376) in 500ml

# M11618 8-13-13 MRL/ICV LL onto 1000 ml val flask pipet the master standard following →

0.5% HCl, $HNO_3$

Bring upto Mark With DI $H_2O$.

ex 1/2/13

| Analyte | (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 20 | M11170 | 1000 | 1 |
| Al | 400 | M11537 | 10000 | 2 |
| Ba | 10 | M11052 | 1000 | 0.5 |
| Be | 4 | M11239 | 1000 | 0.2 |
| Cd | 5 | M11242 | 1000 | 0.25 |
| Co | 10 | M11355 | 1000 | 0.5 |
| Cr | 10 | M11053 | 10000 | 0.05 |
| Cu | 10 | M11051 | 10000 | 0.05 |
| Mg | 500 | M11536 | 10000 | 2.5 |
| Mn | 10 | M11054 | 10000 | 0.05 |
| Mo | 10 | M11357 | 1000 | 0.5 |
| Ni | 10 | M11358 | 1000 | 0.5 |
| Pb | 10 | M11400 | 1000 | 0.5 |
| Sb | 20 | M11172 | 1000 | 1 |
| V | 10 | M11241 | 1000 | 0.5 |
| Zn | 10 | M11240 | 10000 | 0.05 |
| K | 1000 | M11243 | 10000 | 5 |
| Na | 1000 | M11366 | 10000 | 5 |
| As | 20 | M11173 | 1000 | 1. |
| Ca | 500 | M11539 | 10000 | 2.5 |
| Fe | 300 | M11535 | 10000 | 1.5 |
| Se | 20 | M11171 | 10000 | 0.1 |
| Tl | 20 | M11361 | 1000 | 1 |
| Si | 100 | M11356 | 1000 | 5 |
| B | 20 | M11205 | 1000 | 1 |
| Li | 20 | M11362 | 1000 | 1 |
| W | 50 | M11365 | 1000 | 2.5 |
| Tl | 10 | M11364 | 1000 | 0.5 |
| Sr | 10 | M11360 | 1000 | 0.5 |
| Sn | 50 | M11359 | 1000 | 2.5 |
| S | 100 | M11343 | 1000 | 5 |

# M11619 8-13-13 MRL, onto 500 ml val flask pipet 10mls of Master std # M11618. Bring upto Mark w/ DI $H_2O$
0.5% HCl, $HNO_3$

# M11620 8-13-13 ICV LL onto 500 ml val flask pipet ~~50mls~~ 30 8-19-13 of Master std # 11618. Bring up to Mark w/ DI $H_2O$.
0.5% HCl, $HNO_3$

# M11621 8-19-13 Na 1000 mg/L CPI Lot 13E226 ex 2/15

# M11622 8-19-13 Fe 10,000 mg/L CPI Lot 13H100 ex 2/15

# M11623 8-19-13 K 10,000 mg/L CPI Lot 13H099 ex 2/15

# M11624 8-19-13 K 1000 mg/L CPI Lot 13E108 ex 2/15

#M11625 08/20/13 LSF Potassium permanganate soln: 50g potassium permanganate (#M11285) dissolve into 1000ml of D.I. $H_2O$.
Exp: 02/20/14

#M11626 08/20/13 LSF NaCl Hydroxylamine Sulfate Reagent: Dissolve into 60g NaCl (#M11493) and 60g hydroxylamine sulfate (#M11376) in 500ml Milli-Q $H_2O$.
Exp: 02/20/14

#M11677 8-20-1

# M11678 8

# M11679

#M11680 08/22/13

# M11681 8-2

# M11682 8-2

#M11683 08/22/1

#M11684 08/22/13

[redacted]

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#M11606
8-7-13
5% HCL
5% HNO3

Continuing Calibration Standard 1(CCV1)

Into a one liter volmetric flask pipet 50mls of # M11584b (ex 07/14) and 5 ml of #M11585 (ex 07/14).
ex. 07/14
Bring up to mark with DI H2O

#M11607
8-7-13
5% HCL+HNO3

Continuing Calibration Standard 2(CCV2)

Into a one liter volmetric flask pipet 5 mls of # M11584b (ex 7/14) and 0.5 ml of #M11585 (ex 07/14).
ex. 7/14
Bring up to mark with DI H2O

#M11608
8-7-13
5% HCL + HNO3

Initial Calibration Standard (ICV)
Into one liter volumetric flask pipet 10 mls of M11542 ( ex 6/14) 2.0 mls of #m11399 (ex 03/14) and 0.5 mls #M11357 Mo (ex 08/14) and 0.5 mls of #M11205 B (ex 5/14) bring up to mark with DI H2O

HNO3 (AB: 554)

Chloride (#M11558) in

#M11609 5% HCL 5% HNO3 8-7-13 ICSAB (DODCal) into 500ml vol flask pipet 50 mls #M11399 2.5mls #M11584b, 2.5 mls #M11585, 15 mls #M11535. Bring up to mark w/DI H2O. ex 3/14.

3-195NY

#M11610 5% HCL 5% HNO3 8-7-13 ICSA (DODCal) Into 500 ml vol flask pipet 50 mls #M11399 15 mls #M11535 bring up to mark with DI H2O ex 3/14

| | | |
|---|---|---|
| #M11611 08/13/13 SF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11612 08/13/13 SF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M11613 08/13/13 SF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 11612 ) into 100ml = 3.0ug/L Hg |
| #M11614 08/13/13 SF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M11615 08/13/13 SF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 11612 ) into 100ml = 0.2ug/L Hg |
| #M11616 08/13/13 SF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M11617 08/13/13 SF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11558) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

ug/L std
tric flask= 1000 ug/L std
0 mls #M11400 Pb (ex 3-14),
,10 mls #M11537 AL (ex 12/14)
), 50 mls #M11537 AL (ex 12/14)
2/14),100 mls #M11537 AL (ex 12/14)
ex 2-14

40

| | | |
|---|---|---|
| #M11597 08/05/13SF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11598 08/05/13SF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M11599 08/05/13SF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 11598) into 100ml = 3.0ug/L Hg |
| #M11600 08/05/13SF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M11601 08/05/13SF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 11598 ) into 100ml = 0.2ug/L Hg |
| #M11602 08/05/13SF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M11603 08/05/13SF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11558 ) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M11604 8-6-13 Spex Certiprep Custom Assurance Std Lot # 3-195NY
ex Aug 2014.

#M11605
8-7-13

# ICAP Working Standards
## 5% HNO3 5%HCL

| Standard name | Pipet the following respectively: |
|---|---|
| 0.25 | 0.25 mls of standard 100 ug/L into 1000 ml volumetric flask = 0.25 ug/L std |
| 0.5 | 0.50 mls of standard 100 ug/L into 1000ml volumentric flask= 0.50 ug/L std |
| 1 | 1.0 mls of standard 100ug/L into 1000 ml volumentrc flask =1.00 ug/L std |
| 5 | 5.0 mls of standard 100ug/L into 1000 ml volumentrc flask =5.00 ug/L std |
| 10 | 10.0 mls of standard 100ug/L into 1000 ml volumentrc flask =10.0 ug/L std |
| 20 | 20.0 mls of standard 100ug/L into 1000 ml volumentrc flask =20.0 ug/L std |
| 50 | 50.0 mls of standard 100ug/L into 1000 ml volumentrc flask =50.0 ug/L std |
| 100 | 1.0 mls of #M11584b(ex 07/14) and 1.0 mls of #M11585 (ex 07/14) into 1000 ml volumectric flask= 100 ug/L std |
| 1000 | 10.0 mls of #M11584b(ex 07/14) and #M11585 (ex 07/14) and 1 mL of #M11356 Si into 1000 ml volumetric flask= 1000 ug/L std |
| 10,000 | 100 mls #M11584b (ex 07/14),100 mls #M11585 (ex 07/14), |
| 100k | 10 mls of #M11051 Cu (ex 2/14) , 10 mls of #M11054 Mn (ex 2/14) , 10 mls of #M11053 Cr (ex 2/14), 100 mls #M11400 Pb (ex 3-14), 10 mls zn #M11240(ex 6-14), 10 mls #M11366 Na (ex 8/14)= 100,000 ug/L 10mls #11667 As (ex 8/14) |
| 100,000 | 10 mls of #M11536 Mg (ex 12/14) , 10 mls of #M11535 Fe (ex 12/14) ,10 mls of #M11539 Ca (ex 12/14),10 mls #M11537 AL (ex 12/14) , into 1000 ml vol flask = 100,000 ug/l std |
| 500,000 | 50 mls of #M11536 Mg (ex 12/14) , 50 mls of #M11535 Fe (ex 12/14) ,50 mls of #M11539 Ca (ex 12/14), 50 mls #M11537 AL (ex 12/14) into 1000 ml vol flask = 500,000 ug/l std |
| 1000k | 100 mls of #M11536 Mg (ex 12/14) , 100 mls of #M11535 Fe (ex 12/14) ,100 mls of #M11539 Ca (ex 12/14),100 mls #M11537 AL (ex 12/14) into 1000 ml vol flask = 1,000,000 ug/l std |

Bring the 1000 ml volumetric up to mark with DI H2O

ex 2-14

#M11606
8-7-13
5% HCL
5% HNO3

#M11607
8-7-13
5% HCL+HNO3

#M11608
8-7-13
5% HCL
+ HNO3

#M11609
5% HCL 8-7-13
5% HNO3

#M11610
5% HCL 8-7-13
5% HNO3

#M11611 08/13/13SF

#M11612 08/13/13SF

#M11613 08/13/13SF

#M11614 08/13/13SF

#M11615 08/13/13SF

#M11616 08/13/13SF

#M11617 08/13/13SF

$H_2O$. Add 114ml and 128.6ml dilute to 20L with 0.05

193E, product # 39043

#10-709P

pipet 50 mls

11573 & M11085. 9/13

$H_2O$ Add 114ml 10N NaOH $H_2O$ and mix.

(AB: 554)

w/ D.I. $H_2O$.

with D.I. $H_2O$.

#M11584b 7-29-13 Custum Assurance std 100mg/L(22) Spex Certiprep Lot # 20-105CR.
ex 7/14.

#M11585 7-29-13 Custum Assurance std 100mg/L(3) Spex Certiprep Lot # 20-104CR.
ex 7/14.

| | | |
|---|---|---|
| #M11586 07/30/13 SF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11587 07/30/13 SF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M11588 07/30/13 SF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M11587) into 100ml = 3.0ug/L Hg |
| #M11589 07/30/13 SF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M11590 07/30/13 SF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 11587) into 100ml = 0.2ug/L Hg |
| #M11591 07/30/13 SF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M11592 07/30/13 SF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11492) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M11593 07/31/13 SF NaCl Hydroxylamine Sulfate Reagent: Dissolve into 60g NaCl (#M11493) and 60g hydroxylamine sulfate (#M11376) in 500mL Milli-Q $H_2O$.
Exp: 01/31/13

#M11594 07/31/13 MDS TCLP Extraction Fluid #1: Fill a 20L Carboy with 19L D.I. $H_2O$. Add 114mL Glacial Acetic (AB 565) and 128.6mL 10N NaOH (M11507). Dilute to 20L with D.I. $H_2O$ + mix.
pH = 4.93±0.05

#M11595 07/31/13 MDS TCLP Extraction Fluid #1: Fill a 20L Carboy with 19L D.I. $H_2O$. Add 114ml Glacial Acetic (AB 565) and 128.6mL 10N NaOH (M11507). Dilute to 20L with D.I. $H_2O$.
pH: 4.93±0.05

#M11596 08/02/13 SF Potassium permanganate Sol'n: 50g Potassium permanganate (#M11285) dissolve into 1000mL of D.I. $H_2O$.
Exp: 02/02/14

#M11571 07/16/13 LSF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB 565) and 128.6ml 10N NaOH (#M11507) ~~Acidic~~ Dilute to 20L w/ D.I. H2O and mix. pH = 4.93 ± 0.05
Exp: 07/16/14

#M11572 07/16/13 MDS Nickel Nitrate Matrix Modifier Sol'n Alfa Aesar - Specpure Lot # 32-441193E, product # 39043
exp. 07/14

#M11573 07/16/13 Spex Certiprep Custom Assurance std Lot # 10-70YP
ex 7/30/14

#M11574 7-17-13 ICSAB into 500 ml vol flask pipet 50 mls ex 8/13 #M11399 15 mls #M11535 2.5 mls of #M11573 + M11085 Bring up to mark with DI H2O ex 9/13

#M11575 07/23/13 LSF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114ml Glacial Acetic (AB565) and 128.6ml 10N NaOH (#M11507). Dilute to 20L with D.I. H2O and mix. pH = 4.93 ± 0.05
Exp: 07/23/14

| | | |
|---|---|---|
| M11576 07/24/13 LSF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| M11577 07/24/13 LSF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| M11578 07/24/13 LSF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 11577) into 100ml = 3.0ug/L Hg |
| M11579 07/24/13 LSF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| M11580 07/24/13 LSF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 11577) into 100ml = 0.2ug/L Hg |
| M11581 07/24/13 LSF | Hg Aqua Regia Reagent: | "Carefully" in hood; mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| M11582 07/24/13 LSF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11490) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

M11583 07/25/13 MDS GFAA Base Std. Into a Liter vol. Flask, pipet 0.25ml #M11430. Bring up to volume w/ D.I. H2O.
exp. 05/14

M11584 07/25/13 MDS GFAA ICV (alt source) - Into a Liter vol Flask, pipet 1ml #M11431. Bring up to volume with DI H2O.

#M11584 7-29-13 Custum Assurance std 100mg/L(2) Spex Certiprep
ex 7/14

#M11585 7-29-13 Custum Assurance st 100mg/L(3) Spex Certiprep
ex 7/14

| | | |
|---|---|---|
| #M11586 07/30/13 LSF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10m<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11587 07/30/13 LSF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10m<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M11588 07/30/13 LSF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 11587) into 100ml = 3.0 |
| #M11589 07/30/13 LSF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10r<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M11590 07/30/13 LSF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 11587) into 100ml = 0.2 |
| #M11591 07/30/13 LSF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) wit |
| #M11592 07/30/13 LSF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g S 70 mL HCl (AB: 553). Bring up to volume with D |

#M11593 07/31/13 LSF NaCl Hydroxylamine Sulfate Reagent: Dissolve into 60g NaCl (... hydroxylamine Sulfate (#M... H2O.
Exp: 01/31/13

#M11594 07/31/13 MDS TCLP Extraction Fluid #1: Fill a 20L Carboy with 19L D.I. H2O. Ad... and 128.6mL 10N NaOH (M11507). Dilut...
pH = 4.93 ± 0.05

#M11595 07/31/13 MDS TCLP Extraction Fluid #1: Fill a 20L Carboy with 19L DI H2O. Add 114ml and 128.6mL 10N NaOH (M 11507). Dilut...
pH = 4.93 ± 0.05

#M11554 07/10/13 LSF — Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11555 07/10/13 LSF — Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M11553) into 100ml = 0.2ug/L Hg

#M11556 07/10/13 LSF — Hg Aqua Regia Reagent:
"Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11557 07/10/13 LSF — Stannous Chloride Reagent:
Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11095) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11558 07/08/13 LSF Stannous Chloride (Macron) - Lot # 0000045932

#M11559 07/10/13 MOS GFAA Base Std. - Into a Liter vol. Flask, pipet 0.25mL #M11430. Bring up to volume with D.I water.
exp. 05/14

#M11560 07/10/13 MOS GFAA ICV (Alt. Source) - Into a 1-Liter vol. flask, pipet 1ml # M11431 + bring up to volume with D.I water.

#M11561 07/10/13 MOS GFAA CCV - Into a 1-Liter vol. Flask, pipet 0.1mL # M11430 + bring up to volume with D.I water.

#M11562 07/10/13 LSF — Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11563 07/10/13 LSF — Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11564 07/10/13 LSF — Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 11563) into 100ml = 3.0ug/L Hg

#M11565 07/10/13 LSF — Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11566 07/10/13 LSF — Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M11563 ) into 100ml = 0.2ug/L Hg

#M11567 07/10/13 LSF — Hg Aqua Regia Reagent:
"Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11568 07/10/13 LSF — Stannous Chloride Reagent:
Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11492) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11569 07/15/13 LSF Potassium permanganate soln: 50g potassium permanganate (#M11285) dissolve into 1,000mL of D.I. H2O.
Exp: 07/15/14

#M11570 07/16/13 LSF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114mL Glacial Acetic Acid (AB. ~~3349~~ 365) and 128.6mL 10N NaOH (# ~~M11344~~). Dilute to 20L
07/16/13 LSF
Exp: 07/16/14

#M11538 06/24/13 LBF Na 1000mg/L CPI Lot#13E225 Exp: 12/14/14

#M11539 06/24/13 LBF Ca 10,000mg/L CPI Lot#13B105 Exp: 12/14/14

M11540 06/24/13 LBF K 1000mg/L CPI Lot#13E108 Exp: 12/14/14

M11541 06/25/13 LBF Potassium permanganate soln: 50g potassium permanganate (#M11285) dissolve into 1,000mL of D.I. H2O. Exp: 12/25/13

#M11542 06/26/13 JA Custom Assurance std Spex Certiprep Lot # 3-8 exp 6/14.

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|---|---|---|
| #M11543 06/26/13 LBF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11544 06/26/13 LBF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M11545 06/26/13 LBF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 11544) into 100ml = 3.0ug/L Hg |
| #M11546 06/26/13 LBF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M11547 06/26/13 LBF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 11544) into 100ml = 0.2ug/L Hg |
| #M11548 06/26/13 LBF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M11549 06/26/13 LBF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11045) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M11550 6-26-13 JA Y 10,000 µg/mL Env Express Lot # 1311349 e 12/14

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|---|---|---|
| #M11551 07/02/13 LBF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11552 07/02/13 LBF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M11553 07/02/13 LBF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 11552) into 100ml = 3.0ug/L Hg |

#M11523 06/13/13 MDS GFAA LOD/LOQ Water Spiking Soln: Into a 1L vol. Flask, pipet 10mL of #M11522
(1% $HNO_3$) and bring up to volume with D.I water.

#M11524 06/13/13 JSF Potassium persulfate: 50g potassium persulfate (#M9903) dissolve into 1,000mL
Exp: 12/13/13 D.I. $H_2O$.

#M11525 06/14/13 MDS GFAA LOD/LOQ Soil Working Std: Into a 200mL vol. Flask partially filled with D.I $H_2O$,
pipet the following and bring up to volume with D.I $H_2O$.
1.2mL Sb 1000mg/L (#M11172) = 6,000ug/L Sb
3.2mL As 1000mg/L (#M11173) = 16,000ug/L As
3.2mL Se 1000mg/L (#M11171) = 16,000ug/L Se
0.08mL Pb 10000 mg/L (#M10837) = 4,000 ug/L Pb
1.0mL Tl 1000mg/L (#M11361) = 5,000ug/L Tl

#M11526 06/14/13 MDS GFAA LOD/LOQ Soil Spiking Soln: Into a 1L vol. Flask, pipet 10mL of #M11525 +
bring up to volume with D.I $H_2O$.

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|---|---|---|
| #M11527 06/17/13 JSF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11528 06/17/13 JSF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg . |
| #M11529 06/17/13 JSF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 11528 ) into 100ml = 3.0ug/L Hg |
| #M11530 06/17/13 JSF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M11531 06/17/13 JSF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 11528 ) into 100ml = 0.2ug/L Hg |
| #M11532 06/17/13 JSF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M11533 06/17/13 JSF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11075) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M11534 06/20/13 JSF NaCl Hydroxylamine sulfate Reagent: Dissolve into 60g NaCl (#M11493) and 60g hydroxylamine
Exp: 12/20/13 sulfate (#M11376) in 500mL Mill-Q $H_2O$.

#M11535 06/24/13 JSF Fe 10,000 mg/L CPI Lot# 13D184 Exp: 12/14/14

#M11536 06/24/13 JSF Mg 10,000 mg/L CPI Lot# 13B063 Exp: 12/14/14

#M11537 06/24/13 JSF Al 10,000 mg/L CPI Lot# 13D139 Exp: 12/14/14

#M11511 06/10/13 JSF NaCl Hydroxylamine Sulfate Reagent: Dissolve 60g NaCl (#M11493) and 60g hydroxylamine sulfate (#M11376) in 500ml Milli-Q $H_2O$.
Exp: 12/10/13

#M11512 06/10/13 JSF Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11513 ~~05~~ 06 09 /10/13 JSF 6/10/13 JSF Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11514 06/10/13 JSF Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 11513) into 100ml = 3.0ug/L Hg

#M11515 06/10/13 JSF Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11516 06/10/13 JSF Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 11513) into 100ml = 0.2ug/L Hg

#M11517 06/10/13 JSF Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11518 06/10/13 JSF Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11075 in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11519 06/12/13 mos Pd/Mg Modifier – Into a 50mL vol. Flask, pipet 15mL #M11411 and 5mL #M10551. Bring up to volume with milli-Q $H_2O$.

#M11520 06/13/13 mos GFAA LOD/LOQ Soil Ag Spiking Sol'n: (1% $HNO_3$) exp 04/24/14
Into a 1L vol. Flask, pipet 10mL of #M11521 and bring up to volume w/ D.I. water.

#M11521 06/13/13 mos GFAA LOD/LOQ Soil Ag Working Std: (1% $HNO_3$) exp. 04/24/14
Into a 200mL vol. Flask, partially filled w/ D.I water, pipet the Following and bring up to volume w/ D.I $H_2O$.
0.12 mL Ag 1000mg/L (#M11170) = 600 ug/L Ag

#M11522 06/13/13 mos GFAA LOD/LOQ Water Working Std: (1% $HNO_3$)
Into a 100mL vol. Flask, partially Filled with D.I $H_2O$, pipet the Following + bring up to volume w/ D.I $H_2O$:
1.5mL Sb 1000mg/L (#M11172) = 15,000 ug/L Sb
1.0mL As 1000mg/L (#M11173) = 10,000 ug/L As
2.0mL Se 1000mg/L (#M11171) = 20,000 ug/L Se
0.045mL Pb 10,000 mg/L (#M10839) = 4500 ug/L Pb
0.4mL Tl 1000 mg/L (#M11361) = 4000 ug/L Tl
0.1mL Ag 1000 mg/L (#M11170) = 1000 ug/L Ag

#M11523 06/13/13 m

#M11524 06/13/13 L
Exp

#M11497 05/28/13 JSF TCLP Extraction Fluid #1: Fill a 20L Carboy w/ 19L D.I. H2O. Add 114mL Glacial Acetic Acid (AB.534) and 128.6mL 10N NaOH (#M11344). Dilute to 20L with D.I. H2O and mix. pH = 4.93 ± 0.05
Exp: 05/28/14

#M11498 05/31/13 JSF Potassium permanganate Soln: 50g potassium permanganate (#M11285) dissolve into 1,000mL of D.I. H2O.
Exp: ~~12/01/13~~ 11/30/13 JSF

| | | |
|---|---|---|
| #M11499 06/03/13 JSF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11500 06/03/13 JSF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M11501 06/03/13 JSF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 11500 ) into 100ml = 3.0ug/L Hg |
| #M11502 06/03/13 JSF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M11503 06/03/13 JSF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 11500) into 100ml = 0.2ug/L Hg |
| #M11504 06/03/13 JSF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M11505 06/03/13 JSF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11075) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M11506 06/04/13 MDS TCLP Extraction Fluid #1: Fill a 20L Carboy w/ 19L D.I H2O. Add 114mL Glacial/Acetic Acid ~~(AB.534)~~ (AB.565) 06/04/13 MDS and 128.6mL 10N NaOH ~~(#M11344)~~ (#M11469) MDS 06/04/13. Dilute to 20L w/ D.I H2O and mix. pH = 4.93 ± 0.05

#M11507 06/04/13 MDS 10N NaOH: Into a 1L Flask, add 400g NaOH (#M11145) and bring to volume w/ D.I H2O.

#M11508 06/04/13 MDS TCLP Extraction Fluid #1: Fill a 20L Carboy w/ 19L D.I H2O. Add 114mL Glacial Acetic Acid (AB.565) and add 128.6mL 10N NaOH (#M11469). Dilute to 20L w/ D.I H2O and mix. pH = 4.93 ± 0.05

#M11509 06/04/13 MDS TCLP Extraction Fluid #1: Fill a 20L Carboy w/ 19L D.I H2O. Add 114mL Glacial Acetic Acid (AB.565) and add 128.6mL 10N NaOH (#M11507). Dilute to 20L w/ D.I H2O and mix. pH = 4.93 ± 0.05

#M11510 06/07/13 JSF Potassium permanganate soln: 50g potassium permanganate (#M11785) dissolve into 1,000mL of D.I. H2O.
Exp: ~~6/07/14~~ 12/09/13 JSF

#M11483 05/17/13 SF Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11484 05/17/13 SF Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11485 05/17/13 SF Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 11484) into 100ml = 3.0ug/L Hg

#M11486 05/17/13 SF Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11487 05/17/13 SF Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 11484) into 100ml = 0.2ug/L Hg

#M11488 05/17/13 SF Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11489 05/17/13 SF Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11075) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11490 05/20/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy with 19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB534) and 128.6ml 10N NaOH (#M11344). Dilute to 20L with D.I. H2O and mix. pH = 4.93 ± 0.05
Exp: 05/20/14

#M11491 05/21/13 SF NaCl Hydroxylamine Sulfate Reagent: Dissolve 60g NaCl (#M9574) and 60g hydroxylamine sulfate (#M11039) in 500ml Milli-Q H2O.
Exp: 11/21/13

#M11492 05/28/13 SF Stannous chloride (Macron) - Lot #0000046028

#M11493 05/28/13 SF Sodium Chloride Fisher lot NO. 126180 f.w. 58.44

#M11494 05/28/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB534) and 128.6ml 10N NaOH (#M11344). Dilute to 20L with D.I. H2O and mix. pH = 4.93 ± 0.05
Exp: 05/28/14

#M11495 05/28/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB534) and 128.6ml 10N NaOH (#M11344). Dilute to 20L with D.I. H2O and mix. pH = 4.93 ± 0.05
Exp: 05/28/14

#M11496 05/28/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB534) and 128.6ml 10N NaOH (#M11344). Dilute to 20L with D.I. H2O and mix. pH = 4.93 ± 0.05
Exp: 05/28/13

#M11497 05/28/13 SF
#M11498 05/31/13 SF
#M11499 06/03/13 SF
#M11500 06/03/13 SF
#M11501 06/03/13 SF
#M11502 06/03/13 SF
#M11503 06/03/13 SF
#M11504 06/03/13 SF
#M11505 06/03/13 SF
#M11506 06/04/13 mos
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#M11508 06/04/13 mos
#M11509 06/04/13 mos
#M11510 06/07/13

#M11471

| | | | |
|---|---|---|---|
| 4ml Glacial #M11344). 4.93 ± 0.05 | 5-1-13 | Boron & Silicon ICV onto 200 ml vol flask piped 0.2 mls 1% HCl #M11205 & #M11356. Bring up to mark with DI $H_2O$. ex 5/14. | |
| 114ml Glacial (#M11344). 4.93 ± 0.05 | 5-1-13 #M11472 | ICSA List 2 Into 500 ml vol flask pipet 50mls #M11225 & 0.25 mls of #M11359, #M11362, #M11364, #M11056, #M11360 Bring up to mark with DI $H_2O$. ex 12/13 | |
| ganate ml of D.I. $H_2O$. | #M11473 05/09/13 SF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| | #M11474 05/09/13 SF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| | #M11475 05/09/13 SF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M11474) into 100ml = 3.0ug/L Hg |
| | #M11476 05/09/13 SF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| | #M11477 05/09/13 SF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 11474) into 100ml = 0.2ug/L Hg |
| | #M11478 05/09/13 SF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| : 554) (#M11675) in | #M11479 05/09/13 SF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11675) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M11480 05/10/13 SF Potassium Persulfate: 50g potassium persulfate (#M10573) dissolve into 1,000ml of D.I. $H_2O$. Exp: 11/10/13

05/10/13 SF

) and 60g 500ml Milli-Q $H_2O$

#M11481 05/13/13 SF Potassium permanganate soln: 50g potassium permanganate (#M9903) dissolve into 1,000ml of D.I. $H_2O$. Exp: 11/13/13

to volume with

#M11482 05/15/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. $H_2O$. Add 114ml Glacial Acetic Acid (AB.534) and 128.6ml 10N NaOH (#M11469). Dilute to 20L with D.I. $H_2O$ and mix. pH: 4.93 ± 0.05. Exp: 05/15/14

pipet 5mls DI $H_2O$. /2014

#M11458 04/24/13SF TCLP Extraction Fluid #1: Fill a 20L Carboy w/19L D.I. $H_2O$. Add 114ml Glacial Acetic Acid (AB.534) and 128.6mL 10N NaOH (#M11344).
Exp: 04/24/14 Dilute to 20L with D.I. $H_2O$ and mix. pH = 4.93 ± 0.05

#M11459 04/30/13SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. $H_2O$. Add 114mL Glacial Acetic Acid (AB.534) and 128.6mL 10N NaOH (#M11344).
Exp: 04/30/14 Dilute to 20L with D.I. $H_2O$ and mix. pH = 4.93 ± 0.05

#M11460 05/01/13SF 05/01/13SF Potassium permanganate soln: 50g potassium permanganate (#M9903) dissolve into 1000mL of D.I. $H_2O$.
Exp: 11/01/13

| | | |
|---|---|---|
| #M11461 05/01/13SF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11462 05/01/13SF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg |
| #M11463 05/01/13SF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M11462) into 100ml = 3.0ug/L Hg |
| #M11464 05/01/13SF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M11465 05/01/13SF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M11462) into 100ml = 0.2ug/L Hg |
| #M11466 05/01/13SF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M11467 05/01/13SF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M1675) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M11468 05/01/13SF NaCl Hydroxylamine Sulfate Reagent: Dissolve 60g NaCl (#M9903 9574 05/01/13SF) and 60g hydroxylamine sulfate (#M11039) in 500ml Milli-Q $H_2O$
Exp: 11/01/13

#M11469 05/03/13SF 10N NaOH: Into a 1L flask add 400g NaOH (#M11145) and bring up to volume with D.I. $H_2O$.
Exp: 11/03/13

#M11470 · 2A ICV Sodium & Potassium: Into a 500 ml vol flask piped 5mls of #M11243 & 5mls M11366 Bring up to mark with DI $H_2O$.
5-1-13
1% HNO3, 1% HCL
ex Jun/2014

#M11471
5-1-13 2A Boron
1% HCL
1% 5-7-13

5-1-13 2A
#M11472

#M11473 05/09/13SF

#M11474 05/09/13SF

#M11475 05/09/13SF

#M11476 05/09/13SF

#M11477 05/09/13SF

#M11478 05/09/13SF

#M11479 05/09/13SF

#M11480 05/10/13SF

#M11481 05/13/13S

#M11482 05/15/13SF
Exp:

(AB: 554)

de (#M 1675) in

xp: 04/01/14

: 04/01/14

pet
$H_2O$

Vol flask
ask DI DI

ask pipet
t with DI $H_2O$

#M11442 04/09/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB:534) and 128.6ml 10N NaOH (#M11344). Dilute to 20L with D.I. H2O and mix. pH = 4.93 ± 0.05
Exp: 04/09/14

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#M11443 04/12/13 SF
Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11444 04/12/13 SF
Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11445 04/12/13 SF
Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 11444 ) into 100ml = 3.0ug/L Hg

#M11446 04/12/13 SF
Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11447 04/12/13 SF
Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 11444 ) into 100ml = 0.2ug/L Hg

#M11448 04/12/13 SF
Hg Aqua Regia Reagent:
"Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11449 04/12/13 SF
Stannous Chloride Reagent:
Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 1165) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11450 04/12/13 SF Potassium permanganate Soln: 50g potassium permanganate (#M9903) dissolve into 1000ml of D.I. H2O.
Exp: 10/12/13

#M11451 04/22/13 SF
Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11452 04/22/13 SF
Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11453 04/22/13 SF
Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 11452 ) into 100ml = 3.0ug/L Hg

#M11454 04/22/13 SF
Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

IO3 (AB: 554)

nloride (#M 1675) in

#M11455 04/22/13 SF
Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 11452) into 100ml = 0.2ug/L Hg

#M11456 04/22/13 SF
Hg Aqua Regia Reagent:
"Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11457 04/22/13 SF
Stannous Chloride Reagent:
Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 1165) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11427 04/01/13SF — Hg MRL: (0.2% HNO3, HCl) — 0.2ml of 100ug/L Hg (#M11424) into 100ml = 0.2ug/L Hg

#M11428 04/01/13SF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11429 04/01/13SF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11675) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11430 04/01/13SF ~~CTT Spk~~ Custom Solution 04/01/13SF Inorganic Ventures lot# G2-MEB471044 Exp: 04/01/14

#M11431 04/01/13SF Custom Solution Inorganic Ventures lot#G2-MEB471043 Exp: 04/01/14

#M11432 04-02-13 GFAA Base Std. Into Liter Vol flask pipet 0.25 mls of #M11430 bring up to mark with DI $H_2O$. 7A 0.5% HNO3 ex 5/14.

#M11433 4-2-13 GFAA ICV (Alt Source). Into 1 Liter Vol flask pipet 1ml #M11431. Bring up to mark DI $H_2O$. 7A 0.5% HNO3 ex 5/14

#M11434 4-2-13 GFAA CCV - Into 1 Liter Vol flask pipet 0.1mls M11430. Bring up to mark with DI $H_2O$ 7A 0.5% HNO3 ex 5/14

#M11435 04/05/13SF — Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11436 04/05/13SF — Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11437 04/05/13SF — Hg ICV / LCSW (0.2% HNO3, HCl) — 3.0ml of 100ug/L Hg (#M11436) into 100ml = 3.0ug/L Hg

#M11438 04/05/13SF — Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11439 04/05/13SF — Hg MRL: (0.2% HNO3, HCl) — 0.2ml of 100ug/L Hg (#M11436) into 100ml = 0.2ug/L Hg

#M11440 04/05/13SF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11441 04/05/13SF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11675) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11442 04/09/13SF
Ex
#M11443 04/12/13SF
#M11444 04/12/13SF
#M11445 04/12/13SF
#M11446 04/12/13SF
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Ex
#M11451 04/22/13SF
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#M11456 04/22/13SF
#M11457 04/22/13SF

| | | |
|---|---|---|
| ~~#M 11413~~ 03/21/13SF #M11413 03/21/13SF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11414 03/21/13SF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M11415 03/21/13SF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 11414 ) into 100ml = 3.0ug/L Hg |
| #M11416 03/21/13SF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M11417 03/21/13SF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 11414 ) into 100ml = 0.2ug/L Hg |
| #M11418 03/21/13SF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M11419 03/21/13SF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11075) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M11420 03/25/13SF Potassium permanganate Soln: 50g Potassium permanganate (#M9963) dissolve into 1,000ml of D.I. H2O
Exp: 09/25/13

#M11421 03/29/13SF Potassium persulfate: 50g Potassium persulfate (#M10573) dissolve into 1,000mL D.I. H2O.
Exp: 09/29/13

#M11422 03/29/13SF NaCL Hydroxylamine Sulfate Reagent: Dissolve 60g NaCL (#M9574) and 60g hydroxylamine sulfate (#M11039) in 500mL Milli-Q H2O.
Exp: 09/29/13

| | | |
|---|---|---|
| #M11423 04/01/13SF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11424 04/01/13SF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M11425 04/01/13SF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 11424 ) into 100ml = 3.0ug/L Hg |
| #M11426 04/01/13SF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |

#M11398 03/15/13 SF Custom Assurance Standard. Spex Certiprep Lot# 1-222XL Exp: ~~03/14~~ 03/30/ 03/15/13 [redacted]
Cat#: XCTWI-5-500

#M11399 03/15/13 SF Interferents A Standard. Spex Certiprep Lot# 6-126YP Exp: 03/30/14 [redacted]

#M11400 03/15/13 SF Pb 1,000 mg/L Spex Certiprep Lot# 18-129PBY Exp: 03/30/14 [redacted]

#M11401 03/15/13 SF As 1,000 mg/L Spex Certiprep Lot# 18-131ASY Exp: 03/30/14 [redacted]

| | | |
|---|---|---|
| #M11402 03/18/13 SF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11403 03/18/13 SF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M11404 03/18/13 SF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 11403 ) into 100ml = 3.0ug/L Hg |
| #M11405 03/18/13 SF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M11406 03/18/13 SF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 11403 ) into 100ml = 0.2ug/L Hg |
| #M11407 03/18/13 SF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M11408 03/18/13 SF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11075) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M11409 03/19/13 SF Hg 1,000 mg/L CPI Lot# 12H328 Exp: 09/13/14

#M11410 3/21/13 JA ICV 2 ICPDOD Cal Into 1 Liter Vol flask pipet 5mls #M[redacted]
5% HCL & #M 11400. Bring up to Mark with DI $H_2O$. ex 3/1[redacted]
5% $HNO_3$ = 5000 ug/L As + Pb

#M11411 3-21-13 JA $PdNO_3$ Env Express Lot# 1234818 ex 3/14

#M11412 03/21/13 SF TCLP Extraction Fluid #1: Fill a 20L Carboy w/19L D.I. $H_2O$. Add 114mL Glacial Acet[redacted]
Acid (AB: 534) and 128.6mL 10N NaOH (#M11344). Dilute to 2[redacted]
with D.I. $H_2O$ and mix. pH=4.93 ± ~~0.5~~ 0.05 03/21/13 SF

#M11388 03/08/13 JF GFAA $H_2O$ LoQ Spiking Solution

Spiking Solution calc
Base SPIKE PREPARATION 50x Exp: 04/13

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag water | 0.4 | M11170 | 1000 | 0.02 |
| As water | 4 | M11173 | 1000 | 0.2 |
| Pb water | 1.8 | M10839 | 1000 | 0.09 |
| Sb water | 6 | M11172 | 1000 | 0.3 |
| Se water | 8 | M11171 | 1000 | 0.4 |
| Tl water | 1.6 | M10566 | 1000 | 0.08 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

#M11389 03/08/13 JF GFAA soil LoQ Spiking Solution

Spiking Solution calc
Base SPIKE PREPARATION 50x Exp: 4/13

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag soil | 0.48 | M11170 | 1000 | 0.024 |
| As soil | 6.4 | M11173 | 1000 | 0.32 |
| Pb soil | 1.6 | M10839 | 1000 | 0.08 |
| Sb soil | 2.4 | M11172 | 1000 | 0.12 |
| Se soil | 6.4 | M11171 | 1000 | 0.32 |
| Tl soil | 2 | M10566 | 1000 | 0.1 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

#M11390 03/11/13 JF — Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11391 03/11/13 JF — Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11392 03/11/13 JF — Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M ~~11312~~ 11391 03/11/13 JF) into 100ml = 3.0ug/L Hg

#M11393 03/11/13 JF — Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11394 03/11/13 JF — Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M ~~11312~~ 11391 03/11/13 JF) into 100ml = 0.2ug/L Hg

#M11395 03/11/13 JF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11396 03/11/13 JF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 10757) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11397 03/14/13 JF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. $H_2O$. Add 114ml Glacial Acetic Acid (AB.534) and 128.6ml 10N NaOH (#M11344). Dilute to 20L with D.I. $H_2O$ and mix. pH= 4.93 ± 0.05

Exp: 03/14/14

#M11381 03/04/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. $H_2O$. Add 114 ml Glacial Acetic Acid (AB.534) and 128.6 ml 10 N NaOH (#M11344). Dilute to 20L with D.I. $H_2O$ and mix. pH = 4.93 ± 0.05

Exp: 03/04/14

# M11382 Working Stds list 2. Into 4 200 ml vol flasks pipet

3-5-13

1% $HNO_3$

1% HCL

10 0.02 mls #M11203 & .002 mls #M11365

100 ug/L 0.2 mls #M11203 & .02 mls #M11365

1000 ug/L 2 mls #M11203 & .2 mls #M11365

10,000 ug/L 20 mls #M11203 & 2 mls M11365

Bring up to mark with DI $H_2O$ ex NOV 2013

# M11383 ICV L2 Into a 200 ml vol flask piped 0.2 mls of #M11356, #M11365, #M11359, #M11360 and #M11056

3-5-13

1% $HNO_3$

1% HCL

Bring up to mark with DI $H_2O$ 4-12/13

#M11384 03/07/13 SF LOD, LOQ check (3050) Into 1 liter volumetric flask pipet 1 ml M11343. Bring up to mark with D.I. $H_2O$ x50 dilution use 1 ml in 50 ~~~~ or 10 into 500 ml for = 240 ug/L or 6 mg/kg.

03/07/13 SF

Exp: 02/28/14

#M11385 03/07/13 SF LOD, LOQ check (300) $H_2O$. Into a 1 Liter volumetric flask pipet 1 ml M11343. Bring up to mark with D.I. $H_2O$ x50 dilution use 1 ml in 50 or 10 into 500 ml for = 240 ug/L or 6 mg/kg.

Exp: 02/28/14

#M11386 03/08/13 SF Hg $H_2O$ LOQ spiking Solution

Spiking Solution calc

Base SPIKE PREPARATION 50x

Exp: 04/13

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Hg water | 0.12 | M10563 | 1000 | 0.006 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

#M11387 03/08/13 SF Hg soil LOQ spiking solution

Spiking Solution calc

Base SPIKE PREPARATION 50x

Exp: 04/13

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Hg soil | 0.2 | M10563 | 1000 | 0.01 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

#M11368 02/26/13SF Fe 10,000mg/L CPI Lot# 13B029 Exp: 08/20/14

#M11369 02/28/13SF Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11370 02/28/13SF Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11371 02/28/13SF Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 11370) into 100ml = 3.0ug/L Hg

#M11372 02/28/13SF Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11373 02/28/13SF Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 11370) into 100ml = 0.2ug/L Hg

#M11374 02/28/13SF Hg Aqua Regia Reagent:
"Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11375 02/28/13SF Stannous Chloride Reagent:
Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M~~[illegible]~~) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11376 03/01/13SF (Fisher) Hydroxylamine Sulfate Lot#1164718A Exp: 03/01/14

M 11377 5 working stds. into 4 100 ml vol. flask pipet Respectively
7A 3-1-13 from #M 11343 10,000 mg/L S Spex Ceritprep Lot# AG14-125S 4 std
0.01 mls → = 1000 ug/L S
0.1 mls → = 10,000 ug/L S
1.0 mls → = 100,000 ug/L S
10 mls → = 1000 K ug/L S
Bring up + mark w/ DI H2O ex 2/14

#M11378 S ICV (Alt) into 1 100 vol flask pipet from #M10773
7A 3-1-13 7A Plasma Cal lot 5120116017 0.01 mls = 1000 ug/L S. ex 10/13
bring up to mark w/DI.

#M11379 03/04/13SF Stannous Chloride (Macron) - Lot #0000017703

M11380 3/4/13 7A ICV into 1 Liter Vol flask Piped 10 mls M11342, 2 mls #M11225,
0.5 mls #M11357. Bring up to mark with DI H2O. ex Nov. 2013.

#M11349 02/19/13 SF — Hg MRL: (0.2% HNO3, HCl) — 0.2ml of 100ug/L Hg (#M11346) into 100ml = 0.2ug/L Hg

#M11350 02/19/13 SF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11351 02/19/13 SF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11075) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11352 02/22/13 SF Potassium permanganate soln: 50g potassium permanganate (#M9903) dissolve into 1000mL of D.I. $H_2O$.
Exp: 08/22/13

#M11353 02/22/13 SF NaCl Hydroxylamine sulfate Reagent: Dissolve 60g NaCL (#M9574) and 60g hydroxylamine sulfate (#M11... in 500mL Milli-Q $H_2O$.
Exp: 08/22/13

#M11354 02/22/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. $H_2O$. Add 114mL Glacial Acetic Acid (AB.534) and 128.6mL 10N NaOH (#M11344). Dilute to 20L with D.I. $H_2O$ and mix.
Exp: 02/22/14
pH = 4.93 ± 0.05

#M11355 2-26-13 ~~CPI~~ Co 1000mg/L CPI Lot # 12H067 ex. 8/20/14
M

#M11356 02/26/13 SF Si 1000 mg/L CPI Lot#13A214 Exp: 08/20/14

#M11357 02/26/13 SF Mo 1000 mg/L CPI Lot#12K060 Exp: 08/20/14

#M11358 02/26/13 SF Ni 1000 mg/L CPI Lot#13A215 Exp: 08/20/14

#M11359 02/26/13 SF Sn 1000 mg/L CPI Lot#12I125 Exp: 08/20/14

#M11360 02/26/13 SF Sr 1000 mg/L CPI Lot#12L094 Exp: 08/20/14

#M11361 02/26/13 SF Tl 1000mg/L CPI Lot#12G229 Exp: 08/20/14

#M11362 02/26/13 SF Li 1000mg/L CPI Lot#12A008 Exp: 08/20/14

#M11363 02/26/13 SF Al 10,000mg/L CPI Lot#12K049 Exp: 08/20/14

#M11364 02/26/13 SF Ti 1000mg/L CPI Lot#12K061 Exp: 08/20/14

#M11365 02/26/13 SF W 1000mg/L CPI Lot#12H257 Exp: 08/20/14

#M11366 02/26/13 SF Na 10,000mg/L CPI Lot#13A194 Exp: 08/20/14

#M11367 02/26/13 SF Ca 10,000mg/L CPI Lot#12L059 Exp: 08/20/14

#M11336 02/07/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy with 19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB.534) and 128.6ml 10N NaOH (#M10910). Dilute to 20L with D.I. H2O and mix. pH = 4.93 ± 0.05
Exp: 02/07/14

#M11337 02/08/13 SF Potassium permanganate soln: 50g potassium permanganate (#M9905) dissolve into 1,000mL of D.I. H2O.
Exp: 08/08/13

#M11338 02/11/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy with 19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB534) and 128.6ml 10N NaOH (#M10910). Dilute to 20L with D.I. H2O and mix. pH = 4.93 ± 0.05
Exp: 02/11/14

#M11339 2-13-13 TCLP Extraction Fluid #1: fill a 20 Liter w 19L DI H2O, Add 114 ml Glacial Acetic Acid (AB-534) and 128.6 ml 10N NaOH (#M10910) Dilute to 20L with DI H2O & mix. pH = 4.93 ± .05 (exp 2-13-13)

#M11340 02/16/13 SF SPLP Extraction Fluid #1: Into a 20L carboy add D.I. H2O to mark and adjust pH to 4.20 ± 0.05 with M10857.
Exp: 08/16/13

#M11341 02/16/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy with 19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB.534) and 128.6ml 10N NaOH (#M10910). Dilute to 20L with D.I. H2O and mix. pH = 4.93 ± 0.05
Exp: 02/16/14

#M11342 2-18-13 Custom Assurance Std. Xspike-1-250 Spex Certiprep lot# 18-157CR.

#M11343 2-18-13 Sulfur 10,000mg/L Spex Certiprep Lot# A614-177 S

#M11344 02/18/13 SF 10N NaOH: Into a 1L flask add 400g NaOH (#M11145) and bring up to volume with D.I. H2O.
Exp: 08/18/13

#M11345 02/19/13 SF Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11346 02/19/13 SF Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L Into 100ml = 100ug/L Hg

#M11347 02/19/13 SF Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M11346) into 100ml = 3.0ug/L Hg

#M11348 02/19/13 SF Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11321 01/29/13SF — Hg ICV / LCSW (0.2% HNO3, HCl): 3.0ml of 100ug/L Hg (#M11320) into 100ml = 3.0ug/L Hg

#M11322 01/29/13SF — Hg CCV (0.2% HNO3, HCl):
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11323 01/29/13SF — Hg MRL: (0.2% HNO3, HCl): 0.2ml of 100ug/L Hg (#M11320) into 100ml = 0.2ug/L Hg

#M11324 01/29/13SF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11325 01/29/13SF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11045) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11326 01/30/13SF TCLP Extraction Fluid #1: Fill a 20L carboy w 19L D.I. H2O. Add 114mL Glacial Acetic Acid (AB 534) and 128.6mL 10N NaOH (#M10910). Dilute to 20L with D.I. H2O and mix. pH=4.93±0.05
Exp: 01/30/14

~~#M11327~~ #M11327 02/05/13SF 02/05/13SF 1N HCL for TCLP: Into a 1L vol. flask, partially filled with Milli-Q H2O, add 83mL of Conc. HCL (AB 561) and bring up to volume with Milli-Q H2O.
Exp: 02/05/14

#M11328 02/06/13SF — Hg Working Stds: (0.2% HNO3, HCl):
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11329 02/06/13SF — Hg Alt Source Working Std: (0.2% HNO3, HCl):
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11330 02/06/13SF — Hg ICV / LCSW (0.2% HNO3, HCl): 3.0ml of 100ug/L Hg (#M11329) into 100ml = 3.0ug/L Hg

#M11331 02/06/13SF — Hg CCV (0.2% HNO3, HCl):
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11332 02/06/13SF — Hg MRL: (0.2% HNO3, HCl): 0.2ml of 100ug/L Hg (#M11329) into 100ml = 0.2ug/L Hg

#M11333 02/06/13SF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11334 02/06/13SF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M11045) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11335 02/07/13SF NaCl Hydroxylamine Sulfate Reagent: Dissolve 60g NaCl (#M9574) and 60g hydroxylamine Sulfate (#M~~10216~~ M11039 02/13 SF) in 500mL Milli-Q H2O.
Exp: 08/07/13

#M11308 01/17/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB534) and 128.6ml 10N NaOH (#M11296). Exp: 01/17/14 Dilute to 20L with D.I. H2O and mix. pH = 4.93 ± 0.05

#M11309 01/21/13 SF TCLP Extraction Fluid #1: Fill a 20L carboy w/19L D.I. H2O. Add 114ml Glacial Acetic Acid (AB534) and 128.6ml 10N NaOH (#M11296). Exp: 01/21/14 Dilute to 20L with D.I. H2O and mix. pH = 4.93 ± 0.05

#M11310 1-22-13 Custom Assurance Standard Spex Certiprep Lot 18-068CR ex 1/14

| | | |
|---|---|---|
| #M11311 01/22/13 SF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11312 01/22/13 SF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |
| #M11313 01/22/13 SF | Hg ICV / LCSW (0.2% HNO3, HCl) | 3.0ml of 100ug/L Hg (#M 11312 ) into 100ml = 3.0ug/L Hg |
| #M11314 01/22/13 SF | Hg CCV (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg |
| #M11315 01/22/13 SF | Hg MRL: (0.2% HNO3, HCl) | 0.2ml of 100ug/L Hg (#M 11312 ) into 100ml = 0.2ug/L Hg |
| #M11316 01/22/13 SF | Hg Aqua Regia Reagent: | "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554) |
| #M11317 01/22/13 SF | Stannous Chloride Reagent: | Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11075) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water. |

#M11318 01/23/13 SF Potassium permanganate soln: 50g Potassium permanganate (#M9908) dissolve into 1,000mL of D.I. H2O. Exp: ~~01/23~~ 01/23/13 SF 07/23/13

| | | |
|---|---|---|
| #M11319 01/29/13 SF | Hg Working Stds: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg<br>1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg<br>0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg<br>1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg<br>2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg<br>4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg<br>5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg<br>10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg |
| #M11320 01/29/13 SF | Hg Alt Source Working Std: (0.2% HNO3, HCl) | 1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg<br>1.0ml of 10mg/L into 100ml = 100ug/L Hg |

114ml

H2O

2-4-13

#M11305 01/15/13SF

MDL Spiking soln all 50X into 1 liter vol flask pipet the following:

Bring up to volume with D.I. $H_2O$. Use 1ml into 50mls or 10mls into 500.

3050 MDL Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | MDL (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 5 | M11170 | 1000 | 0.25 |
| Al | 10 | M10670 | 10000 | 0.05 |
| As | 20 | M11173 | 1000 | 1 |
| Ba | 2 | M11052 | 1000 | 0.1 |
| Be | 0.5 | M11239 | 1000 | 0.025 |
| Ca | 50 | M10898 | 10000 | 0.25 |
| Cd | 0.5 | M11242 | 1000 | 0.025 |
| Co | 2.5 | M10561 | 1000 | 0.125 |
| Cr | 5 | M11053 | 10000 | 0.025 |
| Cu | 10 | M11051 | 10000 | 0.05 |
| Fe | 20 | M11228 | 10000 | 0.1 |
| Mg | 25 | M10668 | 10000 | 0.125 |
| Mn | 5 | M11054 | 10000 | 0.025 |
| Mo | 2.5 | M10560 | 1000 | 0.125 |
| Ni | 5 | M10565 | 1000 | 0.25 |
| Pb | 10 | M10839 | 10000 | 0.05 |
| Sb | 20 | M11172 | 1000 | 1 |
| Se | 20 | M11171 | 1000 | 1 |
| Tl | 20 | M10566 | 1000 | 1 |
| V | 5 | M11241 | 1000 | 0.25 |
| Zn | 5 | M11240 | 10000 | 0.025 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

EXPIRES 04/02/13

#M11306 01/15/13SF

MDL Spiking soln B, Si into 1L vol flask pipet the following:

Bring up to volume with D.I. $H_2O$. Use 1ml into 50mls or 10ml into 500mls.

3050 MDL Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | MDL (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| B | 20 | M11205 | 1000 | 1 |
| Si | 100 | M10860 | 1000 | 5 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

EXPIRES 04/02/13

#M11307 01/16/13SF TCLP Extraction Fluid #1: ~~Into~~ a 20L carboy w/19L D.I. $H_2O$. Add 114ml Glacial Acetic Acid (AB.534) and 128.6ml 10N NaOH (#M11796). Dilute to 20L with D.I. $H_2O$ and mix. pH=4.93 ± 0.05

Exp: 01/16/14

01/16/13SF

[illegible] 2/13

#M11292 01/07/13 LSF — Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11293 01/07/13 LSF — Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 11290 ) into 100ml = 0.2ug/L Hg

#M11294 01/07/13 LSF — Hg Aqua Regia Reagent:
"Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11295 01/07/13 LSF — Stannous Chloride Reagent:
Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11075) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11296 01/08/13 LSF 10N NaOH: Into a 1L flask add 400g NaOH (#M10571) and bring up to
Exp: 01/08/14 Volume with D.I. $H_2O$.

#M11297 01/10/13 LSF Potassium persulfate; 50g potassium persulfate (#M10573) dissolve into 1,000mL
Exp: 07/10/13 D.I. $H_2O$.

#M11298 01/11/13 LSF — Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11299 01/11/13 LSF — Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11300 01/11/13 LSF — Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 11299 ) into 100ml = 3.0ug/L Hg

#M11301 01/11/13 LSF — Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11302 ~~01/11~~ 01/11/13 LSF 01/11/13 LSF — Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 11299 ) into 100ml = 0.2ug/L Hg

#M11303 01/11/13 LSF — Hg Aqua Regia Reagent:
"Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11304 01/11/13 LSF — Stannous Chloride Reagent:
Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11075) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

2/28/13

#M11284 SA 1-4-13
5% HCL
5% HNO3

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Li | 14.4 | M10567 | 1000 | 0.72 |
| Sn | 20 | M10562 | 1000 | 1 |
| Sr | 3.2 | M10569 | 1000 | 0.16 |
| Tl | 9.6 | M10709 | 1000 | 0.48 |
| W | 24 | M10559 | 1000 | 1.2 |
| | | | | |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 4/13

01/04/13SF
~~#M11285 01/04/13SF Stannous Chloride (Macron) - Lot. No.~~

#M11285 Potassium permanganate (Fisher) - Lot. No. 123302
01/04/13SF

#M11286 01/07/13SF NaCl Hydroxylamine ~~Sulfate~~ Sulfate 01/07/13SF Reagent: Dissolve 60g NaCl (#M9574) and 60g hydroxylamine sulfate (#M10210) in 500mL Milli-Q H2O.
Exp: 07/07/13

## ICAP Working Standards Boron & Silicon

#M11287 SA 1-7-13

Standard name — Into 1 liter Pipet the following respectively:

| | |
|---|---|
| 50 | 0.5 mls of #M11203 and .05mls #M10860 = 50 ug/L |
| 2100 | 2 mls of #M11203 and 0.2mls #M10860 = 100 ug/L |
| 1000 | 10 mls of #M11203 and 1.0mls #M10860 = 1000 ug/L |
| 2000 | 20 mls of #M11203 and 2.0mls #M10860 = 1000 ug/L |
| 10000 | 100 mls of #M11203 and 10mls #M10860 = 10000 ug/L |

*SA 1-7-13 ex 12-13

#M11288 SA 1-7-13
Initial Calibration Standard (ICV) B, Si
Into 1 liter vol flsk pipet 1 ml of #M11205 & M10564 bring up to mark with DI H2O ex 4/13

#M11289 01/07/13SF
Hg Working Stds:
(0.2% HNO3, HCl)

1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11290 01/07/13SF
Hg Alt Source Working Std:
(0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11291 01/07/13SF
Hg ICV / LCSW
(0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M11290) into 100ml = 3.0ug/L Hg

SA 2/13

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#M11280 JT 1-4-13
5% HCL 5% $HNO_3$

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| K | 2640 | M11243 | 10000 | 13.2 |
| Na | 960 | M10570 | 10000 | 4.8 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 4/13

#M11281 JT 1-4-13
5% HCL, 5% HNO3

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| B | 52 | M11205 | 1000 | 2.6 |
| Si | 192 | M10564 | 1000 | 9.6 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 4/13

#M11282 JT 1-4-13
5% HCL, 5% $HNO_3$

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| B | 16 | M11205 | 1000 | 0.8 |
| Si | 200 | M10564 | 1000 | 10 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 13-Apr

#M11283 JT 1-4-13
5% HCL
5% HNO3

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Li | 10 | M10567 | 1000 | 0.5 |
| Sn | 10 | M10562 | 1000 | 0.5 |
| Sr | 2 | M10569 | 1000 | 0.1 |
| Tl | 8 | M10709 | 1000 | 0.4 |
| W | 36 | M10559 | 1000 | 1.8 |
| | | | | |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 13-Apr

2-4-13 JT

#M11278 1-4-13
5% HCL 5% HNO3

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 4 | M11170 | 1000 | 0.2 |
| Al | 38 | M11226 | 10000 | 0.18 |
| As | 24 | M11173 | 1000 | 1.2 |
| Ba | 1.8 | M11052 | 1000 | 0.09 |
| Be | 0.6 | M11239 | 1000 | 0.03 |
| Ca | 100 | M11227 | 10000 | 0.5 |
| Cd | 2 | M11242 | 1000 | 0.1 |
| Co | 4 | M10561 | 1000 | 0.2 |
| Cr | 4 | M11053 | 10000 | 0.02 |
| Cu | 7 | M11051 | 10000 | 0.035 |
| Fe | 100 | M11228 | 10000 | 0.5 |
| Mg | 40 | M11228 | 10000 | 0.2 |
| Mn | 4 | M11054 | 10000 | 0.02 |
| Mo | 7 | M10560 | 1000 | 0.35 |
| Ni | 6 | M10565 | 1000 | 0.3 |
| Pb | 4 | M10869 | 10000 | 0.02 |
| Sb | 12 | M11172 | 1000 | 0.6 |
| Se | 13 | M11171 | 1000 | 0.65 |
| Tl | 15 | M10566 | 1000 | 0.75 |
| V | 5 | M11241 | 1000 | 0.25 |
| Zn | 10 | M11240 | 10000 | 0.05 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 13-Apr

#M11279 1-4-13
5% HCL, 5% HNO3

3050 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 4 | M11170 | 1000 | 0.2 |
| Al | 9.6 | M11226 | 10000 | 0.048 |
| As | 32 | M11173 | 1000 | 1.6 |
| Ba | 2 | M11052 | 1000 | 0.1 |
| Be | 1.6 | M11239 | 1000 | 0.08 |
| Ca | 56 | M11227 | 10000 | 0.28 |
| Cd | 1.6 | M11242 | 1000 | 0.08 |
| Co | 9.6 | M10561 | 1000 | 0.48 |
| Cr | 5.6 | M11053 | 10000 | 0.028 |
| Cu | 16 | M11051 | 10000 | 0.08 |
| Fe | 72 | M11228 | 10000 | 0.36 |
| Mg | 32 | M11228 | 10000 | 0.16 |
| Mn | 6 | M11054 | 10000 | 0.03 |
| Mo | 9.6 | M10560 | 1000 | 0.48 |
| Ni | 4.8 | M10565 | 1000 | 0.24 |
| Pb | 10 | M10869 | 10000 | 0.05 |
| Sb | 32 | M11172 | 1000 | 1.6 |
| Se | 16 | M11171 | 1000 | 0.8 |
| Tl | 19 | M10566 | 1000 | 0.95 |
| V | 3.2 | M11241 | 1000 | 0.16 |
| Zn | 12 | M11240 | 10000 | 0.06 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 4/13

#M11268 [illegible]
1-2-13
ICV Na, K
5% HCL ~~5% HNO3~~
dissolved

Initial Calibration Standard (ICV) Into 500 ml volumetric pipette 5 mls of #M10570 and #M11243 and bring up to mark with DI H2O. expires april 2013.

#M11269 01/03/13 LSF — Hg Working Stds: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
0.5ml of 100ug/L Hg into 100ml = 0.5ug/L Hg
1.0ml of 100ug/L Hg into 100ml = 1.0ug/L Hg
2.0ml of 100ug/L Hg into 100ml = 2.0ug/L Hg
4.0ml of 100ug/L Hg into 100ml = 4.0ug/L Hg
5.0ml of 100ug/L Hg ino 100ml =5.0ug/L Hg
10.0ml of 100ug/L Hg into 100ml = 10.0ug/L Hg

#M11270 01/03/13 LSF — Hg Alt Source Working Std: (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M9063) into 100ml = 10mg/L Hg
1.0ml of 10mg/L into 100ml = 100ug/L Hg

#M11271 01/03/13 LSF — Hg ICV / LCSW (0.2% HNO3, HCl)
3.0ml of 100ug/L Hg (#M 11270 ) into 100ml = 3.0ug/L Hg

#M11272 01/03/13 LSF — Hg CCV (0.2% HNO3, HCl)
1.0ml of 1000mg/L Hg (#M10563) into 100ml=10mg/L Hg
1.0ml of 10mg/L Hg into 100ml = 100ug/L Hg
3.0ml of 100ug/L Hg into 100ml = 3.0ug/L Hg

#M11273 01/03/13 LSF — Hg MRL: (0.2% HNO3, HCl)
0.2ml of 100ug/L Hg (#M 11270 ) into 100ml = 0.2ug/L Hg

#M11274 01/03/13 LSF — Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11275 01/03/13 LSF — Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11075) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11276 01/03/13 LSF TCLP Extraction Fluid #1: 01/03/13 LSF Fill a 20L carboy w/19L D.I. H2O. ~~Into a 20L carboy add D.I. H2O.~~ Add 114mL Glacial Acetic Acid (AB:534) and 128.6mL 10N NaOH (#M10910). Dilute to 20L with D.I. H2O and mix. pH=4.93 ± 0.05
Exp: 01/03/14

#M11277 1-4-13 [illegible]
5% HCL, 5% HNO3

3010 LOQ Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | LOQ (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| K | 500 | M11243 | 10000 | 2.5 |
| Na | 600 | M10570 | 10000 | 3 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard.

Expires: 13-Apr

[illegible] 2-1-13

#M11263 12/27/12 15F Hg Aqua Regia Reagent: "Carefully" in hood, mix 3 parts HCl (AB: 553) with 1part HNO3 (AB: 554)

#M11264 12/27/12 13F Stannous Chloride Reagent: Into a 1000 mL volumetric flask, dissolve 100g Stannous Chloride (#M 11065) in 70 mL HCl (AB: 553). Bring up to volume with D.I. Water.

#M11265 12/28/12 13F Potassium Permanganate Soln: 50g potassium permanganate (#M9703) dissolved into 1,000mL of D.I. $H_2O$.
Exp: 06/28/13

#M11266 1-2-13
2a
0% $HNO_3$
5% HCL

MRL Spiking Solution
Base SPIKE PREPARATION 50x

Into a 1000 mL Volumetric Flask, pipet the following:

| Analyte | MRL (ug/L) | Std ID # | Std Conc (mg/L) | Amount (mL) to pipet into 1 L |
|---|---|---|---|---|
| Ag | 20 | M11170 | 1000 | 1 |
| Al | 400 | M11228 | 10000 | 2 |
| Ba | 10 | M11052 | 1000 | 0.5 |
| Be | 4 | M11239 | 1000 | 0.2 |
| Cd | 5 | M11242 | 1000 | 0.25 |
| Co | 10 | M10561 | 1000 | 0.5 |
| Cr | 10 | M11053 | 10000 | 0.05 |
| Cu | 10 | M11051 | 10000 | 0.05 |
| Mg | 500 | M11228 | 10000 | 2.5 |
| Mn | 10 | M11054 | 10000 | 0.05 |
| Mo | 10 | M10560 | 1000 | 0.5 |
| Ni | 10 | M10565 | 1000 | 0.5 |
| Pb | 10 | M10839 | 10000 | 0.05 |
| Sb | 20 | M11172 | 1000 | 1 |
| V | 10 | M11241 | 1000 | 0.5 |
| Zn | 10 | M11240 | 10000 | 0.05 |
| K | 5000 | M11243 | 10000 | 25 |
| Na | 1000 | M10570 | 10000 | 5 |
| As | 20 | M11173 | 1000 | 1 |
| Ca | 500 | M11227 | 10000 | 2.5 |
| Fe | 300 | M11228 | 10000 | 1.5 |
| Se | 20 | M11171 | 1000 | 1 |
| Tl | 20 | M10566 | 1000 | 1 |
| Si | 100 | M10564 | 1000 | 5 |
| B | 20 | M11205 | 1000 | 1 |
| Li | 20 | M10567 | 1000 | 1 |
| W | 50 | M10559 | 1000 | 2.5 |
| Ti | 10 | M10709 | 1000 | 0.5 |
| Sr | 10 | M10569 | 1000 | 0.5 |
| Sn | 50 | M10562 | 1000 | 2.5 |
| S | 100 | M10773 | 1000 | 5 |

Of this Base standard, pipet 10 mls into 500 ml volumetric to create a working std or 1 ml into 50 ml digestion tube for a digested working standard. EX 4-13

#M11267 1-2-13 NaK working stds
2A

Working Standards for Sodium and Potassium; into seven, 200 ml volumetric flasks pipette from #M11245 and #M11244.

For the 0.5 mg/L std– 0.1 mls of each
1.0 mg/L std – 0.2 mls of each
5.0 mg/L std – 1.0 mls of each
10.0 mg/L std – 2.0 mls of each
50.0 mg/L std - 10.0 mls of each
100 mg/L std -20.0 mls each also used for Continuing Calibration Standard (CCV)
200 mg/L std -40.0 mls of each
Bring up to mark with DI H2O. Expires June 5 2014.

JS 2013

# INORGANIC
# CLP FORMS
# DOCUMENTS

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

1

***INORGANIC ANALYSIS DATA SHEET***

**DUP-SW**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595906 |
| Analytical Method: | EPA 9040C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115827 | Analysis Date/Time | 06/16/2015 10:00 |
| Analytical Prep Batch #: | | Prep. Date/Time: | |
| ICAL Calibration #: | | Concentration Units: | S.U. |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| PH | pH | 7.77 | | | | | |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**DUP-SW**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595906 |
| Analytical Method: | EPA 310.2 | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115996 | Analysis Date/Time | 06/22/2015 14:25 |
| Analytical Prep Batch #: | | Prep. Date/Time: | |
| ICAL Calibration #: | 06222015 | Concentration Units: | mg/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| ALK | Alkalinity | 40 | | 6.0 | 15 | 30 | 30 |

CT LABORATORIES
delivering more than data from your environmental analyses

1

***INORGANIC ANALYSIS DATA SHEET***

Sample Description

**G-21**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SOIL | SDG No.: | 111888 |
| % Solids: | 91.0 | Lab Sample ID: | 595910 |
| Analytical Method: | EPA 8000C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115862 | Analysis Date/Time | 06/17/2015 09:24 |
| Analytical Prep Batch #: | | Prep. Date/Time: | |
| ICAL Calibration #: | | Concentration Units: | % |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| SOLID | Solids, Percent | 91.0 | | 0.1 | 0.1 | 0.1 | 0.1 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**G-22**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SOIL | SDG No.: | 111888 |
| % Solids: | 87.3 | Lab Sample ID: | 595912 |
| Analytical Method: | EPA 8000C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115862 | Analysis Date/Time | 06/17/2015 09:24 |
| Analytical Prep Batch #: | | Prep. Date/Time: | |
| ICAL Calibration #: | | Concentration Units: | % |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| SOLID | Solids, Percent | 87.3 | | 0.1 | 0.1 | 0.1 | 0.1 |

CT LABORATORIES
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Sample Description

1

***INORGANIC ANALYSIS DATA SHEET***

**G-25**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SOIL | SDG No.: | 111888 |
| % Solids: | 95.1 | Lab Sample ID: | 595908 |
| Analytical Method: | EPA 8000C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115862 | Analysis Date/Time | 06/17/2015 09:24 |
| Analytical Prep Batch #: | | Prep. Date/Time: | |
| ICAL Calibration #: | | Concentration Units: | % |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| SOLID | Solids, Percent | 95.1 | | 0.1 | 0.1 | 0.1 | 0.1 |

CT LABORATORIES
delivering more than data from your environmental analyses

1

***INORGANIC ANALYSIS DATA SHEET***

Sample Description

**G-26**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SOIL | SDG No.: | 111888 |
| % Solids: | 85.6 | Lab Sample ID: | 595914 |
| Analytical Method: | EPA 8000C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115862 | Analysis Date/Time | 06/17/2015 09:24 |
| Analytical Prep Batch #: | | Prep. Date/Time: | |
| ICAL Calibration #: | | Concentration Units: | % |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| SOLID | Solids, Percent | 85.6 | | 0.1 | 0.1 | 0.1 | 0.1 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-1**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595902 |
| Analytical Method: | EPA 9040C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115827 | Analysis Date/Time | 06/16/2015 10:00 |
| Analytical Prep Batch #: | | Prep. Date/Time: | |
| ICAL Calibration #: | | Concentration Units: | S.U. |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| PH | pH | 7.79 | | | | | |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-1**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595902 |
| Analytical Method: | EPA 310.2 | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115996 | Analysis Date/Time | 06/22/2015 14:16 |
| Analytical Prep Batch #: | | Prep. Date/Time: | |
| ICAL Calibration #: | 06222015 | Concentration Units: | mg/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| ALK | Alkalinity | 41 | | 6.0 | 15 | 30 | 30 |

CT LABORATORIES
delivering more than data from your environmental analyses

1

*INORGANIC ANALYSIS DATA SHEET*

Sample Description

**SW-2**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595903 |
| Analytical Method: | EPA 9040C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115827 | Analysis Date/Time | 06/16/2015 10:00 |
| Analytical Prep Batch #: | | Prep. Date/Time: | |
| ICAL Calibration #: | | Concentration Units: | S.U. |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| PH | pH | 7.79 | | | | | |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-2**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595903 |
| Analytical Method: | EPA 310.2 | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115996 | Analysis Date/Time | 06/22/2015 14:17 |
| Analytical Prep Batch #: | | Prep. Date/Time: | |
| ICAL Calibration #: | 06222015 | Concentration Units: | mg/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| ALK | Alkalinity | 41 | M | 6.0 | 15 | 30 | 30 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-3**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595904 |
| Analytical Method: | EPA 9040C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115827 | Analysis Date/Time | 06/16/2015 10:00 |
| Analytical Prep Batch #: | | Prep. Date/Time: | |
| ICAL Calibration #: | | Concentration Units: | S.U. |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| PH | pH | 7.81 | | | | | |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-3**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595904 |
| Analytical Method: | EPA 310.2 | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115996 | Analysis Date/Time | 06/22/2015 14:21 |
| Analytical Prep Batch #: | | Prep. Date/Time: | |
| ICAL Calibration #: | 06222015 | Concentration Units: | mg/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| ALK | Alkalinity | 43 | | 6.0 | 15 | 30 | 30 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-4**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595905 |
| Analytical Method: | EPA 9040C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115827 | Analysis Date/Time | 06/16/2015 10:00 |
| Analytical Prep Batch #: | | Prep. Date/Time: | |
| ICAL Calibration #: | | Concentration Units: | S.U. |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| PH | pH | 7.78 | | | | | |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-4**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595905 |
| Analytical Method: | EPA 310.2 | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115996 | Analysis Date/Time | 06/22/2015 14:22 |
| Analytical Prep Batch #: | | Prep. Date/Time: | |
| ICAL Calibration #: | 06222015 | Concentration Units: | mg/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| ALK | Alkalinity | 44 | | 6.0 | 15 | 30 | 30 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-5**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595907 |
| Analytical Method: | EPA 9040C | Date Received: | 06/15/2015 |
| Dilution Factor: | 1 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115827 | Analysis Date/Time | 06/16/2015 10:00 |
| Analytical Prep Batch #: | | Prep. Date/Time: | |
| ICAL Calibration #: | | Concentration Units: | S.U. |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| PH | pH | 7.77 | | | | | |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-5**

**1**

***INORGANIC ANALYSIS DATA SHEET***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix (soil/water): | SURFACE WATER | SDG No.: | 111888 |
| % Solids: | | Lab Sample ID: | 595907 |
| Analytical Method: | EPA 310.2 | Date Received: | 06/15/2015 |
| Dilution Factor: | 1.00 | TCLP/SPLP Extraction Date/time: | |
| Analytical Run #: | 115996 | Analysis Date/Time | 06/22/2015 14:27 |
| Analytical Prep Batch #: | | Prep. Date/Time: | |
| ICAL Calibration #: | 06222015 | Concentration Units: | mg/L |

| CAS # | Analyte | Concentration | Qualifiers | DL | LOD | LOQ | RL |
|---|---|---|---|---|---|---|---|
| ALK | Alkalinity | 42 | | 6.0 | 15 | 30 | 30 |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**ICV**

**2A-1**

***INITIAL CALIBRATION VERIFICATION***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115996

Lab Sample ID: 599016

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Alkalinity | 6/22/15 | 13:20 | 75.00 | 78.80 | 105 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115996

Lab Sample ID: 598961

ICAL Calibration #: 06222015

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | | Spiked Conc. | Measured Conc. | %R** | Lower Limit (1) | Upper Limit (1) |
|---|---|---|---|---|---|---|---|
| Alkalinity | 6/22/15 | 14:11 | 375.0 | 374.0 | 100 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115996

Lab Sample ID: 598966

ICAL Calibration #: 06222015

Concentration Units: mg/L

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | | **Spiked Conc.** | **Measured Conc.** | **%R**** | **Lower Limit (1)** | **Upper Limit (1)** |
|---|---|---|---|---|---|---|---|
| Alkalinity | 6/22/15 | 14:23 | 375.0 | 373.0 | 99 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No.

**CCV**

**2A-2**

***CONTINUING CALIBRATION VERIFICATION***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115996

Lab Sample ID: 598968

ICAL Calibration #: 06222015

Concentration Units: mg/L

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | | **Spiked Conc.** | **Measured Conc.** | **%R**** | **Lower Limit (1)** | **Upper Limit (1)** |
|---|---|---|---|---|---|---|---|
| Alkalinity | 6/22/15 | 14:36 | 375.0 | 376.0 | 100 | 90 | 110 |

Default Limits (not applicable to MDL Check) **No percent recovery is calculated for MDL checks. The check is simply whether the analyte is detected.

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**ICB**

**3-1**

***INITIAL CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115996

Lab Sample ID: 599017

Analytical Prep Batch #

Preparation Date/Time:

ICAL Calibration #:

Concentration Units: mg/L

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | **Measured Concentration** | **C*** ** | **Detection Limit**** | **Control Limit** |
|---|---|---|---|---|---|
| Alkalinity | 06/22/2015 13:21 | 2.900 | | | 15 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**CCB**

**3-2**

***CONTINUING CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115996

Lab Sample ID: 598962

Analytical Prep Batch # 0

Preparation Date/Time:

ICAL Calibration #: 06222015

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit |
|---|---|---|---|---|---|
| Alkalinity | 06/22/2015 14:12 | 0 | | | 15 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**CCB**

**3-2**

***CONTINUING CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115996

Lab Sample ID: 598967

Analytical Prep Batch # 0

Preparation Date/Time:

ICAL Calibration #: 06222015

Concentration Units: mg/L

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | **Measured Concentration** | **C*** ** | **Detection Limit** ** | **Control Limit** |
|---|---|---|---|---|---|
| Alkalinity | 06/22/2015 14:24 | 0 | | | 15 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was
less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**CCB**

**3-2**

***CONTINUING CALIBRATION BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115996

Lab Sample ID: 598969

Analytical Prep Batch # 0

Preparation Date/Time:

ICAL Calibration #: 06222015

Concentration Units: mg/L

Analysis Type: Initial Analysis

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit |
|---|---|---|---|---|---|
| Alkalinity | 06/22/2015 14:37 | 0 | | | 15 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample No

**MB**

**3-3**

***METHOD BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115996

Lab Sample ID: 598641

Analytical Prep Batch #

Preparation Date/Time:

ICAL Calibration #: 06222015

Concentration Units: mg/L

Analysis Type: Initial Analysis

| **Analyte** | **Analysis Date/Time** | **Measured Concentration** | **C*** ** | **Detection Limit**** | **Control Limit** |
|---|---|---|---|---|---|
| Alkalinity | 06/22/2015 14:15 | 0.2110 | U | 6 | 15 |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was less.

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-2**

**5A**

***SPIKE SAMPLE RECOVERY***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solids for Sample: | | Concentration Units: | mg/L |
| Sample No | 598964 | Parent Sample No.: | 595903 |
| Analytical Prep Batch # | 0 | Analytical Preparation Date/Time: | |
| Analytical Run #: | 115996 | ICAL Calibration #: | 06222015 |

Analysis Type *Initial Analysis* Analysis Date: ----- 06/22/2015 Analysis Time: -------- 14:19

| Analyte | Control Limit (%R) | Spike Result | C (Spike) | Parent Result | C (Parent) | Spike Amount | %R | Q | M | |
|---|---|---|---|---|---|---|---|---|---|---|
| Alkalinity | 92-107 | 164 | | 41 | | 100 | 123 | | AS | *FAIL* |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-2**

**5C**

***SPIKE DUPLICATE SAMPLE RECOVERY***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solids for Sample: | | Concentration Units: | mg/L |
| Sample No | 598965 | Parent Sample No.: | 598964 |
| Analytical Prep Batch # | 0 | Analytical Preparation Date/Time: | |
| Analytical Run #: | 115996 | ICAL Calibration #: | 06222015 |

| Analysis Type | *Initial Analysis* | Analysis Date: ----- | 06/22/2015 | Analysis Time: -------- | 14:20 |
|---|---|---|---|---|---|

| **Analyte** | **Control Limit (%R)** | **Spike Result** | **C (Spike)** | **Parent Result** | **C (Parent)** | **Spike Amount** | **%R** | **Q** | **M** | |
|---|---|---|---|---|---|---|---|---|---|---|
| Alkalinity | 92-107 | 159 | | 41 | | 100 | 118 | | AS | *FAIL* |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-5**

**6**

***DUPLICATES***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solid for Sample: | | Concentration Units: | S.U. |
| Analytical Prep Batch # | 1 | Analytical Preparation Date/Time | |
| Analytical Run #: | 115827 | ICAL Calibration #: | |
| Sample #: | 596338 | Parent Sample #: | 595907 |

Analysis Type *Initial Analysis*

| **Analyte** | **Analysis Date/Tim** | | **RPD Limit** | **Original Parent Conc. (S)** | **C** | **Duplicate Conc. (D)** | **C** | **RPD** | **Q** | **M** |
|---|---|---|---|---|---|---|---|---|---|---|
| pH | 06/16/2015 | 10:00 | 1 | 7.77 | | 7.78 | | 0 | | ELEC |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**G-26**

**6**

***DUPLICATES***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | SOLID | SDG No.: | 111888 |
| % Solid for Sample: | 85.6 | Concentration Units: | % |
| Analytical Prep Batch # | 1 | Analytical Preparation Date/Time | 0 |
| Analytical Run #: | 115862 | ICAL Calibration #: | |
| Sample #: | 597684 | Parent Sample #: | 595914 |

Analysis Type *Initial Analysis*

| Analyte | Analysis Date/Tim | | RPD Limit | Original Parent Conc. (S) | C | Duplicate Conc. (D) | C | RPD | Q | M |
|---|---|---|---|---|---|---|---|---|---|---|
| Solids, Percent | 06/17/2015 | 09:24 | 8 | 85.6 | | 82.3 | | 4 | | GRA |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-2**

**6**

***DUPLICATES***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

Matrix: LIQUID

SDG No.: 111888

% Solid for Sample:

Concentration Units: mg/L

Analytical Prep Batch # 1

Analytical Preparation Date/Time 0

Analytical Run #: 115996

ICAL Calibration #: 06222015

Sample #: 598963

Parent Sample #: 595903

Analysis Type *Initial Analysis*

| Analyte | Analysis Date/Tim | | RPD Limit | Original Parent Conc. (S) | C | Duplicate Conc. (D) | C | RPD | Q | M |
|---|---|---|---|---|---|---|---|---|---|---|
| Alkalinity | 06/22/2015 | 14:18 | 20 | 41 | | 41.6 | | 1 | | AS |

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**SW-2**

**6A**

***MATRIX SPIKE DUPLICATES***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solid for Sample: | | Concentration Units: | mg/L |
| Analytical Prep Batch # | 0 | Analytical Preparation Date/Time | |
| Analytical Run #: | 115996 | ICAL Calibration #: | 06222015 |
| Sample #: | 598965 | Parent Sample #: | 598964 |

Analysis Type *Initial Analysis*

| **Analyte** | **Analysis Date/Tim** | | **RPD Limit** | **Matrix Spik Parent Conc. (S)** | **C** | **Matrix Spike Duplicate Conc. (D)** | **C** | **RPD** | **Q** | **M** |
|---|---|---|---|---|---|---|---|---|---|---|
| Alkalinity | 06/22/2015 | 14:20 | 20 | 164 | | 159 | | 3 | | AS |

CT LABORATORIES
delivering more than data from your environmental analyses

**7-1**

***LABORATORY CONTROL SAMPLE - AQUEOUS***

Sample No:

**LCS**

Lab Name: CT Laboratories

Contract AECOM-GULL ROCK

LCS Source: SPEX and Ultra

SDG No.: 111888

Concentration Units: mg/L

Analytical Run #: 115996

Sample No.:#: 598640

Analytical Prep Batch #:

Preparation Date/Time:

ICAL Calibration #: 06222015

Analysis Type ------------ Initial Analysis

| Analyte | Analysis Date/Time | Control Limit (%R) | Spike Result | C | Spike Amount | %R | Q | M |
|---|---|---|---|---|---|---|---|---|
| Alkalinity | 06/22/2015 14:14 | 92-107 | 381.0 | | 375.0 | 102 | | AS |

# INORGANICS RAW DATA DOCUMENTS

**Creator :** lachat
**Creation Date :** 08/21/2012 13:14:46
**Last Modified :** 06/15/2015 12:41:39
**Description :**

| Cup | Sample ID | MDF | Weight | Sample Type | Comments |
|---|---|---|---|---|---|
| S1 | STD A 750 | | | Calibration Standard | |
| S2 | STD B 625 | | | Calibration Standard | |
| S3 | STD C 500 | | | Calibration Standard | |
| S4 | STD D 375 | | | Calibration Standard | |
| S5 | STD E250 | | | Calibration Standard | |
| S6 | STD F 125 | | | Calibration Standard | |
| S7 | STD G 75 | | | Calibration Standard | |
| S8 | STD H 25 | | | Calibration Standard | |
| S9 | STD I 0 | | | Calibration Standard | |
| S10 | ICV | | | Check Standard | |
| S9 | ICB | | | Check Standard | < 5.0 mg/L |
| S3 | STD 500 | | | Check Standard | |
| S4 | CCV | | | Check Standard | |
| S11 | 598636 | | | Check Standard | |
| S9 | 598637 | | | Check Standard | |
| 1 | 577883 | | | Unknown | |
| 2 | 577884 | | | Unknown | |
| 3 | 577886 | | | Unknown | |
| 4 | 577887 | | | Unknown | |
| 5 | 593975 | | | Unknown | |
| 6 | 593976 | | | Unknown | |
| 7 | 593977 | | | Unknown | |
| 8 | 593979 | | | Unknown | |
| S4 | CCV | | | Check Standard | |
| S9 | CCB/MBW | | | Check Standard | |
| 9 | 593980 | | | Unknown | |
| 10 | 593981 | | | Unknown | |
| 11 | 593984 | | | Unknown | |
| 12 | 593985 | | | Unknown | |
| 13 | 593986 | | | Unknown | |
| 14 | 593987 | | | Unknown | |
| 15 | 593988 | | | Unknown | |
| 16 | 593989 | | | Unknown | |
| 17 | 597066 | | | Unknown | |
| 18 | 597067 | | | Unknown | |
| S4 | CCV | | | Check Standard | |
| S9 | CCB/MBW | | | Check Standard | |
| 19 | DUP597067 | | | Unknown | |
| 20 | 597069 | | | Unknown | |
| 21 | 597070 | | | Unknown | |

| | | | | | | |
|---|---|---|---|---|---|---|
| S11 | 598638 | | | Check Standard | | |
| S9 | 598639 | | | Check Standard | | |
| 22 | 597071 | | | Unknown | | |
| 23 | DUP597071 | | | Unknown | | |
| 24 | 597072 | | | Unknown | | |
| 25 | 597073 | | | Unknown | | |
| 26 | 597074 | | | Unknown | | |
| S4 | CCV | | | Check Standard | | |
| S9 | CCB/MBW | | | Check Standard | | |
| 27 | 597075 | | | Unknown | | |
| 28 | 597076 | | | Unknown | | |
| 29 | 597077 | | | Unknown | | |
| 30 | 597078 | | | Unknown | | |
| 31 | 597079 | | | Unknown | | |
| 32 | 597080 | | | Unknown | | |
| 33 | 597081 | | | Unknown | | |
| 34 | 597082 | | | Unknown | | |
| 35 | 597083 | | | Unknown | | |
| 36 | 597084 | | | Unknown | | |
| S4 | CCV | | | Check Standard | | |
| S9 | CCB/MBW | | | Check Standard | | |
| 37 | 597085 | | | Unknown | | |
| S11 | 598640 598642 598644 | | | Check Standard | | |
| S9 | 598641 598643 598645 | | | Check Standard | | |
| 38 | 595902 | | | Unknown | | |
| 39 | 595903 | | | Unknown | | |
| 40 | DUP595903 | | | Unknown | | |
| 41 | MSW595903 | | | Unknown | | |
| 42 | MSDW595903 | | | Unknown | | |
| 43 | 595904 | | | Unknown | | |
| 44 | 595905 | | | Unknown | | |
| S4 | CCV | | | Check Standard | | |
| S9 | CCB/MBW | | | Check Standard | | |
| 45 | 595906 | | | Unknown | | |
| 46 | 595907 | | | Unknown | | |
| 47 | 597516 | | | Unknown | | |
| 48 | DUP597516 | | | Unknown | | |
| 49 | MSW597516 | | | Unknown | | |
| 50 | MSDW597516 | | | Unknown | | |
| 51 | 597730 | | | Unknown | | |
| 52 | DUP597730 | | | Unknown | | |
| 53 | MSW597730 | | | Unknown | | |
| 54 | MSDW597730 | | | Unknown | | |
| S4 | CCV | | | Check Standard | | |
| S9 | CCB/MBW | | | Check Standard | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 55 | 597731 | | | Unknown | | |
| S4 | CCV | | | Check Standard | | |
| S9 | CCB/MBW | | | Check Standard | | |

| Analyte Table | Alkalinity |
|---|---|
| | (mg/L) |
| **STD A 750** | 750 |
| **STD B 625** | 625 |
| **STD C 500** | 500 |
| **STD D 375** | 375 |
| **STD E250** | 250 |
| **STD F 125** | 125 |
| **STD G 75** | 75.0 |
| **STD H 25** | 25.0 |
| **STD I 0** | 0.00 |

Author: lachat

Date : 06/22/2015

Original Run Filename: OM_06-22-2015_13-08-30.OMN Created: 06/22/2015 13:08:30
Original Run Author's Signature [lachat]
Current Run Filename: OM_06-22-2015_13-08-30.OMN Last Modified: 06/22/2015 14:43:40
Current Run Author's Signature: [lachat]
Description:

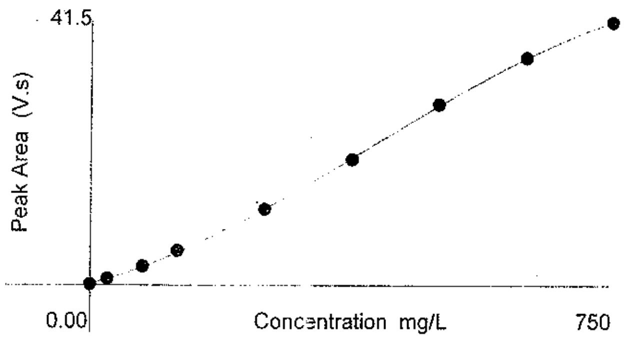
| Sample | Rep. | Cup No. | Channel 1 Alkalinity Conc. (mg/L) | Area (V.s) | Detection Time | ADF | MDF |
|---|---|---|---|---|---|---|---|
| STD A 750 | 1 | S1 | 750 | 41.5 | 06/22/2015@13:11:17 | | |
| STD B 625 | 1 | S2 | 625 | 35.9 | 06/22/2015@13:12:19 | | |
| STD C 500 | 1 | S3 | 500 | 28.6 | 06/22/2015@13:13:21 | | |
| STD D 375 | 1 | S4 | 375 | 19.9 | 06/22/2015@13:14:22 | | |
| STD E250 | 1 | S5 | 250 | 12.0 | 06/22/2015@13:15:26 | | |
| STD F 125 | 1 | S6 | 125 | 5.39 | 06/22/2015@13:16:28 | | |
| STD G 75 | 1 | S7 | 75.0 | 2.94 | 06/22/2015@13:17:32 | | |
| STD H 25 | 1 | S8 | 25.0 | 1.03 | 06/22/2015@13:18:36 | | |
| STD I 0 | 1 | S9 | 0.00 | 0.101 | 06/22/2015@13:19:36 | | |
| ICV | 1 | S10 | 78.8 | 3.23 | 06/22/2015@13:20:37 | | |
| | Known Conc: | | 75.0 | | | | |
| | Calibration: | | Table/Fig. : 1 | | | | |
| ICB | 1 | S9 | 2.90 | 0.180 | 06/22/2015@13:21:38 | | |
| | Known Conc: | | 0.00 | | | | |
| STD 500 | 1 | S3 | 502 | 28.7 | 06/22/2015@13:22:38 | | |
| | Known Conc: | | 500 | | | | |
| CCV | 1 | S4 | 375 | 20.0 | 06/22/2015@13:23:40 | | |
| | Known Conc: | | 375 | | | | |
| 598636 | 1 | S11 | 379 | 20.4 | 06/22/2015@13:24:42 | | |
| | Known Conc: | | 375 | | | | |
| 598637 | 1 | S9 | -0.615 | 0.0481 | 06/22/2015@13:25:44 | | |
| | Known Conc: | | 0.00 | | | | |
| 577883 | 1 | 1 | 1.55 | 0.129 | 06/22/2015@13:26:48 | | |
| 577884 | 1 | 2 | -0.806 | 0.0409 | 06/22/2015@13:27:49 | | |
| 577886 | 1 | 3 | -0.822 | 0.0403 | 06/22/2015@13:28:50 | | |
| 577887 | 1 | 4 | 1.58 | 0.130 | 06/22/2015@13:29:51 | | |
| 593975 | 1 | 5 | -1.46 | 0.0163 | 06/22/2015@13:30:54 | | |
| 593976 | 1 | 6 | -1.69 | 8.00e-3 | 06/22/2015@13:31:55 | | |
| 593977 | 1 | 7 | -0.305 | 0.0597 | 06/22/2015@13:32:56 | | |
| 593979 | 1 | 8 | -0.0827 | 0.0681 | 06/22/2015@13:33:56 | | |
| CCV | 1 | S4 | 374 | 20.0 | 06/22/2015@13:34:59 | | |
| | Known Conc: | | 375 | | | | |
| CCB/MBW | 1 | S9 | -0.248 | 0.0618 | 06/22/2015@13:36:01 | | |
| | Known Conc: | | 0.00 | | | | |
| 593980 | 1 | 9 | -0.657 | 0.0465 | 06/22/2015@13:37:01 | | |
| 593981 | 1 | 10 | 1.02 | 0.110 | 06/22/2015@13:38:04 | | |
| 593984 | 1 | 11 | 0.0347 | 0.0725 | 06/22/2015@13:39:06 | | |
| 593985 | 1 | 12 | -0.634 | 0.0474 | 06/22/2015@13:40:06 | | |
| 593986 | 1 | 13 | 0.757 | 0.0996 | 06/22/2015@13:41:07 | | |
| 593987 | 1 | 14 | 0.563 | 0.0923 | 06/22/2015@13:42:06 | | |
| 593988 | 1 | 15 | 0.385 | 0.0856 | 06/22/2015@13:43:06 | | |
| 593989 | 1 | 16 | 0.0685 | 0.0737 | 06/22/2015@13:44:08 | | |
| 597066 | 1 | 17 | 4.34 | 0.234 | 06/22/2015@13:45:10 | | |
| 597067 | 1 | 18 | 573 | 33.0 | 06/22/2015@13:46:14 | | |
| CCV | 1 | S4 | 377 | 20.2 | 06/22/2015@13:47:15 | | |
| | Known Conc: | | 375 | | | | |
| CCB/MBW | 1 | S9 | 2.34 | 0.159 | 06/22/2015@13:48:16 | | |
| | Known Conc: | | 0.00 | | | | |
| DUP597067 | 1 | 19 | 574 | 33.1 | 06/22/2015@13:49:19 | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 597069 | 1 | 20 | 569 | 32.8 | 06/22/2015@13:50:20 | | |
| 597070 | 1 | 21 | 506 | 29.0 | 06/22/2015@13:51:22 | | |
| 598638 | 1 | S11 | 381 | 20.5 | 06/22/2015@13:52:23 | | |
| | Known Conc: | | 375 | | | | |
| 598639 | 1 | S9 | -1.00 | 0.0336 | 06/22/2015@13:53:23 | | |
| | Known Conc: | | 0.00 | | | | |
| 597071 | 1 | 22 | 293 | 14.5 | 06/22/2015@13:54:25 | | |
| DUP597071 | 1 | 23 | 294 | 14.6 | 06/22/2015@13:55:25 | | |
| 597072 | 1 | 24 | 554 | 31.9 | 06/22/2015@13:56:26 | | |
| 597073 | 1 | 25 | 449 | 25.2 | 06/22/2015@13:57:28 | | |
| 597074 | 1 | 26 | 448 | 25.2 | 06/22/2015@13:58:29 | | |
| CCV | 1 | S4 | 377 | 20.2 | 06/22/2015@13:59:30 | | |
| | Known Conc: | | 375 | | | | |
| CCB/MBW | 1 | S9 | -0.230 | 0.0625 | 06/22/2015@14:00:31 | | |
| | Known Conc: | | 0.00 | | | | |
| 597075 | 1 | 27 | 424 | 23.5 | 06/22/2015@14:01:32 | | |
| 597076 | 1 | 28 | 301 | 15.0 | 06/22/2015@14:02:32 | | |
| 597077 | 1 | 29 | 273 | 13.3 | 06/22/2015@14:03:32 | | |
| 597078 | 1 | 30 | 323 | 16.5 | 06/22/2015@14:04:32 | | |
| 597079 | 1 | 31 | 300 | 15.0 | 06/22/2015@14:05:36 | | |
| 597080 | 1 | 32 | 181 | 8.08 | 06/22/2015@14:06:39 | | |
| 597081 | 1 | 33 | 161 | 7.01 | 06/22/2015@14:07:41 | | |
| 597082 | 1 | 34 | 215 | 9.87 | 06/22/2015@14:08:42 | | |
| 597083 | 1 | 35 | 254 | 12.1 | 06/22/2015@14:09:43 | | |
| 597084 | 1 | 36 | 254 | 12.1 | 06/22/2015@14:10:45 | | |
| CCV | 1 | S4 | 374 | 20.0 | 06/22/2015@14:11:46 | | |
| | Known Conc: | | 375 | | | | |
| CCB/MBW | 1 | S9 | -0.668 | 0.0461 | 06/22/2015@14:12:46 | | |
| | Known Conc: | | 0.00 | | | | |
| 597085 | 1 | 37 | 243 | 11.5 | 06/22/2015@14:13:49 | | |
| 598640 598642 598644 | 1 | S11 | 381 | 20.4 | 06/22/2015@14:14:50 | | |
| | Known Conc: | | 375 | | | | |
| 598641 598643 598645 | 1 | S9 | 0.211 | 0.0791 | 06/22/2015@14:15:51 | | |
| | Known Conc: | | 0.00 | | | | |
| 595902 | 1 | 38 | 41.3 | 1.67 | 06/22/2015@14:16:52 | | |
| 595903 | 1 | 39 | 41.2 | 1.67 | 06/22/2015@14:17:53 | | |
| DUP595903 | 1 | 40 | 41.6 | 1.69 | 06/22/2015@14:18:55 | | |
| MSW595903 | 1 | 41 | 164 | 7.21 | 06/22/2015@14:19:55 | | |
| MSDW595903 | 1 | 42 | 159 | 6.95 | 06/22/2015@14:20:56 | | |
| 595904 | 1 | 43 | 42.7 | 1.73 | 06/22/2015@14:21:56 | | |
| 595905 | 1 | 44 | 44.0 | 1.78 | 06/22/2015@14:22:56 | | |
| CCV | 1 | S4 | 373 | 19.9 | 06/22/2015@14:23:57 | | |
| | Known Conc: | | 375 | | | | |
| CCB/MBW | 1 | S9 | -0.194 | 0.0639 | 06/22/2015@14:24:57 | | |
| | Known Conc: | | 0.00 | | | | |
| 595906 | 1 | 45 | 40.4 | 1.64 | 06/22/2015@14:25:57 | | |
| 595907 | 1 | 46 | 42.0 | 1.70 | 06/22/2015@14:27:00 | | |
| 597516 | 1 | 47 | 163 | 7.13 | 06/22/2015@14:28:02 | | |
| DUP597516 | 1 | 48 | 161 | 7.06 | 06/22/2015@14:29:04 | | |
| MSW597516 | 1 | 49 | 254 | 12.1 | 06/22/2015@14:30:06 | | |
| MSDW597516 | 1 | 50 | 257 | 12.3 | 06/22/2015@14:31:07 | | |
| 597730 | 1 | 51 | 228 | 10.6 | 06/22/2015@14:32:08 | | |
| DUP597730 | 1 | 52 | 225 | 10.4 | 06/22/2015@14:33:09 | | |
| MSW597730 | 1 | 53 | 353 | 18.5 | 06/22/2015@14:34:12 | | |
| MSDW597730 | 1 | 54 | 355 | 18.7 | 06/22/2015@14:35:13 | | |
| CCV | 1 | S4 | 376 | 20.1 | 06/22/2015@14:36:15 | | |
| | Known Conc: | | 375 | | | | |
| CCB/MBW | 1 | S9 | -0.296 | 0.0601 | 06/22/2015@14:37:15 | | |
| | Known Conc: | | 0.00 | | | | |
| 597731 | 1 | 55 | 245 | 11.6 | 06/22/2015@14:38:16 | | |
| CCV | 1 | S4 | 374 | 20.0 | 06/22/2015@14:40:50 | | |
| | Known Conc: | | 375 | | | | |
| CCB/MBW | 1 | S9 | -1.07 | 0.0309 | 06/22/2015@14:41:50 | | |
| | Known Conc: | | 0.00 | | | | |

Table : 1 (Alkalinity)

| | Known Conc. (mg/L) | Rep. | Peak Area (V.s) | Peak Height (V) | % RSD | % Residual | Det. Conc (mg/L) | Detection Date | Detection Time |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 750 | 1 | 41.5 | -2.37 | 0.0 | 0.1 | 749 | 06/22/2015 | 13:11:17 |
| 2 | 625 | 1 | 35.9 | -2.24 | 0.0 | -0.2 | 627 | 06/22/2015 | 13:12:19 |
| 3 | 500 | 1 | 28.6 | -1.94 | 0.0 | -0.6 | 500 | 06/22/2015 | 13:13:21 |
| 4 | 375 | 1 | 19.9 | -1.39 | 0.0 | 1.2 | 373 | 06/22/2015 | 13:14:22 |
| 5 | 250 | 1 | 12.0 | -0.843 | 0.0 | 1.0 | 252 | 06/22/2015 | 13:15:26 |
| 6 | 125 | 1 | 5.39 | -0.368 | 0.0 | -4.7 | 127 | 06/22/2015 | 13:16:28 |
| 7 | 75.0 | 1 | 2.94 | -0.200 | 0.0 | -2.1 | 72.1 | 06/22/2015 | 13:17:32 |
| 8 | 25.0 | 1 | 1.03 | -0.0674 | 0.0 | -1.6 | 25.0 | 06/22/2015 | 13:18:36 |
| 9 | 0.00 | 1 | 0.101 | 8.64e-3 | | | 0.804 | 06/22/2015 | 13:19:36 |

Figure : 1 (Alkalinity)




Area = - 8.09e-8 * Conc^3 + 9.61e-5 * Conc^2 + 0.0285 * Conc + 0.24[illegible]
Conc = 8.78e-3 * Area^3 - 0.572 * Area^2 + 26.7 * Area - 1.90
Correlation Coefficient (r) = 0.99995

Weighting : None

# Daily pH Calibration & Maintenance Logbook

| | pH Buffer Reference ID # | | | ----3 Point Calibration---- | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Date | Analyst | pH 7 | pH 4 | pH 10 | 1St Buffer | 2nd Buffer | 3rd Buffer | Slope % | Temp. °C | Comments / Maintenance Performed (if any) |
| 5/26/15 | MER | W36459 | W33064 | W34786 | 7.02 | 4.00 | 10.06 | 95 | 20.4 | |
| 6/2/15 | MER | W36459 | W36995 | W34786 | 7.02 | 4.00 | 10.06 | 97 | 19.9 | |
| 6/9/15 | MER | W36459 | W36995 | W34786 | 7.01 | 4.00 | 10.03 | 96 | 23.5 | |
| 6/10/15 | MER | W36459 | W36995 | W34786 | 7.01 | 4.00 | 10.05 | 96 | 21.6 | |
| 6/16/15 | SCR | W36459 | W36995 | W34786 | 7.02 | 4.00 | 10.06 | ~~94~~ 98 | 20.5 | |
| 6/17/15 | SCR | W36459 | W36995 | W34786 | 7.02 | 4.00 | 10.06 | 96 | 20.5 | |
| | | | | | | | | | | |
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Reviewed By:________________

# *FWC20,21-02 pH Bench Sheet*

Date: 6/16/15 Analyst: SEK

Instrument: ***Mettler Toledo Seven Easy*** LIMS#: 115827

Slope (%): 98

| | SAMPLE# | MATRIX | pH | TEMP (°C) | COMMENTS: |
|---|---|---|---|---|---|
| 1 | 595902 | SW | 7.79 | 4.7 | |
| 2 | 595903 | | 7.79 | 4.7 | |
| 3 | 595904 | | 7.81 | 4.8 | |
| 4 | 595905 | | 7.78 | 5.3 | |
| 5 | 595906 | | 7.77 | 5.1 | |
| 6 | 595907 | | 7.77 | 5.5 | |
| 7 | DUP595907 | | 7.78 | ~~5.9~~ 6.1 | |
| 8 | | | | SEK | |
| 9 | | | | 6/16/15 | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |
| 13 | | | | | |
| 14 | | | | | |
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| 16 | | | | | |
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| 19 | | | | | |
| 20 | | | | | |
| 21 | | | | | |
| 22 | | | | | |
| 23 | | | | | |
| 24 | | | | | |

# TOTAL SOLIDS (PERCENT)

| | | | | | | |
|---|---|---|---|---|---|---|
| | TOTAL SOLIDS (PERCENT) | | | | LIMS #: | 115862 |
| Start Date: | 06/17/2015 | Start Time: | 9:24 | | Analyst: | ABS |
| | Sample ID# | Dish# | Tared Weight g (D) | Wet Weight g (E) | Dry Weight g (F) | RESULTS % TOTAL SOLIDS |
| 1) | 595908 | C0273583 | 2.60 | 13.67 | 13.13 | 95.1% |
| 2) | 595910 | C0273582 | 2.63 | 13.35 | 12.39 | 91.0% |
| 3) | 595912 | C0273581 | 2.62 | 13.26 | 11.91 | 87.3% |
| 4) | | | | | | 0.0% |
| 5) | | | | | | 0.0% |
| 6) | | | | | | 0.0% |
| 7) | | | | | | 0.0% |
| 8) | | | | | | 0.0% |
| 9) | | | | | | 0.0% |
| 10) | | | | | | 0.0% |
| 11) | | | | | | 0.0% |
| 12) | | | | | | 0.0% |
| 13) | | | | | | 0.0% |
| 14) | | | | | | 0.0% |
| 15) | | | | | | 0.0% |
| 16) | | | | | | 0.0% |
| 17) | | | | | | 0.0% |
| 18) | | | | | | 0.0% |
| 19) | | | | | | 0.0% |
| *20) | 595914 | C0273580 | 2.60 | 13.33 | 11.78 | 85.6% |
| Dup 20) | 595914 | C0273579 | 2.60 | 13.34 | 11.44 | 82.3% |
| Dry Weight = Sample + Dish (gms) | | | | * 2nd Reading, | 11.79 | |
| Wet Weight = Sample + Dish (gms) | | | | | Set RPD: | 4% |
| | | | Balance: BD-202 | | | |
| | | | | | *mg Difference | 10 |

| | |
|---|---|
| Stop Date: | 6/19/2015 |
| Stop Time: | 8:24 |

*2nd reading must be within 50mg of the 1st

Calculations

% Total Solids = ((*F*-*D*)/(*E*-*D*))*100

RPD, % = Absolute value of…((Sample-Dup % TS)/(Average%TS))*100

# INORGANICS
# LOGBOOK
# DOCUMENTS

# WALKALINITY QSM Analytical Run
# 115996 on 6/23/2015

Date Analyzed: ________________ Date Reviewed: ________________

Date Entered: ________________ Date Validated: ________________

| COC | ORDER | SAMPLE DECRIPTION | SAMPLE DATE/ TIME | QC TYPE (Parent Sample) | CLIENT | PROJECT | TEST | PREP BATCH | MATRIX | DEL | RUSH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 599016 | | | ICV | | | WALKALINITY QSM | | | | |
| | 599017 | | | ICB | | | WALKALINITY QSM | | | | |
| | 598961 | | | CCV | | | WALKALINITY QSM | 0 | | | |
| | 598962 | | | CCB | | | WALKALINITY QSM | 0 | | | |
| | 598640 | | | LCSW | | | WALKALINITY QSM | | | | |
| | 598641 | | | MBW | | | WALKALINITY QSM | | | | |
| 111888 | 595902 | SW-1 | 6/9/2015 1010 | | AECOM | GULL ROCK | ALKALINITY QSM | | SW | **4** | |
| 111888 | 595903 | SW-2 | 6/9/2015 1005 | Designated MS/MSD | AECOM | GULL ROCK | ALKALINITY QSM | | SW | **4** | |
| | 598963 | SW-2 | 6/9/2015 1005 | DUP 595903 | | | ALKALINITY QSM | 0 | | | |
| | 598964 | SW-2 | 6/9/2015 1005 | MSW 595903 | | | ALKALINITY QSM | 0 | | | |
| | 598965 | SW-2 | 6/9/2015 1005 | MSDW 598964 | | | ALKALINITY QSM | 0 | | | |
| 111888 | 595904 | SW-3 | 6/9/2015 0957 | | AECOM | GULL ROCK | ALKALINITY QSM | | SW | **4** | |
| 111888 | 595905 | SW-4 | 6/9/2015 0951 | | AECOM | GULL ROCK | ALKALINITY QSM | | SW | **4** | |
| | 598966 | | | CCV | | | WALKALINITY QSM | 0 | | | |
| | 598967 | | | CCB | | | WALKALINITY QSM | 0 | | | |
| 111888 | 595906 | DUP-SW | 6/9/2015 | | AECOM | GULL ROCK | ALKALINITY QSM | | SW | **4** | |
| 111888 | 595907 | SW-5 | 6/9/2015 1030 | | AECOM | GULL ROCK | ALKALINITY QSM | | SW | **4** | |
| | 598968 | | | CCV | | | WALKALINITY QSM | 0 | | | |
| | 598969 | | | CCB | | | WALKALINITY QSM | 0 | | | |

**Matrix: S-Soil Slg-Sludge GW-GroundWater M-Misc Waste SW-Surface Water A-Air WW-WasteWater DW-Drinking Water SD=Sediment Leachate=LE**

WALKALINITY QSM  Analytical Run
# 115996   on  6/23/2015

Date Analyzed: ____________

Date Entered: ____________

Date Reviewed: ____________

Date Validated: ____________

**19** SAMPLE COUNT ON RUN, INCLUDING METHOD AND INSTRUMENT QC



**Matrix: S-Soil  Slg-Sludge  GW-GroundWater  M-Misc Waste  SW-Surface Water  A-Air  WW-WasteWater  DW-Drinking Water  SD=Sediment  Leachate=LE**

# FWC8-01
# Alkalinity Data Validation Checklist

| LIMS #: 115996 | | Method: Alkalinity Automated EPA310.2 | | |
|---|---|---|---|---|
| Analysis Date | Analyst / Data Interpreter | Independent Reviewer | Date of Review | Approved |
| 6/22/15 | MER | MW | 6-24-15 | Yes ... No |

**Instructions:** Complete one checklist per *analytical run.* Enter the appropriate response for each question. Each "No" response requires an explanation in the Comments section, and may require the initiation of a Nonconformance Report.

| Requirement: | Acceptance Criteria | Analyst Review Yes | Analyst Review No | Independent Review Yes | Independent Review No | Comments: (indicate reference to an attachment if necessary) |
|---|---|---|---|---|---|---|
| 1. Were the samples analyzed within hold time? | 14 days | X | | X | | |
| 2. Was the calibration performed using acceptable # of points | Min. 6 for 2nd order<br>7 for 3rd order | | | | | |
| 3. Is the standard prep log number noted on the analytical report? | --- | | | | | |
| 3. Was the correlation coefficient acceptable? | >= 0.995 | | | | | |
| 4. Were the ICV(s) and ICB run immediately after the calibration curve? | --- | | | | | |
| 5. Was the ICV(s) recovery acceptable? | 90 – 110 % | | | | | |
| 6. Was the ICB result acceptable? | < LOD or contract/program specific | | | | | |
| 7. Were the CCV's and the CCB's analyzed at the required frequency? | 1per 10 samples | | | | | |
| 8. Were the CCV recoveries acceptable? | 90 – 110 % | | | | | |
| 9. Were the CCB results acceptable? | < LOD or contract/program specific | | | | | |
| 10. Was an LCS analyzed with each batch of samples | 1 / 20 Samples or contract/program specific | | | | | |
| 11. Was a MB analyzed with each batch of samples | 1 / 20 Samples or contract/program specific | | | | | |
| 12. Was the LCS used before the indicated expiration date? | --- | | | | | |
| 13. Was the LCS recovery acceptable? | Within in-house or contract/program specific limits | | | | | |
| 14. Was the MB result acceptable? | < LOD or contract/program specific | | | | | |
| 15. Were the over-range or colored samples analyzed by titration? | --- | | | | | |
| 16. Were duplicate samples run at the required frequency? | 1 / 20 of the same matrix or contract/program specific | | | | | |
| 17. Was the RPD of the duplicates acceptable? | Within in-house or contract/program specific limits | | | | | |
| 18. Were an MS or MSD required and analyzed with acceptable results? | Contract/program specific | | X | | X | MS/MSD 595903 failed ↑ |
| 19. Are all samples on the job lists accounted for? | --- | X | | X | | |

# Lachat 8000 Run Log

| Date | Start Time | End Time | Analyst | Analyte | LIMs Run # | Lachat Data File/Date | Cal. Std. ID # | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 6/8/15 | 0955 | 1854 | MER | $NH_3$ IL | 115578, 581, 583 | OM 06-08-2015 09-50-18 " 15-29-42 10-48-15 | W36949 | |
| 6/9/15 | 1254 | 1434 | mul | CN | 115584 | om 06-09-2015 12-53-31 | W 36992 | |
| 6/10/15 | 1103 | 1243 | MER | CN IL | 115638 | OM 06-10-2015 10-55-57 " 11-55-46 | W37036 | |
| 6/12/15 | 1424 | 1602 | mul | Re CN | 115626 | om 06-12-2015 14-21-24 | W37045 | |
| 6/15/15 | 1113 | 1136 | mul | Re CN | 115626 | om 06-15-2015 11-10-57 | W37045 | |
| 6/15/15 | 1255 | 1420 | MER | Alk. | 115789, 791, 792, 793, 795 | OM 06-15-2015 - 12-52-55 | W36982 | Saved as "061515" |
| 6/16/15 | 1032 | 1240 | UJS | $NH_3$ H2O Undig | 115822, 23, ~~825~~ [illegible] | om-06-16-2015-10-32-48 / 11-42-46 / 12-24-40 | W 37062 | |
| 6/16/15 | 1344 | 1405 | UJS | $NH_3$ SOG Undig | 115825 | om-06-16-2015 13-44-32 | W37065 | |
| 6/17/15 | 1513 | 2104 | MER | $NH_3$ IL | 115859, 860, 861 | OM 06-17-2015 15-08-18 | W37072 | |
| 6/22/15 | 1311 | 1441 | MER | Alk | 115994, 995, 996, 997, 998 | OM 06-22-2015 13-08-30 | W36982 | |
| 6/22/15 | 1542 | 1640 | MER | Hex Cr+6 $H_2O$ | 116005 | OM 06-22-2015 15-41-15 16-17-08 | W37106 | |
| 6/23/15 | 1147 | 1326 | MER | CN IL | 116023 | OM 06-23-2015 11-40-08 | W37113 | |
| 6/24/15 | 0925 | 1630 | UJS | $NH_3$ IL | 116063, 164 | om-06-24-2015-09-25-02 / 11-38-58 / 14-30-36 / 15-21-29 | W37072 | |
| 6/26/15 | 1152 | 1506 | mul | $NH_3$ undis | 116129, 116130, 116131, 116132 | om 06-26-2015 11-51-05 | W37062 W37065 | |
| | | | | | | | | |
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| | | | | | | | | |

Reviewed By:____________________

Notebook No.

PROJECT

Continued From Page

W32935 11/19/13 MER Conductivity Standard - Cat. Number 09-328-3, FB61243, 255W
Lot Number - CC11891 Received 10/14/13 Expires: 6/10/14
True Value = 998 µ/sm

W32936 ES 11/19/13 0.0202N $H_2SO_4$ ~~Cond~~ Acid Soln - Fisher cat # SA226-4
lot # 135866

W32937 MER 11/19/13 Dishwasher Acid - into a 2L vol, dissolve 820g
Sodium citrate EMD cat # SX0445-5 Lot # A05182
filled to volume w/ DI $H_2O$. Expires 11/19/14

W32938 mml 11/20/13 $NH_3$ IL Hypochlorite
Into a 1L volumetric flask volumetrically add 60 mL 5.25% sodium hypochlorite bleach W 32778 and fill to volume with DI $H_2O$. Exp (one day): 11/21/13

AGIC 11-20-13 W32939 IC Eluent
Into a large carboy, pipetted 20mL eluent concentrate W 32456 and filled to final volume of 10L with Milli Q DI $H_2O$.
Exp: 11-20-13

W32940 ~~CSS~~ 11/20/13
$Cr^{+6}$ Soil Ical using ICal working W 31567 and fill to a final volume of 50mL with digestion solution W32941 Exp. (one month): 12/20/13

| | Ical Working (mL) | True Value (µg/L) |
|---|---|---|
| A | 0 | 0 |
| B | 1 | 100 |
| C | 2.5 | 250 |
| D | 5 | 500 |
| E | 10 | 1000 |

W32941 ES 11/20/13 $Cr^{+6}$ Digestion Solution
Into a ~~2L~~ 4L volumetric flask dissolve ~~40g~~ 80g NaOH W 32029 and ~~60g~~ 120g $NaCO_3$ W 28223 and fill to volume with DI $H_2O$. Exp. (one year): 11/20/14
ES 11/20/13

W32942 CES 11/20/13 Sodium Carbonate Anhydrous JT Baker cat # 3602-01
lot # 0000019246

Continued on Page

Read and Understood By

Signed Date Signed Date

PROJECT ______ Notebook No. ______ 41
Continued From Page ______

W34206 MER 4/28/14 KHP Buffer (pH 3.1)
Into a large beaker dissolve 2.5g potassium hydrogen phthalate (KHP) W 29079 + W34207 in 450 ml $CO_2$-free DI water. Add 42.5ml of 0.1 M HCL W 33112 and adjust pH to 3.1± 0.05.
EXP (one week): 5/5/14

W34207 MER 4/28/14 Potassium Hydrogen Phthalate (KHP) - Fisher Scientific Cat # P243-100 Lot # 132808

W34208 AGK 04-28-14 IC ICAL Mixed Standard (50 mg/L):
Into a 100 mL volumetric flask pipetted 5 mL of 1000 mg/L Nitrite W32990, Fluoride W32406, Bromide W34057, Nitrate W33225, and Phosphate W32479 and brought to volume with Milli-Q DI $H_2O$.
EXP (48 Hours):04/30/14

W34209 AGK 04-28-14 IC ICAL
Prepared in 100 mL volumetric flasks and brought to volume with Milli-Q DI $H_2O$.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| mLs Mixed Std 50mg/L W34208 | 0 | 0.2 | 1.0 | 2.0 | 4.0 | 10.0 | 14.0 | 28.0 |
| mLs Chloride 1000mg/L W34199 | 0 | 0.05 | 0.1 | 0.5 | 1.0 | 2.0 | 3.0 | 4.0 |
| mLs Sulfate 1000mg/L W33537 | 0 | 0.05 | 0.1 | 0.5 | 1.0 | 3.0 | 5.0 | 7.0 |

EXP (48 Hours):04/30/14

W34210 GES 4/28/14 Cyanide In-Line Phosphate Buffer
Into a 1L volumetric flask, dissolve 97 g potassium dihydrogen phosphate monobasic W ~~32106~~ W33932 GES 4/28/14 and fill to volume with DI $H_2O$. Exp. (One month): 5/28/14

W34211 GES 4/28/14 Sodium Salicylate-Nitroprusside Color Reagent
Into a 1L volumetric flask dissolved 150g sodium salicylate W 34212 and 1g sodium nitroprusside W 33031 and brought to volume with DI $H_2O$.
EXP(1 month): 5/28/14

W34212 GES 4/28/14 ~~Alf~~ GES 4/28/14 Sodium Salicylate - Alfa Aesar - cat # A17056 Lot # J03Z041

W34213 GES 4/28/14 0.8M Sodium Hydroxide
Into a 1L volumetric flask dissolved 32g NaOH W 33021 and brought to volume with DI $H_2O$. EXP(1 month): 5/28/14

Read and Understood By

5/9/14 GES

Signed ______ Date ______ Signed ______ Date ______

**WetChem Logbook 2**
**01/19/2015**

NOTEBOOK VIEW: LTN_WetChem_2_Default, NOTEBOOK: WetChem_2, PAGE: 32
Page is Locked
Author: cstieve1 on: 25.10.2014 11:46:25
Page is not Witnessed
Project: Unassigned
Page Title: 102114

| | | | |
|---|---|---|---|
| Standard Log #: | W35641 | Reagent: | 4AAP COLOR |
| Analyst: | LJS | | |
| Prep Date: | 10/21/14 | Expiration Date (1Day): | 10/22/14 |
| Prep: | Into a 500mL volumetric flask dissolve 0.32g 4-Aminoantipyrine (4-AAP) W21897 and fill to volume with DI $H_2O$. | | |

| | | | |
|---|---|---|---|
| Standard Log #: | W35642 | Reagent: | Cupric Digestion Solution |
| Analyst: | LJS | | |
| Prep Date: | 10/21/14 | Expiration Date (1 month): | 11/21/14 |
| Prep: | Into a 2L volumetric flask, dissolve 268g of potassium sulfate W34796 and 14.6g of copper sulfate W34799, and slowly volumetrically add 268mL of $H_2SO_4$ W35526 and fill to volume with DI $H_2O$. | | |

| | | | |
|---|---|---|---|
| Standard ID#: | W35643 | Vendor: | FISHER |
| Analyst: | MER | Chemical: | HYDROCHLORIC ACID |
| Date Received: | N/A | Lot #: | 135078 |
| Expiration Date (if any): | N/A | Catelog #: | A144C-212 |

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**WetChem Logbook 2**
**01/19/2015**

NOTEBOOK VIEW: LTN_WetChem_2_Default, NOTEBOOK: WetChem_2, PAGE: 68
Page is Locked
Author: cstieve1 on: 10.01.2015 11:16:03
Page is not Witnessed
Project: Unassigned
Page Title: 121614

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|---|---|---|---|
| Standard Log #: | W36031 | Reagent: | METHYL ORANGE |
| Analyst: | MER | | |
| Prep Date: | 12/16/14 | Expiration Date (1Month): | 1/16/15 |
| Prep: | Into a 1 L volumetric flask, volumetrically added 100 ml methyl orange solution W36032 and brought to volume with $CO_2$-free DI $H_2O$. | | |

| | | | |
|---|---|---|---|
| Standard ID#: | W36032 | Vendor: | FISHER |
| Analyst: | MER | Chemical: | METHYL ORANGE SOLN |
| Date Received: | 10/16/14 | Lot #: | 141493 |
| Expiration Date (if any): | 10/2015 | Catalog #: | SM54-500 |

| | | | |
|---|---|---|---|
| Standard Log #: | W36033 | Reagent: | ALK KHP BUFFER |
| Analyst: | MER | | |
| Prep Date: | 12/16/14 | Expiration Date (1Week): | 12/23/14 |
| Prep: | Into a large beaker dissolve 2.5g potassium hydrogen phthalate (KHP) W34207 in 450 ml $CO_2$-free DI water. Add 42.5ml of 0.1 M HCL W33112 and adjust pH to 3.1± 0.05. | | |

| | | | |
|---|---|---|---|
| Standard Log #: | W36034 | Reagent: | 0.1N HCL |
| Analyst: | MER | | |
| Prep Date: | 12/16/14 | Expiration Date (1Year): | 12/16/15 |
| Prep: | Into a 500 ml volumetric flask containing about 400 ml of DI water add 4.15 ml concentrated hydrochloric acid W35643 and brought to volume with DI $H_2O$. | | |

**WetChem Logbook 3**
02/04/2015
NOTEBOOK VIEW: LTN_WetChem_3_Default, NOTEBOOK: WetChem_3, PAGE: 8
Page is Locked
Author: mradske on: 21.05.2015 14:59:04
Page is not Witnessed
Project: Unassigned
Page Title: 021615

| | | | |
|---|---|---|---|
| Standard ID#: | W36417 | Vendor: | RICCA |
| Analyst: | LJS | Chemical: | BROMO GREEN-METHYL RED |
| Date Received: | N/A | Lot #: | 4411826 |
| Expiration Date (if any): | NOV 2015 | Catalog #: | 1220-16 |

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**WetChem Logbook 3**
02/04/2015
NOTEBOOK VIEW: LTN_WetChem_3_Default, NOTEBOOK: WetChem_3, PAGE: 77
Page is Locked
Author: mradske on: 03.06.2015 09:18:44
Page is not Witnessed
Project: Unassigned
Page Title: 060215

| | | | |
|---|---|---|---|
| Standard Log #: | W36979 | Reagent: | ALK KHP BUFFER |
| Analyst: | LJS | | |
| Prep Date: | 6/2/15 | Expiration Date (1Week): | 6/9/15 |
| Prep: | Into a large beaker dissolve 2.5g potassium hydrogen phthalate (KHP) W34207 in 450 ml $CO_2$-free DI water. Add 42.5ml of 0.1 M HCL W36034 and adjust pH to 3.1± 0.05. | | |

| | | | |
|---|---|---|---|
| Standard Log #: | W36980 | Reagent: | METHYL ORANGE |
| Analyst: | LJS | | |
| Prep Date: | 6/2/15 | Expiration Date (1Month): | 7/2/15 |
| Prep: | Into a 1 L volumetric flask, volumetrically added 100 ml methyl orange solution W36032 and brought to volume with $CO_2$-free DI $H_2O$. | | |

| | | | |
|---|---|---|---|
| Standard Log #: | W36981 | Reagent: | ALK ICAL/CCV STK |
| Analyst: | LJS | Concentration: | 2500 mg/L |
| Prep Date: | 6/2/15 | Expiration Date (1 month): | 7/2/15 |
| Prep: | Into a 250mL volumetric flask dissolve 0.6625g $Na_2CO_3$ W32942 and fill to volume with $CO_2$ free DI $H_2O$. | | |

| | | | |
|---|---|---|---|
| Standard Log #: | W36982 | Standard: | ALK ICAL |
| Analyst: | LJS | | |
| Prep Date: | 6/2/15 | Expiration Date (1 month): | 7/2/15 |
| Prep: | Alkalinity ICAL using Ical stock (2500 mg/L) W36981 fill to final volume of 100ml with $CO_2$ free DI $H_2O$: | | |

| | ICal Stock (mL) | True Value (mg/L) |
|---|---|---|
| A | 30 | 750 |
| B | 25 | 625 |
| C | 20 | 500 |
| D | 15 | 375 |
| E | 10 | 250 |
| F | 5 | 125 |
| G | 3 | 75 |
| H | 1 | 25 |
| I | 0 | 0 |

| | | | |
|---|---|---|---|
| Standard Log #: | W36983 | Reagent: | ALK LCS/ICV STK |
| Analyst: | LJS | Concentration: | 2500 mg/L |
| Prep Date: | 6/2/15 | Expiration Date (1 month): | 7/2/15 |
| Prep: | Into a 250mL volumetric flask dissolve 0.6625g $Na_2CO_3$ W28305 and fill to volume with $CO_2$ free DI $H_2O$. | | |

| | | | |
|---|---|---|---|
| Standard Log #: | W36984 | Standard: | ALK LCS |
| Analyst: | LJS | Concentration: | 375 mg/L |
| Prep Date: | 6/2/15 | Expiration Date (1 Month): | 7/2/15 |
| Prep: | Into a 200mL volumetric flask pipette 30 mL LCS/ICV stock (2500mg/L) W36983 and fill to volume with $CO_2$ free DI $H_2O$. | | |

| | | | |
|---|---|---|---|
| Standard Log #: | W36985 | Standard: | ALK ICV |
| Analyst: | LJS | Concentration: | 75 mg/L |
| Prep Date: | 6/2/15 | Expiration Date (1 Month): | 7/2/15 |
| Prep: | Into a 100mL volumetric flask pipette 3 mL LCS/ICV stock (2500mg/L) W36983 and fill to volume with $CO_2$ free DI $H_2O$. | | |

| | | | |
|---|---|---|---|
| Standard ID#: | W36986 | Vendor: | FISHER |
| Analyst: | MER | Chemical: | AMMONIUM CHLORIDE |
| Date Received: | 5/4/15 | Lot #: | 148936 |
| Expiration Date (if any): | N/A | Catalog #: | A661-3 |

| | | | |
|---|---|---|---|
| Standard Log #: | W36987 | Reagent: | NO2 NO3 BUFFER |
| Analyst: | MER | | |
| Prep Date: | 6/2/15 | Expiration Date (1 Month): | 7/2/15 |
| Prep: | Into a 1 L volumetric flask dissolve 85g ammonium chloride W36986 and 1g EDTA W35251 and fill to volume with DI $H_2O$ and degas. Adjust pH to 8.5 with 15 N NaOH W36989 | | |

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**WetChem Logbook 3**
02/04/2015
NOTEBOOK VIEW: LTN_WetChem_3_Default, NOTEBOOK: WetChem_3, PAGE: 91
Page is Locked
Author: mradske on: 23.06.2015 10:46:16
Page is not Witnessed
Project: Unassigned
Page Title: 062215

| | | | |
|---|---|---|---|
| Standard Log #: | W37103 | Reagent: | ALK KHP BUFFER |
| Analyst: | MER | | |
| Prep Date: | 6/22/15 | Expiration Date (1Week): | 6/29/15 |
| Prep: | Into a large beaker dissolve 2.5g potassium hydrogen phthalate (KHP) W34207 in 450 ml $CO_2$-free DI water. Add 42.5ml of 0.1 M HCL W36034 and adjust pH to 3.1± 0.05. | | |

| | | | |
|---|---|---|---|
| Standard Log #: | W37104 | Reagent: | TKN Hypochlorite |
| Analyst: | MER | | |
| Prep Date: | 6/22/15 | Expiration Date (1 day): | 6/23/15 |
| Prep: | Into a 500mL volumetric flask, volumetrically add 30mL of sodium hypochlorite solution W36976 and fill to volume with DI $H_2O$. | | |

| | | | |
|---|---|---|---|
| Standard ID#: | W37105 | Vendor: | SPEX |
| Analyst: | LJS | Chemical: | NITRITE-NITROGEN 1000UG/ML ST |
| Date Received: | MAY 2015 | Lot #: | 3-106N02N-2Y |
| Expiration Date (if any): | 05-30-2016 | Catalog #: | AS-N02N9-2Y |

WPH Analytical Run
# 115827 on 6/16/2015

Date Analyzed: ____________ Date Reviewed: ____________

Date Entered: ____________ Date Validated: ____________

| COC | ORDER | SAMPLE DECRIPTION | SAMPLE DATE/ TIME | | QC TYPE (Parent Sample) | | CLIENT | PROJECT | TEST | PREP BATCH | MATRIX | DEL | RUSH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 111888 | 595902 | SW-1 | 6/9/2015 | 1010 | | | AECOM | GULL ROCK | PH | | SW | **4** | |
| 111888 | 595903 | SW-2 | 6/9/2015 | 1005 | Designated MS/MSD | | AECOM | GULL ROCK | PH | | SW | **4** | |
| 111888 | 595904 | SW-3 | 6/9/2015 | 0957 | | | AECOM | GULL ROCK | PH | | SW | **4** | |
| 111888 | 595905 | SW-4 | 6/9/2015 | 0951 | | | AECOM | GULL ROCK | PH | | SW | **4** | |
| 111888 | 595906 | DUP-SW | 6/9/2015 | | | | AECOM | GULL ROCK | PH | | SW | **4** | |
| 111888 | 595907 | SW-5 | 6/9/2015 | 1030 | | | AECOM | GULL ROCK | PH | | SW | **4** | |
| | 596338 | SW-5 | 6/9/2015 | 1030 | DUP | 595907 | | | PH | | | | |

**7** SAMPLE COUNT ON RUN, INCLUDING METHOD AND INSTRUMENT QC



**Matrix: S-Soil Slg-Sludge GW-GroundWater M-Misc Waste SW-Surface Water A-Air WW-WasteWater DW-Drinking Water SD=Sediment Leachate=LE**

Distribution: C:\LIMSREPS\ANALYTICALRUN.RPT

# *FWC20,21-01*
# *Data Validation Checklist*

| LIMS #: 115827 | Method: pH EPA 150.1 | | | |
|---|---|---|---|---|
| Analysis Date | Analyst / Data Interpreter | Independent Reviewer | Date of Review | Approved |
| 6/16/15 | SCK/SCK | [illegible] | 6-18-15 | Yes ... No |

**Instructions:** Complete one checklist per *analytical run.* Enter the appropriate response for each question. Each "No" response requires an explanation in the Comments section, and may require the initiation of a Nonconformance Report.

| Requirement: | Acceptance Criteria | Analyst Review Yes | Analyst Review No | Independent Review Yes | Independent Review No | Comments: (indicate reference to an attachment if necessary) |
|---|---|---|---|---|---|---|
| 1. Was the calibration slope recorded on the bench sheet? | --- | X | | X | | |
| 2. Were duplicates analyzed at the appropriate frequency? | 1 every 20 samples of the same matrix | X | | X | | |
| 3. Were the duplicates within acceptable limits? | Differ by ≤ 0.10 pH units | X | | X | | |
| 4. Are all samples on the job lists accounted for? | --- | X | | X | | |

# Mettler Toledo (Easy Seven) Instrument Run Logbook

| Date / Int. | Start Time | End Time | Test (Analyte) | Sample Run # (s) / Prep Batch # (s) | Comments: |
|---|---|---|---|---|---|
| 3/17/15 VTS | 1015 | 1100 | pH | 113169, 113171, 113170, 113172 | |
| 3/18/15 mnl | 1445 | 1500 | ph | 113229 | |
| 3/24/15 MER | 1115 | 1345 | pH | 113374, 375, ~~376~~ | |
| 4/2/15 MER | 0925 | 1010 | pH | 113579, 580, 581, 582 | |
| 4/10/15 mnl | 1300 | 1400 | ph | 113778, 113775 | |
| 4/13/15 mnl | 1345 | 1600 | ph | 113779, 113923 | |
| 4/14/15 mnl | 1200 | 1220 | ph | 113958 | |
| 4/16/15 mnl | 1400 | 1530 | ph | 114066, 114067, 114068, 114072 | |
| 4/22/15 mnl | 1330- | 1400 | ph | 114301 | |
| 4/23/15 mnl | 1400 | 1530 | ph | 114290, 114289 | |
| 4/29/15 mnl | il | 1230 | ph | 114516, 114514 | |
| 5/8/15 MER | 1400 | 1425 | pH | 114780. | |
| 5/11/15 MER | 1330 | 1440 | pH | 114819, 114821 | |
| 5/12/15 VTS | 1100 | 1200 | CRW | 114840, 841 | |
| 5/14/15 mnl | 1520 | 1610 | ph | 114935, 114947 | |
| 5/19/15 MER | 1400 | 1440 | pH | 115100, 115101, 115102 | |
| 5/26/15 MER | 1440 | 1650 | pH | 115246, 115247, 115248 | |
| 6/2/15 MER | 1530 | 1625 | pH | 115438, 439, 440, 443 | |
| 6/9/15 MER | 1410 | 1440 | HexCr$^{+6}$ | 115608 | |
| 6/10/15 MER | 1330 | 1600 | pH | 115639, 640, 641, 642, 643 | |
| 6/16/15 [illegible] | 1000 | 1115 | pH | 115816, 115817, 115818, 115827 | |

Reviewed By:____________________

**WetChem Logbook 1**
**06/03/2014**

NOTEBOOK VIEW: LTN_WetChem_1_Default, NOTEBOOK: WetChem_1, PAGE: 86
Page is Locked
Author: CSTIEVE1 on: 07.07.2014 16:46:39
Witness: cstieve1 on: 11.07.2014 14:41:01
Project: Unassigned
Page Title: 070314E

| | | | |
|---|---|---|---|
| Standard ID#: | W34786 | Vendor: | RICCA |
| Analyst: | MER | Chemical: | PH 10 BUFFER |
| Date Received: | | Lot #: | 4403813 |
| Expiration Date (if any): | SEPT 2015 | Catelog #: | 1601-1 |

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**CT Laboratories LLC**

**WetChem Logbook 3**
02/04/2015
NOTEBOOK VIEW: LTN_WetChem_3_Default, NOTEBOOK: WetChem_3, PAGE: 16
Page is Unlocked
Page is not Witnessed
Project: Unassigned
Page Title: 022615

| | | | |
|---|---|---|---|
| Standard ID#: | W36459 | Vendor: | MG SCIENTIFIC |
| Analyst: | MER | Chemical: | PH 7 BUFFER |
| Date Received: | 11/8/14 | Lot #: | 4408476 |
| Expiration Date (if any): | 08/2016 | Catalog #: | 1551-1 |

| | | | |
|---|---|---|---|
| Standard Log #: | W36460 | Standard: | RESIDUAL CL LCS |
| Analyst: | MER | Concentration: | 1mg/L |
| Prep Date: | 2/26/15 | Expiration Date (2 Years): | 2/26/17 |
| Prep: | Into a 100 mL volumetric flask, pipette 0.1mL potassium permanganate stock (1000 mg/L) W33725 and fill to volume with DI $H_2O$. | | |

| | | | |
|---|---|---|---|
| Standard Log #: | W36461 | Standard: | TKN/TPHOS Spiking Solution |
| Analyst: | MER | Concentration: | 200mg/L $NH_3$ as N and $PO_4^{-3}$ as P |
| Prep Date: | 2/26/15 | Expiration Date (1 month): | 3/26/15 |
| Prep: | Into a 100mL volumetric flask, pipetted 20mL of TPHOS ICV/LCS Stock Standard (1000mg/L) W36090 and 20mL $NH_3$/TKN ICV/LCS Stock Standard (1000mg/L) W35823 and brought to volume with DI $H_2O$. | | |

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**WetChem Logbook 3**
02/04/2015
NOTEBOOK VIEW: LTN_WetChem_3_Default, NOTEBOOK: WetChem_3, PAGE: 77
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Author: mradske on: 03.06.2015 09:18:44
Page is not Witnessed
Project: Unassigned
Page Title: 060215

| | | | |
|---|---|---|---|
| Standard Log #: | W36993 | Standard: | LCS/ICV Working |
| Analyst: | MML | Concentration: | 10 mg/L |
| Prep Date: | 6/2/15 | Expiration Date (1 Week): | 6/9/15 |
| Prep: | Into a 100 mL volumetric flask pipette 1 mL CN LCS/ICV stock (1000mg/L) W36845 and fill to volume with 0.25N NaOH W36990 . | | |

| | | | |
|---|---|---|---|
| Standard Log #: | W36994 | Standard: | CN SOLID LCS/ICV |
| Analyst: | MML | Concentration: | 50 □g/L |
| Prep Date: | 6/2/15 | Expiration Date (1 Week): | 6/9/15 |
| Prep: | Into a 200 mL volumetric flask pipetted 1 mL CN LCS/ICV **WORKING STD** 10,000 µg/L W36993 and brought to volume with 0.25 M NaOH W36990 | | |

| | | | |
|---|---|---|---|
| Standard ID#: | W36995 | Vendor: | RICCA |
| Analyst: | MER | Chemical: | PH 4 BUFFER |
| Date Received: | 5/29/15 | Lot #: | 4505426 |
| Expiration Date (if any): | 5/31/17 | Catalog #: | 1501-1 |

1

**Ct Laboratories LLC**

WSOLIDS Analytical Run
# 115862 on 6/19/2015

Date Analyzed: ____________ Date Reviewed: ____________

Date Entered: ____________ Date Validated: ____________

| COC | ORDER | SAMPLE DECRIPTION | SAMPLE DATE/ TIME | | QC TYPE (Parent Sample) | | CLIENT | PROJECT | TEST | PREP BATCH | MATRIX | DEL | RUSH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 111888 | 595908 | G-25 | 6/9/2015 | 0955 | | | AECOM | GULL ROCK | SOLIDS,PERCENT | | S | **4** | |
| 111888 | 595910 | G-21 | 6/9/2015 | 1005 | | | AECOM | GULL ROCK | SOLIDS,PERCENT | | S | **4** | |
| 111888 | 595912 | G-22 | 6/9/2015 | 1015 | | | AECOM | GULL ROCK | SOLIDS,PERCENT | | S | **4** | |
| 111888 | 595914 | G-26 | 6/9/2015 | 0945 | | | AECOM | GULL ROCK | SOLIDS,PERCENT | | S | **4** | |
| | 597684 | G-26 | 6/9/2015 | 0945 | DUP | 595914 | | | SOLIDS,PERCENT | 0 | | | |

**5** SAMPLE COUNT ON RUN, INCLUDING METHOD AND INSTRUMENT QC

Page 775

**Matrix: S-Soil Slg-Sludge GW-GroundWater M-Misc Waste SW-Surface Water A-Air WW-WasteWater DW-Drinking Water SD=Sediment Leachate=LE**

Distribution: C:\LIMSREPS\ANALYTICALRUN.RPT

## FWC26-10 Data Review Checklist

| | | | | | |
|---|---|---|---|---|---|
| | | Method: Percent Solids SW846-8000C | Independent Data Review Checklist | | |
| **LIMS Run #(s)** | **Analysis Date** | **Analyst / Data Interpreter** | **Independent Reviewer** | **Date of Review** | **Approved? (Yes or No)** |
| 115862, 115863, 115864, 115865 | 06/17/15 | ABS | RLD | 06/19/15 | Yes |

**Instructions:** Complete one checklist per *analytical run* . Enter the appropriate response for each question.
Each "No" response requires an explanation in the Comments section, and may require the initiation of a Nonconformance Report.

| **Requirement:** | **Acceptance Criteria** | **Analyst Review** | | **Independent Review** | | **Comments:** (indicate reference to an attachment if necessary) |
|---|---|---|---|---|---|---|
| | | Yes | No | Yes | No | |
| 1. Were samples analyzed within hold time? | 14 days or program/project specific | Yes | | Yes | | Qualify data prepared after hold time |
| 2. Were samples dried overnight? | > 8hours | Yes | | Yes | | If No: place samples back into oven for mimium of 8 hours of total dry time. |
| 3. Were drying start and stop times recorded? | --- | Yes | | Yes | | If No: record times and temperatures |
| 4. Were duplicates analyzed at the appropriate frequency? | 1 per 20 of similar matrix or at program/project specific frequency | Yes | | Yes | | If No: reprep samples with appropreate frequency for a duplicate. |
| 5. Were the duplicates within acceptable limits? | Within in-house or program/project specific QC limits | Yes | | Yes | | If No: reprep and reanalyze samples or qualify parent sample result (Y). |
| 6. Are all samples on the job lists accounted for? | --- | Yes | | Yes | | If No: analyze samples that were were missed. |
| 7. Were nonconformities (if applicable) documented in the NCR spreadsheet? | | Yes | | Yes | | If No: Enter nonformities into the NCR spreadsheet before data review/validation. |

# CHAIN OF CUSTODY,
# PM CONFIRMATION
# AND
# SAMPLE CONDITION FORMS
# DOCUMENTS

Rev 8/2014

# CHAIN OF CUSTODY



Company: AECOM
Project Contact: Lance Lindberg
Telephone: 906-226-4980
Project Name: Gull Rock
Project #: 60289135
Location: Michigan
Sampled By: Tony Parkinson

Folder #: 111888
Company: AECOM
Project: GULL ROCK
Logged By: TKR PM: PM

0 Lange Court, Baraboo, WI 53913
508-356-2760 Fax 608-356-2766
www.ctlaboratories.com

am:
RCRA SDWA NPDES
Waste Other CERCLA

Report To: Michelle Freimund
EMAIL: Michelle.Freimund
Company: AECOM
Address: 558 Main St. Oshkosh, WI 54901

Invoice To:*
EMAIL:
Company: Same as above
Address:

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed:
*Rush analysis requires prior CT Laboratories' approval*
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

ANALYSES REQUESTED — Fill in Spaces with Bottles per Test

| Date | Time | Matrix | Grab/Comp | Sample # | Sample ID Description | Filtered? Y/N | Total Lead | Alkalinity | Hardness, total | pH | Total Lead | TCLP Lead | Total # Containers | Designated MS/MSD | CT Lab ID # (Lab use only) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6-9-15 | 10:10am | SW | Grab | | SW-1 | N | X | X | X | X | | | | | 595902 |
| 6-9-15 | 10:05am | | | | SW-2 | | | | | | | | | | 595903 |
| | 9:51am | | | | SW-3 | | | | | | | | | | 595904 |
| | 9:51am | | | | SW-4 | | | | | | | | | | 595905 |
| | | | | | Dup-SW | | | | | | | | | | 595906 |
| 6-9-15 | 10:05am | SW | | | MSD | N | | | | | | | | | 595903 |
| | | | | | MS | | | | | | | | | | 595903 |
| 6-9-15 | 10:30am | SW | Grab | | SW-5 | N | | | | | | | | | 595907 |
| | 9:55am | S | | | G-25 | | | | | | X | X | | | 595908/909 |
| | 10:05am | | | | G-21 | | | | | | | | | | 595910/911 |
| | 10:15am | | | | G-22 | | | | | | | | | | 595912/913 |
| | 9:45am | | | | G-26 | | | | | | | | | | 595914/915 |

| Relinquished By: | Date/Time | Received By: | Date/Time | Lab Use Only |
|---|---|---|---|---|
| [signature] | 6-9-15/6:30pm | TKR | 6/15/15 1000 | Ice Present Yes No; Temp 5.6° IR Gun # 4 |
| Received by: [signature] | 6-9-15/6:30pm | Received for Laboratory by: TKR | 6/15/15 1525 | Cooler # 3711 |

# CT Laboratories Terms and Conditions

Where a purchaser (Client) places an order for laboratory, consulting or sampling services from CT Laboratories (CTL), CTL shall provide the ordered services pursuant to these Terms and Conditions, and the related Quotation, or as agreed in a negotiated contract. In the absence of a written agreement to the contrary, the Order constitutes an acceptance by the Client of CTL's offer to do business under these Terms and Conditions, and an agreement to be bound by these Terms and Conditions. No contrary or additional terms and conditions expressed in a Client's document shall be deemed to become a part of the contract created upon acceptance of these Terms and Conditions, unless accepted by CTL in advance of the start of the project and in writing.

**1. ORDERS AND RECEIPT OF SAMPLES (Sample Acceptance Policy)**
1.1 The Client may place the Order (i.e., specify a Scope of Work) either by submitting a purchase order to CTL in writing, by telephone (confirmed in writing) or by negotiated contract. Whichever option the Client selects for placing the Order, the Order shall not be valid unless it contains sufficient specification to enable CTL to carry out the Client's requirements. It is the policy of CT Laboratories that samples not meeting the acceptance criteria, outlined in the NELAC standards and Section 5.8.3.2 of the DOD QSM, will not be accepted by the laboratory or will be qualified on the final report. All samples submitted to the laboratory must: (1) be accompanied by proper, full and complete documentation, including sample identification, location, date and time of collection, the collector's name, type of preservation (if any), type of sample, any special comments concerning the sample and any additional pertinent fields on the chain-of-custody. In the absence of any of the required information, the laboratory will attempt to contact the client to obtain the information; if unable to obtain the necessary information, the final report will be qualified. (2) be labeled appropriately with a unique sample identification written with indelible ink on water resistant labels. If the laboratory cannot determine the identity of a sample, it will be rejected and the client will be contacted for further instructions or resampling. (3) be in an appropriate sample container. If the container is inappropriate, the client will be contacted for further instructions or resampling. If analysis is possible, the final report will be qualified. CT Laboratories can provide a sampling guide containing approved containers and preservations for analytical methods requested. (4) adhere to specified holding times. If samples are received with less than ½ the holding time remaining for the requested test, CT Laboratories will make its best effort to analyze the samples and notify the client. If holding times are exceeded, the final report will be qualified. (5) contain adequate sample volume to perform the necessary testing. If sufficient volume is not present, the sample will be rejected and the client will be contacted for further instructions or resampling. If samples show signs of damage, contamination or inadequate preservation, the client will be notified. If analysis can be performed, the final report will be qualified. If not, the samples will be rejected and the client notified for further instructions or resampling.
1.2 CT Laboratories must be supplied with complete written disclosure of the known or suspected presence of any hazardous substances, as defined by applicable federal or state law. Where any samples which were not accompanied by the required disclosure, cause interruptions in the lab's ability to process work due to contamination of instruments or work areas, the Client will be responsible for the costs of clean up and recovery.
1.3 Prior to Sample Acceptance, the entire risk of loss or damage to samples remains with the Client. In no event will CTL have any responsibility or liability for the action or inaction of any carrier shipping or delivering any sample to or from CTL's premises. Client is responsible to assure that any sample containing any hazardous substance which is to be delivered to CTL's premises will be packaged, labeled, transported and delivered properly and in accordance with applicable laws

**2. PAYMENT TERMS**
2.1 Services performed by CTL will be in accordance with prices quoted and later confirmed in writing or as stated in the Price Schedule. Invoices may be submitted to Client upon completion of any sample delivery group. Payment in advance is required for all Clients except those whose credit has been established with CTL. For Clients with approved credit, payment terms are net 30 days from the date of invoice by CTL. All overdue payments are subject to an additional interest and service charge of one and one-half percent (1.5%) (or the maximum rate permissible by law, whichever is lesser) per month or portion thereof from the due date until the date of payment. All fees are charged or billed directly to the Client. The billing of a third party will not be accepted without a statement, signed by the third party that acknowledges and accepts payment responsibility. CTL may suspend work and withhold delivery of data under this order at any time in the event Client fails to make timely payment of its invoices. Client shall be responsible for all costs and expenses of collection including reasonable attorney's fees. CTL reserves the right to refuse to proceed with work at any time based upon an unfavorable Client credit report.

**3. CHANGE ORDERS, TERMINATION**
3.1 Changes to the Scope of Work, price, or result delivery date may be initiated by CTL after Sample Acceptance due to any condition which conflicts with analytical, QA or other protocols warranted in these Terms and Conditions. CTL will not proceed with such changes until an agreement with the Client is reached on the amount of any cost, schedule change or technical change to the Scope of Work, and such agreement is documented in writing.
3.2 Changes to the Scope of Work, including but not limited to increasing or decreasing the work, changing test and analysis specification or acceleration in the performance of the work may be initiated by the Client after sample acceptance. Such a change will be documented in writing and may result in a change in cost and turnaround time commitment. CTL's acceptance of such changes is contingent upon technical feasibility and operational capacity.
3.3 Suspension or termination of all or any part of the work may be initiated by the Client. CTL will be compensated consistent with Section 2 of these Terms and Conditions. CTL will complete all work in progress and be paid in full for all work completed.

**4. WARRANTIES AND LIABILITY**
4.1 Where applicable, CTL will use analytical methodologies which are in substantial conformity with published test methods. CTL has implemented these methods in its Laboratory Quality Manuals and referenced Standard Operating Procedures and where the nature or composition of the sample requires it, CTL reserves the right to deviate from these methodologies as necessary or appropriate, based on the reasonable judgment of CTL, which deviations, if any, will be made on a basis consistent with recognized standards of the industry and/or CTL's Laboratory Quality Manuals. Client may request that CTL perform according to a mutually agreed Quality Assurance Project Plan (QAPP). In the event that samples arrive prior to agreement on a QAPP, CTL will proceed with analyses under its standard Quality Manuals then in effect, and CTL will not be responsible for any resampling or other charges if work must be repeated to comply with a subsequently finalized QAPP.
4.2 CTL shall start preparation and/or analysis within holding times provided that Sample Acceptance occurs within 48 hours of sampling or 1/2 of the holding time for the test, whichever is less. Where resolution of inconsistencies leading to Sample Acceptance does not occur within this period, CTL will use its best efforts to meet holding times and will proceed with the work provided that, in CTL's judgment, the chain-of-custody or definition of the Scope of Work provide sufficient guidance. Reanalysis of samples to comply with CTL's Quality Manuals will be deemed to have met holding times provided the initial analysis was performed within the applicable holding time. Where reanalysis demonstrates that sample matrix interference is the cause of failure to meet any Quality Manual requirements, the warranty will be deemed to have been met.
4.3 CTL warrants that it possesses and maintains all licenses and certifications which are required to perform services under these Terms and Conditions provided that such requirements are specified in writing to CTL prior to Sample Acceptance. CTL will notify the Client in writing of any decertification or revocation of any license, or notice of either, which affects work in progress.
4.4 The warranty obligations set forth in Sections 4.1, 4.2 and 4.3 are the sole and exclusive warranties given by CTL in connection with any services performed by CTL or any Results generated from such services, and CTL gives and makes NO OTHER REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. No representative of CTL is authorized to give or make any other representation or warranty or modify this warranty in any way.
4.5 Client's sole and exclusive remedy for the breach of warranty in connection with any services performed by CTL, will be limited to repeating any services performed, contingent on the Client's providing, at the request of CTL and at the Client's expense, additional sample(s) if necessary. Any reanalysis requested by the Client generating Results consistent with the original Results will be at the Client's expense. If resampling is necessary, CTL's liability for resampling costs will be limited to actual cost or one hundred or one hundred fifty dollars ($150) per sample, whichever is less.
4.6 CTL's liability for any and all causes of action arising hereunder, whether based in contract, tort, warranty, negligence or otherwise, shall be limited to the lesser amount of compensation for the services performed or $100,000. All claims, including those for negligence, shall be deemed waived unless suit thereon is filed within one year after CTL's completion of the services. Under no circumstances, whether arising in contract, tort (including negligence), or otherwise, shall CTL be responsible for loss of use, loss of profits, or for any special, indirect, incidental or consequential damages occasioned by the services performed or by application or use of the reports prepared.
4.7 In no event shall CTL have any responsibility or liability to the Client for any failure or delay in performance by CTL which results, directly or indirectly, in whole or in part, from any cause or circumstance beyond the reasonable control of CTL. Such causes and circumstances shall include, but not be limited to, acts of God, acts of Client, acts or orders of any governmental authority, strikes or other labor disputes, natural disasters, accidents, wars, civil disturbances, equipment breakdown, matrix interference or unknown highly contaminated samples that impact instrument operation, unavailability of supplies from usual suppliers, difficulties or delays in transportation, mail or delivery services, or any other cause beyond CTL's reasonable control.

**5. RESULTS, WORK PRODUCT**
5.1 Data or information provided to CTL or generated by services performed under this agreement shall only become the property of the Client upon receipt in full by CTL of payment for the whole Order. Ownership of any analytical method, QA/QC protocols, software programs or equipment developed by CTL for performance of work will be retained by CTL, and Client shall not disclose such information to any third party.
5.2 Data and sample materials provided by Client or at Client's request, and the result obtained by CTL shall be held in confidence (unless such information is generally available to the public or is in the public domain or Client has failed to pay CTL for all services rendered or is otherwise in breach of these Terms and Conditions), subject to any disclosure required by law or legal process.
5.3 Should the Results delivered by CTL be used by the Client or Client's client, even though subsequently determined not to meet the warranties described in these Terms and Conditions, then the compensation will be adjusted based upon mutual agreement. In no case shall the Client unreasonably withhold CTL's right to independently defend its data.
5.4 CTL reserves the right to subcontract services ordered by the Client to another laboratory or laboratories, if, in CTL's sole judgment, it is reasonably necessary, appropriate or advisable to do so, and with the Client's permission. CTL will in no way be liable for any subcontracted services and all applicable warranties, guarantees and insurance are those of the subcontracted laboratory.
5.5 CTL shall dispose of the Client's samples 30 days after the analytical report is issued, unless instructed to store them for an alternate period of time or to return such samples to the Client, in a manner consistent with U.S. Environmental Protection Agency regulations or other applicable Federal, state or local requirements. Any samples for projects that are canceled or not accepted, or for which return was requested, will be returned to the Client at their own expense. CTL reserves the right to return to the Client any sample or unused portion of a sample that is not within CTL's permitted capability or the capabilities of CTL's designated waste disposal vendor(s).
5.6 Unless a different time period is agreed to in any order under these Terms and Conditions, CTL agrees to retain all records for five (5) years.
5.7 In the event that CTL is required to respond to legal process related to services for Client, Client agrees to reimburse CTL for hourly charges for personnel involved in the response and attorney fees reasonably incurred in obtaining advice concerning the response, preparation to testify, and appearances related to the legal process, travel and all reasonable expenses associated with the litigation.

**6. INSURANCE**
6.1 CTL shall maintain in force during the performance of services under these Terms and Conditions, Workers' Compensation and Employer's Liability Insurance in accordance with the laws of the states having jurisdiction over CTL's employees who are engaged in the performance of the work. CTL shall also maintain during such period, Comprehensive General and Contractual Liability (limit of $2,000,000 per occurrence/ aggregate), Comprehensive Automobile Liability, owned and hired, ($1,000,000 combined single limit), and Professional/Pollution Liability Insurance (limit of $5,000,000 per occurrence/aggregate). Any Client required changes to these limits or conditions may result in a change in cost to the Client.

**7. AUDIT**
7.1 Upon prior notice to CTL, the Client may audit and inspect CTL's records and accounts covering reimbursable costs related to work done for the Client, for a period of one (1) year after completion of the work. The purpose of any such audit shall be only for verification of such costs, and CTL shall not be required to provide access to cost records where prices are expressed as fixed fees or published unit prices

Rev 8/2014

# CHAIN OF CUSTODY



Company:
Project Contact:
Telephone:
Project Name:
Project #:
Location:
Sampled By:

CT LABORATORIES
1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

*Lab Use Only*
*Place Header Sticker Here:*

Program:
QSM RCRA SDWA NPDES
Solid Waste Other ________

PO #

**Report To:**
EMAIL:
Company:
Address:

**Invoice To:***
EMAIL:
Company:
Address:

**Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions*

**Client Special Instructions**

**Matrix:**
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

**Turnaround Time**
Normal RUSH*
Date Needed: ________
*Rush analysis requires prior CT Laboratories' approval*
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

**ANALYSES REQUESTED** — Fill in Spaces with Bottles per Test

| Collection Date | Collection Time | Matrix | Grab/ Comp | Sample # | Sample ID Description | Filtered? Y/N | VOCs | | | | | | | | | | | | | | Total # Containers | Designated MS/MSD | CT Lab ID # *Lab use only* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Trip Blank | | X | | | | | | | | | | | | | | | | |

| Relinquished By: | Date/Time | Received By: | Date/Time |
|---|---|---|---|
| [signature] | 6/11/15 5:15 PM | TW | 6/15/15 1000 |
| **Received by:** [signature] | 6/11/15 5:15 Pm | **Received for Laboratory by:** TW | 6/15/15 1525 |

*Lab Use Only*
Ice Present Yes No
Temp 5.6° IR Gun # 4
Cooler # 3711

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1.3 Prior to Sample Acceptance, the entire risk of loss or damage to samples remains with the Client. In no event will CTL have any responsibility or liability for the action or inaction of any carrier shipping or delivering any sample to or from CTL's premises. Client is responsible to assure that any sample containing any hazardous substance which is to be delivered to CTL's premises will be packaged, labeled, transported and delivered properly and in accordance with applicable laws.

**2. PAYMENT TERMS**

2.1 Services performed by CTL will be in accordance with prices quoted and later confirmed in writing or as stated in the Price Schedule. Invoices may be submitted to Client upon completion of any sample delivery group. Payment in advance is required for all Clients except those whose credit has been established with CTL. For Clients with approved credit, payment terms are net 30 days from the date of invoice by CTL. All overdue payments are subject to an additional interest and service charge of one and one-half percent (1.5%) (or the maximum rate permissible by law, whichever is lesser) per month or portion thereof from the due date until the date of payment. All fees are charged or billed directly to the Client. The billing of a third party will not be accepted without a statement, signed by the third party that acknowledges and accepts payment responsibility. CTL may suspend work and withhold delivery of data under this order at any time in the event Client fails to make timely payment of its invoices. Client shall be responsible for all costs and expenses of collection including reasonable attorney's fees. CTL reserves the right to refuse to proceed with work at any time based upon an unfavorable Client credit report.

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3.3 Suspension or termination of all or any part of the work may be initiated by the Client. CTL will be compensated consistent with Section 2 of these Terms and Conditions. CTL will complete all work in progress and be paid in full for all work completed.

**4. WARRANTIES AND LIABILITY**

4.1 Where applicable, CTL will use analytical methodologies which are in substantial conformity with published test methods. CTL has implemented these methods in its Laboratory Quality Manuals and referenced Standard Operating Procedures and where the nature or composition of the sample requires it, CTL reserves the right to deviate from these methodologies as necessary or appropriate, based on the reasonable judgment of CTL, which deviations, if any, will be made on a basis consistent with recognized standards of the industry and/or CTL's Laboratory Quality Manuals. Client may request that CTL perform according to a mutually agreed Quality Assurance Project Plan (QAPP). In the event that samples arrive prior to agreement on a QAPP, CTL will proceed with analyses under its standard Quality Manuals then in effect, and CTL will not be responsible for any resampling or other charges if work must be repeated to comply with a subsequently finalized QAPP.

4.2 CTL shall start preparation and/or analysis within holding times provided that Sample Acceptance occurs within 48 hours of sampling or 1/2 of the holding time for the test, whichever is less. Where resolution of inconsistencies leading to Sample Acceptance does not occur within this period, CTL will use its best efforts to meet holding times and will proceed with the work provided that, in CTL's judgment, the chain-of-custody or definition of the Scope of Work provide sufficient guidance. Reanalysis of samples to comply with CTL's Quality Manuals will be deemed to have met holding times provided the initial analysis was performed within the applicable holding time. Where reanalysis demonstrates that sample matrix interference is the cause of failure to meet any Quality Manual requirements, the warranty will be deemed to have been met.

4.3 CTL warrants that it possesses and maintains all licenses and certifications which are required to perform services under these Terms and Conditions provided that such requirements are specified in writing to CTL prior to Sample Acceptance. CTL will notify the Client in writing of any decertification or revocation of any license, or notice of either, which affects work in progress.

4.4 The warranty obligations set forth in Sections 4.1, 4.2 and 4.3 are the sole and exclusive warranties given by CTL in connection with any services performed by CTL or any Results generated from such services, and CTL gives and makes NO OTHER REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. No representative of CTL is authorized to give or make any other representation or warranty or modify this warranty in any way.

4.5 Client's sole and exclusive remedy for the breach of warranty in connection with any services performed by CTL will be limited to repeating any services performed, contingent on the Client's providing, at the request of CTL and at the Client's expense, additional sample(s) if necessary. Any reanalysis requested by the Client generating Results consistent with the original Results will be at the Client's expense. If resampling is necessary, CTL's liability for resampling costs will be limited to actual cost or one hundred or one hundred fifty dollars ($150) per sample, whichever is less.

4.6 CTL's liability for any and all causes of action arising hereunder, whether based in contract, tort, warranty, negligence or otherwise, shall be limited to the lesser amount of compensation for the services performed or $100,000. All claims, including those for negligence, shall be deemed waived unless suit thereon is filed within one year after CTL's completion of the services. Under no circumstances, whether arising in contract, tort (including negligence), or otherwise, shall CTL be responsible for loss of use, loss of profits, or for any special, indirect, incidental or consequential damages occasioned by the services performed or by application or use of the reports prepared.

4.7 In no event shall CTL have any responsibility or liability to the Client for any failure or delay in performance by CTL which results, directly or indirectly, in whole or in part, from any cause or circumstance beyond the reasonable control of CTL. Such causes and circumstances shall include, but not be limited to, acts of God, acts of Client, acts or orders of any governmental authority, strikes or other labor disputes, natural disasters, accidents, wars, civil disturbances, equipment breakdown, matrix interference or unknown highly contaminated samples that impact instrument operation, unavailability of supplies from usual suppliers, difficulties or delays in transportation, mail or delivery services, or any other cause beyond CTL's reasonable control.

**5. RESULTS, WORK PRODUCT**

5.1 Data or information provided to CTL or generated by services performed under this agreement shall only become the property of the Client upon receipt in full by CTL of payment for the whole Order. Ownership of any analytical method, QA/QC protocols, software programs or equipment developed by CTL for performance of work will be retained by CTL, and Client shall not disclose such information to any third party.

5.2 Data and sample materials provided by Client or at Client's request, and the result obtained by CTL shall be held in confidence (unless such information is generally available to the public or is in the public domain or Client has failed to pay CTL for all services rendered or is otherwise in breach of these Terms and Conditions), subject to any disclosure required by law or legal process.

5.3 Should the Results delivered by CTL be used by the Client or Client's client, even though subsequently determined not to meet the warranties described in these Terms and Conditions, then the compensation will be adjusted based upon mutual agreement. In no case shall the Client unreasonably withhold CTL's right to independently defend its data.

5.4 CTL reserves the right to subcontract services ordered by the Client to another laboratory or laboratories, if, in CTL's sole judgment, it is reasonably necessary, appropriate or advisable to do so, and with the Client's permission. CTL will in no way be liable for any subcontracted services and all applicable warranties, guarantees and insurance are those of the subcontracted laboratory.

5.5 CTL shall dispose of the Client's samples 30 days after the analytical report is issued, unless instructed to store them for an alternate period of time or to return such samples to the Client, in a manner consistent with U.S. Environmental Protection Agency regulations or other applicable Federal, state or local requirements. Any samples for projects that are canceled or not accepted, or for which return was requested, will be returned to the Client at their own expense. CTL reserves the right to return to the Client any sample or unused portion of a sample that is not within CTL's permitted capability or the capabilities of CTL's designated waste disposal vendor(s).

5.6 Unless a different time period is agreed to in any order under these Terms and Conditions, CTL agrees to retain all records for five (5) years.

5.7 In the event that CTL is required to respond to legal process related to services for Client, Client agrees to reimburse CTL for hourly charges for personnel involved in the response and attorney fees reasonably incurred in obtaining advice concerning the response, preparation to testify, and appearances related to the legal process, travel and all reasonable expenses associated with the litigation.

**6. INSURANCE**

6.1 CTL shall maintain in force during the performance of services under these Terms and Conditions, Workers' Compensation and Employer's Liability Insurance in accordance with the laws of the states having jurisdiction over CTL's employees who are engaged in the performance of the work. CTL shall also maintain during such period, Comprehensive General and Contractual Liability (limit of $2,000,000 per occurrence/ aggregate), Comprehensive Automobile Liability, owned and hired, ($1,000,000 combined single limit), and Professional/Pollution Liability Insurance (limit of $5,000,000 per occurrence/aggregate). Any Client required changes to these limits or conditions may result in a change in cost to the Client.

**7. AUDIT**

7.1 Upon prior notice to CTL, the Client may audit and inspect CTL's records and accounts covering reimbursable costs related to work done for the Client, for a period of one (1) year after completion of the work. The purpose of any such audit shall be only for verification of such costs, and CTL shall not be required to provide access to cost records where prices are expressed as fixed fees or published unit prices

# Cooler Receipt Form

Ice Present YES NO

Temperature 5.6°

IR Gun # 4

Initials JLR

Date 6/15/15 Time 1000

Cooler #: 3711

UPS Next Day Air®
UPS Worldwide Express℠
Shipping Document

| WEIGHT | LTR | PAK | WEIGHT | DIMENSIONAL WEIGHT If Applicable | LARGE PACKAGE |
|---|---|---|---|---|---|
| | ☐ | ☐ | 46 | | ☐ |

☐ EXPRESS (INT'L)
☐ DOCUMENTS ONLY
SATURDAY DELIVERY ☐

1230

SHIPMENT FROM
UPS ACCOUNT NO. RA1034
REFERENCE NUMBER 60289135-1.2
TELEPHONE
LANCE LINDBERG
AECOM
1230 WILSON ST
MARQUETTE, MI 49855

UPS Next Day Air® 1

DELIVERY TO
TELEPHONE
CT LABORATORIES
1230 LANGE CT
BARABOO, WI 53913

J455 345 0136
TRACKING NUMBER

DATE OF SHIPMENT 6/12/15

010191116 1/07 MW United Parcel Service, Louisville, KY

CUSTODY SEAL
DATE 6/11/15 @ 1710 EST
SIGNATURE [signature]

QEC Quality Environmental Containers
800-255-3950 • 304-255-3900

CUSTODY SEAL
DATE 6/11/15 @ 1710 EST
SIGNATURE [signature]

QEC Quality Environmental Containers
800-255-3950 • 304-255-39

**Folder #: 111888**

## PM LOGIN CONFIRMATION

**Contract #:** 2806

**Company:** AECOM
**Project:** GULL ROCK
**Proj #:** 60289135

**Project Phase:**
**PO Number:**
**Invoice #:** 112369

**Project Manager:** *PML* **Date Received:** 06/15/15
**Log Date:** 06/15/2015

Report To: MICHELLE FREIMUND
558 MAIN STREET

OSHKOSH, WI 54901
Phone: :
Rep. E-Mail

CC:

Fax:

Invoice To :ACCOUNTS PAYABLE
558 MAIN STREET

OSHKOSH, WI 54901
Phone:
EMail:

CC:

Fax:

Collected By:
Collector's Phone:

Arrival Temperature: 5.6 oC

**SAMPLE #: 595902 DESCR: SW-1** **PRIMARY / DETAILED MATRIX:** AQUEOUS / SURFACE WATER **SAMPLED: 6/9/2015** **Time: 1010**

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 203 | PH | (EPA 9040C) | | | | | 6/27/2015 | | Logged |
| 848 | ICP TOTAL QSM | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Total Lead | | | | | | |
| 988 | ALKALINITY QSM | (EPA 310.2) | | | | 6/23/2015 | 6/27/2015 | | Logged |
| 1017 | HARDNESS TOTAL QSM | (SM2340B/6010) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |

**SAMPLE #: 595903 DESCR: SW-2** **PRIMARY / DETAILED MATRIX:** AQUEOUS / SURFACE WATER **SAMPLED: 6/9/2015** **Time: 1005**

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 203 | PH | (EPA 9040C) | | | ***DESIGNATED MATRIX SPIKE*** | | 6/27/2015 | | Logged |
| 848 | ICP TOTAL QSM | (EPA 6010C) | | | ***DESIGNATED MATRIX SPIKE*** | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Total Lead | | | | | | |
| 988 | ALKALINITY QSM | (EPA 310.2) | | | ***DESIGNATED MATRIX SPIKE*** | 6/23/2015 | 6/27/2015 | | Logged |

**SAMPLE #: 595903 DESCR: SW-2** **PRIMARY / DETAILED MATRIX:** AQUEOUS / SURFACE WATER **SAMPLED: 6/9/2015** **Time: 1005**

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 1017 | HARDNESS TOTAL QSM | (SM2340B/6010) | | | ***DESIGNATED MATRIX SPIKE*** | 12/6/2015 | 6/27/2015 | | NeedPrep |

**SAMPLE #: 595904 DESCR: SW-3** **PRIMARY / DETAILED MATRIX:** AQUEOUS / SURFACE WATER **SAMPLED: 6/9/2015** **Time: 0957**

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 203 | PH | (EPA 9040C) | | | | | 6/27/2015 | | Logged |
| 848 | ICP TOTAL QSM | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Total Lead | | | | | | |
| 988 | ALKALINITY QSM | (EPA 310.2) | | | | 6/23/2015 | 6/27/2015 | | Logged |
| 1017 | HARDNESS TOTAL QSM | (SM2340B/6010) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |

**SAMPLE #: 595905 DESCR: SW-4** **PRIMARY / DETAILED MATRIX:** AQUEOUS / SURFACE WATER **SAMPLED: 6/9/2015** **Time: 0951**

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 203 | PH | (EPA 9040C) | | | | | 6/27/2015 | | Logged |
| 848 | ICP TOTAL QSM | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Total Lead | | | | | | |
| 988 | ALKALINITY QSM | (EPA 310.2) | | | | 6/23/2015 | 6/27/2015 | | Logged |
| 1017 | HARDNESS TOTAL QSM | (SM2340B/6010) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |

**SAMPLE #: 595906 DESCR: DUP-SW** **PRIMARY / DETAILED MATRIX:** AQUEOUS / SURFACE WATER **SAMPLED: 6/9/2015**

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 203 | PH | (EPA 9040C) | | | | | 6/27/2015 | | Logged |
| 848 | ICP TOTAL QSM | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Total Lead | | | | | | |
| 988 | ALKALINITY QSM | (EPA 310.2) | | | | 6/23/2015 | 6/27/2015 | | Logged |

**Folder #:** 111888 **Company:** *AECOM* **Project:** GULL ROCK

**SAMPLE #: 595906 DESCR: DUP-SW** **PRIMARY / DETAILED MATRIX:** AQUEOUS / SURFACE WATER **SAMPLED: 6/9/2015**

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 1017 | HARDNESS TOTAL QSM | (SM2340B/6010) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |

**SAMPLE #: 595907 DESCR: SW-5** **PRIMARY / DETAILED MATRIX:** AQUEOUS / SURFACE WATER **SAMPLED: 6/9/2015** **Time: 1030**

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 203 | PH | (EPA 9040C) | | | | | 6/27/2015 | | Logged |
| 848 | ICP TOTAL QSM | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Total Lead | | | | | | |
| 988 | ALKALINITY QSM | (EPA 310.2) | | | | 6/23/2015 | 6/27/2015 | | Logged |
| 1017 | HARDNESS TOTAL QSM | (SM2340B/6010) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |

**SAMPLE #: 595908 DESCR: G-25** **PRIMARY / DETAILED MATRIX:** SOLID / SOIL **SAMPLED: 6/9/2015** **Time: 0955**

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 8 | SOLIDS,PERCENT | (EPA 8000C) | | | | 6/23/2015 | 6/27/2015 | | Logged |
| 817 | ICP QSM | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Lead | | | | | | |

**SAMPLE #: 595909 DESCR: G-25** **PRIMARY / DETAILED MATRIX:** AQUEOUS / TCLP **SAMPLED: 6/9/2015** **Time: 0955**

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 1045 | ICP QSM TCLP | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedExt |
| | | | Lead | | | | | | |

**Folder #:** 111888 **Company:** *AECOM* **Project:** GULL ROCK

| SAMPLE #: 595910 | DESCR: G-21 | | | PRIMARY / DETAILED MATRIX: SOLID / SOIL | | | SAMPLED: 6/9/2015 | | Time: 1005 |
|---|---|---|---|---|---|---|---|---|---|
| CLIENT SAMPLE #: | | | | DETAILED SITE/POINT ID INFORMATION: | | | | | |
| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
| 8 | SOLIDS,PERCENT | (EPA 8000C) | | | | 6/23/2015 | 6/27/2015 | | Logged |
| 817 | ICP QSM | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Lead | | | | | | |

| SAMPLE #: 595911 | DESCR: G-21 | | | PRIMARY / DETAILED MATRIX: AQUEOUS / TCLP | | | SAMPLED: 6/9/2015 | | Time: 1005 |
|---|---|---|---|---|---|---|---|---|---|
| CLIENT SAMPLE #: | | | | DETAILED SITE/POINT ID INFORMATION: | | | | | |
| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
| 1045 | ICP QSM TCLP | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedExt |
| | | | Lead | | | | | | |

| SAMPLE #: 595912 | DESCR: G-22 | | | PRIMARY / DETAILED MATRIX: SOLID / SOIL | | | SAMPLED: 6/9/2015 | | Time: 1015 |
|---|---|---|---|---|---|---|---|---|---|
| CLIENT SAMPLE #: | | | | DETAILED SITE/POINT ID INFORMATION: | | | | | |
| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
| 8 | SOLIDS,PERCENT | (EPA 8000C) | | | | 6/23/2015 | 6/27/2015 | | Logged |
| 817 | ICP QSM | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Lead | | | | | | |

| SAMPLE #: 595913 | DESCR: G-22 | | | PRIMARY / DETAILED MATRIX: AQUEOUS / TCLP | | | SAMPLED: 6/9/2015 | | Time: 1015 |
|---|---|---|---|---|---|---|---|---|---|
| CLIENT SAMPLE #: | | | | DETAILED SITE/POINT ID INFORMATION: | | | | | |
| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
| 1045 | ICP QSM TCLP | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedExt |
| | | | Lead | | | | | | |

| SAMPLE #: 595914 | DESCR: G-26 | | | PRIMARY / DETAILED MATRIX: SOLID / SOIL | | | SAMPLED: 6/9/2015 | | Time: 0945 |
|---|---|---|---|---|---|---|---|---|---|
| CLIENT SAMPLE #: | | | | DETAILED SITE/POINT ID INFORMATION: | | | | | |
| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |

**Folder #:** 111888 **Company:** *AECOM* **Project:** GULL ROCK

**SAMPLE #:** 595914 **DESCR:** G-26 **PRIMARY / DETAILED MATRIX:** SOLID / SOIL **SAMPLED:** 6/9/2015 **Time:** 0945

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 8 | SOLIDS,PERCENT | (EPA 8000C) | | | | 6/23/2015 | 6/27/2015 | | Logged |
| 817 | ICP QSM | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Lead | | | | | | |

**SAMPLE #:** 595915 **DESCR:** G-26 **PRIMARY / DETAILED MATRIX:** AQUEOUS / TCLP **SAMPLED:** 6/9/2015 **Time:** 0945

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 1045 | ICP QSM TCLP | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedExt |
| | | | Lead | | | | | | |

**Invoice Number:** 112369 **Preliminary Invoice Estimate:**

| Item | Matrix | Quantity | Price | Expedited TAT Surcharge | Total |
|---|---|---|---|---|---|
| ALKALINITY QSM | SURFACE WATER | 6 | $ 0.00 | 0.00 | $ 0.00 |
| HARDNESS TOTAL QSM | SURFACE WATER | 6 | $ 0.00 | 0.00 | $ 0.00 |
| ICP QSM Lead | SOIL | 4 | | 0.00 | |
| ICP QSM TCLP Lead | TCLP | 4 | | 0.00 | |
| ICP TOTAL QSM Total Lead | SURFACE WATER | 6 | | 0.00 | |
| PH | SURFACE WATER | 6 | $ 10.00 | 0.00 | $ 60.00 |
| SOLIDS,PERCENT | SOIL | 4 | $ 0.00 | 0.00 | $ 0.00 |
| Temporary Fuel Surcharge on lab supplies and services (if applicable): | | | | | $ 0.00 |

Bottle Information

| Container | # Containers | Tests |
|---|---|---|
| **HNO3** | **8** | HRD,ICP |
| **SOLIDS** | **8** | ICP |
| **UNPRES PL** | **8** | ALK,pH |

CT LABORATORIES
delivering more than data from your environmental analyses

# Sample Condition Report

Folder #: 111888
Client: AECOM

Print Date / Time: 06/15/2015 15:25
Received Date / Time / By: 06/15/2015 1000 TKR

Project Name: GULL ROCK
Project Phase:

Log-In Date / Time / By: 06/15/2015 1525 TKR
Project #: 60289135 PM: PML

Coolers: 3711
Custody Seals Present : **Y**

Temperature: 5.6 C On Ice: **N**
COC Present:? **Y** Complete? **Y**

Seal Intact? **Y**
Ship Method: UPS NEXT DAY AIR
Adequate Packaging: **Y**

Numbers: DATED AND SIGNED
Tracking Number: J455 345 0136
Temp Blank Enclosed? **Y**

Notes: SAMPLES RECEIVED IN GOOD CONDITION, BUT IN MELT WATER ONLY.

2 CUSTODY SEALS PRESENT AND INTACT ON COOLER, DATED AND SIGNED.

PAGE 2 OF 2 OF THE COCS ONLY HAD A TRIP BLANK DOCUMENTED ON IT FOR VOC ANALYSIS. THERE WERE NO VOCS ASSOCIATED WITH THE GULL ROCK SAMPLES AND THUS IT WAS NOT LOGGED IN.

| Sample ID / Description | | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|---|
| **595902** | SW-1 | | | | |
| | | UNPRES PL | 1 | / | ALK,pH |
| | | **Total # of Containers of Type** | ***( UNPRES PL )* = 1** | | |
| **595902** | SW-1 | | | | |
| | | HNO3 | 1 | Y / | HRD,ICP |
| | | **Total # of Containers of Type** | ***( HNO3 )* = 1** | | |

| Sample ID / Description | | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|---|
| **595903** | SW-2 | | | | |
| | | UNPRES PL | 1 | / | ALK,pH |
| | | UNPRES PL | 1 | / | ALK,pH |
| | | UNPRES PL | 1 | / | ALK,pH |
| | | **Total # of Containers of Type** | ***( UNPRES PL )* = 3** | | |
| **595903** | SW-2 | | | | |
| | | HNO3 | 1 | Y / | HRD,ICP |
| | | HNO3 | 1 | Y / | HRD,ICP |
| | | HNO3 | 1 | Y / | HRD,ICP |
| | | **Total # of Containers of Type** | ***( HNO3 )* = 3** | | |

| Sample ID / Description | | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|---|
| **595904** | SW-3 | | | | |
| | | UNPRES PL | 1 | / | ALK,pH |

111888

**Total # of Containers of Type ( *UNPRES PL* ) = 1**

| | | | | | |
|---|---|---|---|---|---|
| **595904** SW-3 | | | | | |
| | HNO3 | 1 | Y | / | HRD,ICP |

**Total # of Containers of Type ( *HNO3* ) = 1**

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595905** SW-4 | | | | |
| | UNPRES PL | 1 | / | ALK,pH |

**Total # of Containers of Type ( *UNPRES PL* ) = 1**

| | | | | | |
|---|---|---|---|---|---|
| **595905** SW-4 | | | | | |
| | HNO3 | 1 | Y | / | HRD,ICP |

**Total # of Containers of Type ( *HNO3* ) = 1**

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595906** DUP-SW | | | | |
| | UNPRES PL | 1 | / | ALK,pH |

**Total # of Containers of Type ( *UNPRES PL* ) = 1**

| | | | | | |
|---|---|---|---|---|---|
| **595906** DUP-SW | | | | | |
| | HNO3 | 1 | Y | / | HRD,ICP |

**Total # of Containers of Type ( *HNO3* ) = 1**

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595907** SW-5 | | | | |
| | UNPRES PL | 1 | / | ALK,pH |

**Total # of Containers of Type ( *UNPRES PL* ) = 1**

| | | | | | |
|---|---|---|---|---|---|
| **595907** SW-5 | | | | | |
| | HNO3 | 1 | Y | / | HRD,ICP |

**Total # of Containers of Type ( *HNO3* ) = 1**

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595908** G-25 | | | | |
| | SOLIDS | 1 | / | %SOL,ICP |

**Total # of Containers of Type ( *SOLIDS* ) = 1**

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595909** G-25 | | | | |
| | SOLIDS | 1 | / | ICP |

**Total # of Containers of Type ( *SOLIDS* ) = 1**

111888

| Sample ID / Description | | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|---|
| **595910** | G-21 | SOLIDS | 1 | / | %SOL,ICP |
| | | **Total # of Containers of Type** | **( *SOLIDS* ) =** | **1** | |

| Sample ID / Description | | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|---|
| **595911** | G-21 | SOLIDS | 1 | / | ICP |
| | | **Total # of Containers of Type** | **( *SOLIDS* ) =** | **1** | |

| Sample ID / Description | | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|---|
| **595912** | G-22 | SOLIDS | 1 | / | %SOL,ICP |
| | | **Total # of Containers of Type** | **( *SOLIDS* ) =** | **1** | |

| Sample ID / Description | | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|---|
| **595913** | G-22 | SOLIDS | 1 | / | ICP |
| | | **Total # of Containers of Type** | **( *SOLIDS* ) =** | **1** | |

| Sample ID / Description | | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|---|
| **595914** | G-26 | SOLIDS | 1 | / | %SOL,ICP |
| | | **Total # of Containers of Type** | **( *SOLIDS* ) =** | **1** | |

| Sample ID / Description | | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|---|
| **595915** | G-26 | SOLIDS | 1 | / | ICP |
| | | **Total # of Containers of Type** | **( *SOLIDS* ) =** | **1** | |

| *Condition Code* | *Condition Description* |
|---|---|
| 1 | Sample Received OK |

111888

# Appendix D – Data Validation Report

AECOM

# Data Usability Summary Report
# USCG Gull Rock Light Station
# 2015 Site Investigation Sampling Event

AECOM Project Number: 60289135
October 20, 2015

## Quality information

| Prepared by | Reviewed by | Checked by |
| --- | --- | --- |
| Greg Malzone<br>Project Chemist | Robert Davis<br>Data Validator/Database Technician | Michelle L. Freimund, P.G.<br>Sr. Project Manager/Program Manager |

## Revision History

| Revision | Revision date | Details | Authorized | Name | Position |
| --- | --- | --- | --- | --- | --- |
| | | | | | |
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## Prepared for:

USCG Civil Engineering Unit Cleveland

## Prepared by:

AECOM Technical Services, Inc.
T: 412-395-8888

Gulf Tower
707 Grant Street, 5th Floor
Pittsburgh, PA 15219
aecom.com

## Table of Contents



## Appendices

# Executive Summary

## Overview

A data validation was performed by Gregory A. Malzone of AECOM Technical Services, Inc.'s (AECOM's) Pittsburgh office on one data package from CT Laboratories, located at 230 Lange Court in Baraboo, Wisconsin for the analysis of soil and surface water samples collected on June 9, 2015 at the U.S. Coast Guard (USCG) Gull Rock Light Station (Site). The samples were collected to evaluate subsurface soil and off-site surface water at the Site to obtain the data necessary to delineate and characterize the lead impacts identified during the September 2004 Phase II Environmental Site Assessment activities and to evaluate potential biologic impacts to Lake Superior.

Data were evaluated and qualifiers were applied in accordance with: method specifications; the validation criteria set forth in the *USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review* (USEPA-540-R-07-003, July 2008), with additional reference to *USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Data Review* (USEPA 540/R-99-008, May 1999) and *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA-540-R-04-004, October 2004), as they applied to the analytical methods employed; the *Gull Rock Light Station CERCLA Investigation - Quality Assurance Project Plan* (March 2015; QAPP) criteria (Worksheets #12 and #36); CT Laboratories SOPs (QAPP Attachment 4); and professional judgment.

CT Laboratories processed the samples and reported the results under sample delivery group (SDG): 111888. The following analytical methods were requested on the chain-of-custody (CoC) records:

- Total Lead in Soil and Water by USEPA SW-846 Method 6010C,
- Toxicity Characteristic Leaching Procedure (TCLP) Lead by USEPA SW-846 Methods 1311/6010C,
- Total Alkalinity by USEPA MCAWW Method 310.2,
- Total Hardness by Standard Methods SM2340B and USEPA SW-846 Method 6010C,
- pH by USEPA SW-846 Method 9040C, and
- Total Residue by USEPA SW-846 Method 8000C (soils only) for dry weight corrections.

Table 1 provides a sample submittal list that cross references the laboratory sample IDs with the field IDs.

**Table 1 – Sample Submittals**
**USCG/Gull Rock Soil and Surface Water Samples**

| Field ID | Matrix | CT Laboratories ID | Sample Collection Date | Sample Collection Time |
|---|---|---|---|---|
| SW-1 | Surface Water | 595902 | 6/9/2015 | 10:10 |
| SW-2 | Surface Water | 595903 | 6/9/2015 | 10:05 |
| SW-3 | Surface Water | 595904 | 6/9/2015 | 9:57 |
| SW-4 | Surface Water | 595905 | 6/9/2015 | 9:51 |
| DUP-SW | Surface Water (QC) | 595906 | 6/9/2015 | 00:00 |
| SW-5 | Surface Water | 595907 | 6/9/2015 | 10:30 |
| G-25 | Soil | 595908 | 6/9/2015 | 9:55 |
| G-25 | TCLP | 595909 | 6/9/2015 | 9:55 |
| G-21 | Soil | 595910 | 6/9/2015 | 10:05 |
| G-21 | TCLP | 595911 | 6/9/2015 | 10:05 |

| Field ID | Matrix | CT Laboratories ID | Sample Collection Date | Sample Collection Time |
|---|---|---|---|---|
| G-22 | Soil | 595912 | 6/9/2015 | 10:15 |
| G-22 | TCLP | 595913 | 6/9/2015 | 10:15 |
| G-26 | Soil | 595914 | 6/9/2015 | 9:45 |
| G-26 | TCLP | 595915 | 6/9/2015 | 9:45 |

The soil and surface water sample shipment was received at CT Laboratories intact and on-ice with a cooler temperature of 5.6$^{o}$ (degrees Celsius). The cooler temperature was within the optimal Quality Control (QC) acceptance criteria of 4$^{o}$ C ± 2$^{o}$ C. No samples were observed to be frozen. Thermal preservation was adequate. No validation action was necessary based on QAPP Worksheet #36A.

Samples SW-2 and G-25 were designated in the field to be processed as the quality control samples, that is, as the matrix spike/matrix spike duplicate (MS/MSD) and the laboratory duplicate samples.

A trip blank was included with the sample shipment but was not required.

## Summary

Inorganic data quality was evaluated by reviewing the following parameters: holding times, matrix spikes, initial calibrations, continuing calibration verification standard recoveries, contract required detection limit standard recoveries, laboratory control samples, Inductively Coupled Plasma (ICP) interference check sample recoveries, ICP serial dilution results, field and laboratory duplicates, laboratory blanks, and analyte quantitation.

For the soil sample set, all data have been determined to be useable for the purpose of assessing the presence/absence and quantitative concentrations of the analytes/compounds in the media tested (i.e., soil) with the qualifications listed in Appendix B. No data points were rejected. Completeness of 100% was achieved for the soil data set, which is acceptable.

For the surface water sample set, all data have been determined to be useable for the purpose of assessing the presence/absence and quantitative concentrations of the analytes/compounds in the media tested (i.e., surface water) with the qualifications listed in Appendix B. No data points were rejected. Completeness of 100% was achieved for the surface water data set, which is acceptable.

A glossary of data qualifier definitions is included in Appendix A of this report. The summary table of qualified results is attached as Appendix B of this report.

Each noncompliance with specific data usability criteria is discussed below. Support documentation for data qualifications was included in Appendix C of this report.

# 1. Total Lead

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Matrix Spike Recoveries: The G-25 MS/MSD recoveries for total lead were less than the lower advisory limit of 80%, but greater than 30% (54% and 52%). The post-digestion spike recovery for lead was 55%, less than the lower acceptance limit of 85%. All soil samples were affected. All soil lead results were positive and were qualified “J-,” as estimated concentrations, biased low because of matrix effects.

The SW-2 MS/MSD recoveries for total lead were less than or equal to the lower advisory limit of 80%, but greater than 30% (78% and 80%). The post-digestion spike recovery for total lead was 88%, within the acceptance limits of 85-115%. All surface water lead samples were affected. All surface water lead results were non-detect and were qualified “UJ,” as estimates, because of matrix effects.

# 2. TCLP Lead

111888

Matrix Spike Recoveries: The G-25 MS/MSD recoveries for TCLP lead were less than the lower advisory limit of 80%, but greater than 30% (62% and 64%). The post-digestion spike recovery for TCLP lead was 88%, within the acceptance limits of 85-115%. All soil TCLP lead samples were affected. The positive and non-detect soil TCLP lead results were qualified “J/UJ,” as estimates, because of matrix effects.

Laboratory Replicate Precision: The related percent difference (RPD) between the original and replicate TCLP lead results for sample G-25 was greater than the maximum limit of 20%. The results were less than five times the reporting limit and the difference between the original and replicate results was less than the reporting limit. No data qualification was required.

# 3. General (Wet) Chemistry Parameters

111888

Holding Time: The surface water pH samples were received and analyzed outside the USEPA “analyze immediately” (i.e., 15-minute) holding time. All pH results were qualified “J,” as estimates, because the holding time was exceeded. The direction of bias could not be determined.

Blank Contamination: Magnesium was detected in the method blank associated with preparation batch 52893 at a concentration that was less than the reporting limit. All surface water hardness samples were affected. The magnesium results for all surface water samples were greater than ten times the blank level. No data qualifications were required.

Matrix Spike Recoveries: The SW-2 MS/MSD recoveries for alkalinity were greater than the upper statistically-derived advisory limit. All surface water samples were affected. The alkalinity results for all surface water samples were positive and water qualified “J+,” as estimated concentrations, biased high because of matrix effects and/or high method bias.

ICP Serial Dilution Results: The ICP serial dilution analysis was performed on sample MW-2. The percent difference between the original and diluted magnesium results was greater than the advisory limit of 10%, at 21%. Magnesium comprised a significant part of the surface water hardness results. All surface water samples were affected. The hardness results for all surface water samples were positive and were qualified “J,” as estimated concentrations, because of the presence of physical/chemical matrix interference.

# 4. Field Duplicate Comparison

A field duplicate sample was collected for sampling point SW-2. The results for the primary and field duplicate samples were non-detects, with exception to those listed in Table 2 below. All RPDs were less than the maximum advisory limit of 100% or the difference criteria was met for all analytes. Field sampling/laboratory precision and sample homogeneity were acceptable. No data qualifications were required.

The following notations are used in the field precision table.

RPD: Relative percent difference

mg/L: milligrams per liter; SU: standard pH units

**Table 2 – Field Duplicate Comparison**
**USCG/Gull Rock Surface Water Samples**

| Parameter | SW-2 | | DUP-SW | | RPD (%) |
|---|---|---|---|---|---|
| pH | 7.79 | SU | 7.77 | SU | 0.26 |
| Alkalinity | 41 | mg/L | 40 | mg/L | 2.5 |
| Hardness | 42 | mg/L | 42 | mg/L | 0 |

# 5. Notes

Positive results less than the reporting limit (i.e., limit of quantitation), but greater than the method detection limit (MDL) were qualified “J,” as estimated concentrations, due to increased uncertainty near the detection limit. The “J” qualifiers were maintained in the data validation.

Matrix spike and matrix spike duplicates, laboratory duplicates, and ICP serial dilutions that were performed on non-project samples were not evaluated because matrix similarity to project samples could not be assumed.

# Appendix A - Glossary of Data Qualifier Codes

| | |
|---|---|
| U | The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit. |
| UJ | The analyte was analyzed for, but was not detected. The reported quantitation limit is approximated and may be inaccurate or imprecise. |
| J | The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample. |
| J+ | (Inorganics) The result is an estimated quantity, likely to be biased high. The associated numerical value is the approximate concentration of the analyte in the sample. |
| J- | (Inorganics) The result is an estimated quantity, likely to be biased low. The associated numerical value is the approximate concentration of the analyte in the sample. |
| R | The data are unusable. The sample results are rejected due to serious deficiencies in the ability to meet quality control criteria. The presence or absence of the analyte cannot be verified. |
| N | (Organics) The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification. |
| NJ | (Organics) The analysis indicates the presence of an analyte that has been tentatively identified and the associated numerical value represents its approximate concentration. |

# Appendix B - Data Qualification Summary

| Sample ID | Method | Analyte | Lab Result | Lab Qual. | Validated Result | Validation Qualifier[1] | Units | Reason Codes[2] |
|---|---|---|---|---|---|---|---|---|
| SW-1 | 6010C | Lead | 4.0 | U | 4.0 | UJ | µg/L | MS |
| SW-1 | 310.2 | Alkalinity | 41 | | 41 | J+ | mg/L | MS |
| SW-1 | 2340B/6010 | Hardness | 43 | | 43 | J | mg/L | SD |
| SW-1 | 9040C | pH | 7.79 | | 7.79 | J | SU | HT |
| SW-2 | 6010C | Lead | 4.0 | U | 4.0 | UJ | µg/L | MS |
| SW-2 | 310.2 | Alkalinity | 41 | M | 41 | J+ | mg/L | MS |
| SW-2 | 2340B/6010 | Hardness | 42 | | 42 | J | mg/L | SD |
| SW-2 | 9040C | pH | 7.79 | | 7.79 | J | SU | HT |
| SW-3 | 6010C | Lead | 4.0 | U | 4.0 | UJ | µg/L | MS |
| SW-3 | 310.2 | Alkalinity | 43 | | 43 | J+ | mg/L | MS |
| SW-3 | 2340B/6010 | Hardness | 43 | | 43 | J | mg/L | SD |
| SW-3 | 9040C | pH | 7.81 | | 7.81 | J | SU | HT |
| SW-4 | 6010C | Lead | 4.0 | U | 4.0 | UJ | µg/L | MS |
| SW-4 | 310.2 | Alkalinity | 44 | | 44 | J+ | mg/L | MS |
| SW-4 | 2340B/6010 | Hardness | 42 | | 42 | J | mg/L | SD |
| SW-4 | 9040C | pH | 7.78 | | 7.78 | J | SU | HT |
| DUP-SW | 6010C | Lead | 4.0 | U | 4.0 | UJ | µg/L | MS |
| DUP-SW | 310.2 | Alkalinity | 40 | | 40 | J+ | mg/L | MS |
| DUP-SW | 2340B/6010 | Hardness | 42 | | 42 | J | mg/L | SD |
| DUP-SW | 9040C | pH | 7.77 | | 7.77 | J | SU | HT |
| SW-5 | 6010C | Lead | 4.0 | U | 4.0 | UJ | µg/L | MS |
| SW-5 | 310.2 | Alkalinity | 42 | | 42 | J+ | mg/L | MS |
| SW-5 | 2340B/6010 | Hardness | 42 | | 42 | J | mg/L | SD |
| SW-5 | 9040C | pH | 7.77 | | 7.77 | J | SU | HT |
| G-25 | 6010C | Lead | 3.3 | M | 3.3 | J- | mg/kg | MS |
| G-25 | 1311/6010 | TCLP Lead | 0.0030 | J | 0.0030 | J | mg/L | <LOQ, MS |
| G-21 | 6010C | Lead | 194 | | 194 | J- | mg/kg | MS |
| G-21 | 1311/6010 | TCLP Lead | 0.013 | | 0.013 | J | mg/L | MS |
| G-22 | 6010C | Lead | 18.4 | | 18.4 | J- | mg/kg | MS |
| G-22 | 1311/6010 | TCLP Lead | 0.0023 | J | 0.0023 | J | mg/L | <LOQ, MS |
| G-26 | 6010C | Lead | 3.4 | | 3.4 | J- | mg/kg | MS |
| G-26 | 1311/6010 | TCLP Lead | 0.0040 | U | 0.0040 | UJ | mg/L | MS |

(1): Data Validation Qualifiers:

U: The analyte was analyzed for, but was not detected above the level of the reported sample detection limit.

J: The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.

J+: (Inorganics) The result is an estimated quantity, likely to be biased high. The associated numerical value is the approximate concentration of the analyte in the sample.

J-: (Inorganics) The result is an estimated quantity, likely to be biased low. The associated numerical value is the approximate concentration of the analyte in the sample.

UJ: The analyte was analyzed for, but was not detected. The reported quantitation limit is approximated and may be inaccurate or imprecise.

(2): Reason Codes:

<LOQ: The reported concentration was estimated to be less than the limit of quantitation, but greater than the method detection limit.
HT: The holding time to preparation or analysis was exceeded.
MS: Matrix spike recovery was outside the advisory limits.
SD: The ICP serial dilution percent difference exceeded the quality control limit.

Notes: mg/kg: milligrams per kilogram (ppm); µg/L: micrograms/liter (ppb)
mg/L: milligrams per liter; SU: standard pH units

# Appendix C - Support Documentation

CT LABORATORIES
delivering more than data from your environmental analyses
1230 Lange Court • Baraboo, WI 53913 • 608-356-2760
www.ctlaboratories.com

# Sample Delivery Group
# 111888

AECOM
MICHELLE FREIMUND
558 MAIN STREET
OSHKOSH, WI 54901

Project Name: GULL ROCK
Project #: 60289135

| CT Sample # | Folder # | Client Sample # | Sample Description | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|---|---|
| 595902 | 111888 | | SW-1 | SURFACE WATER | 06/09/2015 | 06/15/2015 |
| 595903 | 111888 | | SW-2 | SURFACE WATER | 06/09/2015 | 06/15/2015 |
| 595904 | 111888 | | SW-3 | SURFACE WATER | 06/09/2015 | 06/15/2015 |
| 595905 | 111888 | | SW-4 | SURFACE WATER | 06/09/2015 | 06/15/2015 |
| 595906 | 111888 | | DUP-SW | SURFACE WATER | 06/09/2015 | 06/15/2015 |
| 595907 | 111888 | | SW-5 | SURFACE WATER | 06/09/2015 | 06/15/2015 |
| 595908 | 111888 | | G-25 | SOIL | 06/09/2015 | 06/15/2015 |
| 595909 | 111888 | | G-25 | TCLP | 06/09/2015 | 06/15/2015 |
| 595910 | 111888 | | G-21 | SOIL | 06/09/2015 | 06/15/2015 |
| 595911 | 111888 | | G-21 | TCLP | 06/09/2015 | 06/15/2015 |
| 595912 | 111888 | | G-22 | SOIL | 06/09/2015 | 06/15/2015 |
| 595913 | 111888 | | G-22 | TCLP | 06/09/2015 | 06/15/2015 |
| 595914 | 111888 | | G-26 | SOIL | 06/09/2015 | 06/15/2015 |
| 595915 | 111888 | | G-26 | TCLP | 06/09/2015 | 06/15/2015 |

Rev 8/2014

# CHAIN OF CUSTODY



Company: AECOM
Project Contact: Lance Lindberg
Telephone: 906-226-4980
Project Name: Gull Rock
Project #: 60289135
Location: Michigan
Sampled By: Tony Parkinson

Folder #: 111888
Company: AECOM
Project: GULL ROCK
Logged By: TKR PM: PM

0 Lange Court, Baraboo, WI 53913
508-356-2760 Fax 608-356-2766
www.ctlaboratories.com

am:
RCRA SDWA NPDES
Waste Other CERCLA

Report To: Michelle Freimund
EMAIL: Michelle. Freimund
Company: AECOM
Address: 558 Main St. Oshkosh WI 54901

Invoice To:*
EMAIL:
Company: Same as above
Address:

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

Matrix:
GW - groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

ANALYSES REQUESTED

Turnaround Time
Normal RUSH*
Date Needed:
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

| Collection Date | Collection Time | Matrix | Grab/ Comp | Sample # | Sample ID Description | Filtered? Y/N | Total Lead | Alkalinity | Hardness, total | pH | Total Lead | TCLP Lead | Total # Containers | Designated MS/MSD | CT Lab ID # Lab use only |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6-9-15 | 10:10am | SW | Grab | | SW-1 | N | X | X | X | X | | | | | 595902 |
| 6-9-15 | 10:05am | | | | SW-2 | | | | | | | | | | 595903 |
| | 9:51am | | | | SW-3 | | | | | | | | | | 595904 |
| | 9:51am | | | | SW-4 | | | | | | | | | | 595905 |
| | | | | | Dup-SW | | | | | | | | | | 595906 |
| 6-9-15 | 10:05am | SW | | | MSD | N | | | | | | | | | 595903 |
| | | | | | MS | | | | | | | | | | 595903 |
| 6-9-15 | 10:30am | SW | Grab | | SW-5 | N | | | | | | | | | 595907 |
| | 9:55am | S | | | G-25 | | | | | | X | X | | | 595908/909 |
| | 10:05am | | | | G-21 | | | | | | | | | | 595910/911 |
| | 10:15am | | | | G-22 | | | | | | | | | | 595912/913 |
| | 9:45am | | | | G-26 | | | | | | | | | | 595914/915 |

Fill in Spaces with Bottles per Test

| Relinquished By: | Date/Time | Received By: | Date/Time |
|---|---|---|---|
| [signature] | 6-9-15/6:30pm | TKR | 6/15/15 1000 |
| Received by: [signature] | 6-9-15/6:30pm | Received for Laboratory by: TKR | 6/15/15 1525 |

Lab Use Only
Ice Present Yes No
Temp 5.6° IR Gun # 4
Cooler # 3711

## CT Laboratories Terms and Conditions

Where a purchaser (Client) places an order for laboratory, consulting or sampling services from CT Laboratories (CTL), CTL shall provide the ordered services pursuant to these Terms and Conditions, and the related Quotation, or as agreed in a negotiated contract. In the absence of a written agreement to the contrary, the Order constitutes an acceptance by the Client of CTL's offer to do business under these Terms and Conditions, and an agreement to be bound by those Terms and Conditions. No contrary or additional terms and conditions expressed in a Client's document shall be deemed to become a part of the contract created upon acceptance of these Terms and Conditions, unless accepted by CTL in advance of the start of the project and in writing.

**1. ORDERS AND RECEIPT OF SAMPLES (Sample Acceptance Policy)**
1.1 The Client may place the Order (i.e., specify a Scope of Work) either by submitting a purchase order to CTL in writing, by telephone (confirmed in writing) or by negotiated contract. Whichever option the Client selects for placing the Order, the Order shall not be valid unless it contains sufficient specification to enable CTL to carry out the Client's requirements. It is the policy of CT Laboratories that samples not meeting the acceptance criteria, outlined in the NELAC standards and Section 5.8.3.2 of the DOD QSM, will not be accepted by the laboratory or will be qualified on the final report. All samples submitted to the laboratory must: (1) be accompanied by proper, full and complete documentation, including sample identification, location, date and time of collection, the collector's name, type of preservation (if any), type of sample, any special comments concerning the sample and any additional pertinent fields on the chain-of-custody. In the absence of any of the required information, the laboratory will attempt to contact the client to obtain the information; if unable to obtain the necessary information, the final report will be qualified. (2) be labeled appropriately with a unique sample identification written with indelible ink on water resistant labels. If the laboratory cannot determine the identity of a sample, it will be rejected and the client will be contacted for further instructions or resampling. (3) be in an appropriate sample container. If the container is inappropriate, the client will be contacted for further instructions or resampling. If analysis is possible, the final report will be qualified. CT Laboratories can provide a sampling guide containing approved containers and preservations for analytical methods requested. (4) adhere to specified holding times. If samples are received with less than ½ the holding time remaining for the requested test, CT Laboratories will make its best effort to analyze the samples and notify the client. If holding times are exceeded, the final report will be qualified. (5) contain adequate sample volume to perform the necessary testing. If sufficient volume is not present, the sample will be rejected and the client will be contacted for further instructions or resampling. If samples show signs of damage, contamination or inadequate preservation, the client will be notified. If analysis can be performed, the final report will be qualified. If not, the samples will be rejected and the client notified for further instructions or resampling.
1.2 CT Laboratories must be supplied with complete written disclosure of the known or suspected presence of any hazardous substances, as defined by applicable federal or state law. Where any samples which were not accompanied by the required disclosure, cause interruptions in the lab's ability to process work due to contamination of instruments or work areas, the Client will be responsible for the costs of clean up and recovery.
1.3 Prior to Sample Acceptance, the entire risk of loss or damage to samples remains with the Client. In no event will CTL have any responsibility or liability for the action or inaction of any carrier shipping or delivering any sample to or from CTL's premises. Client is responsible to assure that any sample containing any hazardous substance which is to be delivered to CTL's premises will be packaged, labeled, transported and delivered properly and in accordance with applicable laws

**2. PAYMENT TERMS**
2.1 Services performed by CTL will be in accordance with prices quoted and later confirmed in writing or as stated in the Price Schedule. Invoices may be submitted to Client upon completion of any sample delivery group. Payment in advance is required for all Clients except those whose credit has been established with CTL. For Clients with approved credit, payment terms are net 30 days from the date of invoice by CTL. All overdue payments are subject to an additional interest and service charge of one and one-half percent (1.5%) (or the maximum rate permissible by law, whichever is lesser) per month or portion thereof from the due date until the date of payment. All fees are charged or billed directly to the Client. The billing of a third party will not be accepted without a statement, signed by the third party that acknowledges and accepts payment responsibility. CTL may suspend work and withhold delivery of data under this order at any time in the event Client fails to make timely payment of its invoices. Client shall be responsible for all costs and expenses of collection including reasonable attorney's fees. CTL reserves the right to refuse to proceed with work at any time based upon an unfavorable Client credit report.

**3. CHANGE ORDERS, TERMINATION**
3.1 Changes to the Scope of Work, price, or result delivery date may be initiated by CTL after Sample Acceptance due to any condition which conflicts with analytical, QA or other protocols warranted in these Terms and Conditions. CTL will not proceed with such changes until an agreement with the Client is reached on the amount of any cost, schedule change or technical change to the Scope of Work, and such agreement is documented in writing.
3.2 Changes to the Scope of Work, including but not limited to increasing or decreasing the work, changing test and analysis specification or acceleration in the performance of the work may be initiated by the Client after sample acceptance. Such a change will be documented in writing and may result in a change in cost and turnaround time commitment. CTL's acceptance of such changes is contingent upon technical feasibility and operational capacity.
3.3 Suspension or termination of all or any part of the work may be initiated by the Client. CTL will be compensated consistent with Section 2 of these Terms and Conditions. CTL will complete all work in progress and be paid in full for all work completed.

**4. WARRANTIES AND LIABILITY**
4.1 Where applicable, CTL will use analytical methodologies which are in substantial conformity with published test methods. CTL has implemented these methods in its Laboratory Quality Manuals and referenced Standard Operating Procedures and where the nature or composition of the sample requires it, CTL reserves the right to deviate from these methodologies as necessary or appropriate, based on the reasonable judgment of CTL, which deviations, if any, will be made on a basis consistent with recognized standards of the industry and/or CTL's Laboratory Quality Manuals. Client may request that CTL perform according to a mutually agreed Quality Assurance Project Plan (QAPP). In the event that samples arrive prior to agreement on a QAPP, CTL will proceed with analyses under its standard Quality Manuals then in effect, and CTL will not be responsible for any resampling or other charges if work must be repeated to comply with a subsequently finalized QAPP.
4.2 CTL shall start preparation and/or analysis within holding times provided that Sample Acceptance occurs within 48 hours of sampling or 1/2 of the holding time for the test, whichever is less. Where resolution of inconsistencies leading to Sample Acceptance does not occur within this period, CTL will use its best efforts to meet holding times and will proceed with the work provided that, in CTL's judgment, the chain-of-custody or definition of the Scope of Work provide sufficient guidance. Reanalysis of samples to comply with CTL's Quality Manuals will be deemed to have met holding times provided the initial analysis was performed within the applicable holding time. Where reanalysis demonstrates that sample matrix interference is the cause of failure to meet any Quality Manual requirements, the warranty will be deemed to have been met.
4.3 CTL warrants that it possesses and maintains all licenses and certifications which are required to perform services under these Terms and Conditions provided that such requirements are specified in writing to CTL prior to Sample Acceptance. CTL will notify the Client in writing of any decertification or revocation of any license, or notice of either, which affects work in progress.
4.4 The warranty obligations set forth in Sections 4.1, 4.2 and 4.3 are the sole and exclusive warranties given by CTL in connection with any services performed by CTL or any Results generated from such services, and CTL gives and makes NO OTHER REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. No representative of CTL is authorized to give or make any other representation or warranty or modify this warranty in any way.
4.5 Client's sole and exclusive remedy for the breach of warranty in connection with any services performed by CTL will be limited to repeating any services performed, contingent on the Client's providing, at the request of CTL and at the Client's expense, additional sample(s) if necessary. Any reanalysis requested by the Client generating Results consistent with the original Results will be at the Client's expense. If resampling is necessary, CTL's liability for resampling costs will be limited to actual cost or one hundred or one hundred fifty dollars ($150) per sample, whichever is less.
4.6 CTL's liability for any and all causes of action arising hereunder, whether based in contract, tort, warranty, negligence or otherwise, shall be limited to the lesser amount of compensation for the services performed or $100,000. All claims, including those for negligence, shall be deemed waived unless suit thereon is filed within one year after CTL's completion of the services. Under no circumstances, whether arising in contract, tort (including negligence), or otherwise, shall CTL be responsible for loss of use, loss of profits, or for any special, indirect, incidental or consequential damages occasioned by the services performed or by application or use of the reports prepared.
4.7 In no event shall CTL have any responsibility or liability to the Client for any failure or delay in performance by CTL which results, directly or indirectly, in whole or in part, from any cause or circumstance beyond the reasonable control of CTL. Such causes and circumstances shall include, but not be limited to, acts of God, acts of Client, acts or orders of any governmental authority, strikes or other labor disputes, natural disasters, accidents, wars, civil disturbances, equipment breakdown, matrix interference or unknown highly contaminated samples that impact instrument operation, unavailability of supplies from usual suppliers, difficulties or delays in transportation, mail or delivery services, or any other cause beyond CTL's reasonable control.

**5. RESULTS, WORK PRODUCT**
5.1 Data or information provided to CTL or generated by services performed under this agreement shall only become the property of the Client upon receipt in full by CTL of payment for the whole Order. Ownership of any analytical method, QA/QC protocols, software programs or equipment developed by CTL for performance of work will be retained by CTL, and Client shall not disclose such information to any third party.
5.2 Data and sample materials provided by Client or at Client's request, and the result obtained by CTL shall be held in confidence (unless such information is generally available to the public or is in the public domain or Client has failed to pay CTL for all services rendered or is otherwise in breach of these Terms and Conditions), subject to any disclosure required by law or legal process.
5.3 Should the Results delivered by CTL be used by the Client or Client's client, even though subsequently determined not to meet the warranties described in these Terms and Conditions, then the compensation will be adjusted based upon mutual agreement. In no case shall the Client unreasonably withhold CTL's right to independently defend its data.
5.4 CTL reserves the right to subcontract services ordered by the Client to another laboratory or laboratories, if, in CTL's sole judgment, it is reasonably necessary, appropriate or advisable to do so, and with the Client's permission. CTL will in no way be liable for any subcontracted services and all applicable warranties, guarantees and insurance are those of the subcontracted laboratory.
5.5 CTL shall dispose of the Client's samples 30 days after the analytical report is issued, unless instructed to store them for an alternate period of time or to return such samples to the Client, in a manner consistent with U.S. Environmental Protection Agency regulations or other applicable Federal, state or local requirements. Any samples for projects that are canceled or not accepted, or for which return was requested, will be returned to the Client at their own expense. CTL reserves the right to return to the Client any sample or unused portion of a sample that is not within CTL's permitted capability or the capabilities of CTL's designated waste disposal vendor(s).
5.6 Unless a different time period is agreed to in any order under these Terms and Conditions, CTL agrees to retain all records for five (5) years.
5.7 In the event that CTL is required to respond to legal process related to services for Client, Client agrees to reimburse CTL for hourly charges for personnel involved in the response and attorney fees reasonably incurred in obtaining advice concerning the response, preparation to testify, and appearances related to the legal process, travel and all reasonable expenses associated with the litigation.

**6. INSURANCE**
6.1 CTL shall maintain in force during the performance of services under these Terms and Conditions, Workers' Compensation and Employer's Liability insurance in accordance with the laws of the states having jurisdiction over CTL's employees who are engaged in the performance of the work. CTL shall also maintain during such period, Comprehensive General and Contractual Liability (limit of $2,000,000 per occurrence/ aggregate), Comprehensive Automobile Liability, owned and hired, ($1,000,000 combined single limit), and Professional/Pollution Liability Insurance (limit of $5,000,000 per occurrence/aggregate). Any Client required changes to these limits or conditions may result in a change in cost to the Client.

**7. AUDIT**
7.1 Upon prior notice to CTL, the Client may audit and inspect CTL's records and accounts covering reimbursable costs related to work done for the Client, for a period of one (1) year after completion of the work. The purpose of any such audit shall be only for verification of such costs, and CTL shall not be required to provide access to cost records where prices are expressed as fixed fees or published unit prices

Rev 8/2014

# CHAIN OF CUSTODY



Company:
Project Contact:
Telephone:
Project Name:
Project #:
Location:
Sampled By:

CT LABORATORIES

1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

*Lab Use Only*
*Place Header Sticker Here:*

Program:
QSM RCRA SDWA NPDES
Solid Waste Other ______

PO #

Report To:
EMAIL:
Company:
Address:

Invoice To:*
EMAIL:
Company:
Address:

**Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions*

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

ANALYSES REQUESTED

Turnaround Time
Normal RUSH*
Date Needed: ______
*Rush analysis requires prior CT Laboratories' approval*
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

| Collection Date | Collection Time | Matrix | Grab/ Comp | Sample # | Sample ID Description | Filtered? Y/N | VOCs | | | | | | | | | | | | | | Total # Containers | Designated MS/MSD | CT Lab ID # *Lab use only* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Trip Blank | | X | | | | | | | | | | | | | | | | |

Fill in Spaces with Bottles per Test

| Relinquished By: | Date/Time | Received By: | Date/Time |
|---|---|---|---|
| [signature] | 6/11/15 5:15 AM | TNr | 6/15/15 1000 |
| **Received by:** [signature] | 6/11/15 5:15 Pm | **Received for Laboratory by:** TNr | 6/15/15 1525 |

*Lab Use Only*
Ice Present Yes No
Temp 5.6° IR Gun # 4
Cooler # 3711

# CT Laboratories Terms and Conditions

Where a purchaser (Client) places an order for laboratory, consulting or sampling services from CT Laboratories (CTL), CTL shall provide the ordered services pursuant to these Terms and Conditions, and the related Quotation, or as agreed in a negotiated contract. In the absence of a written agreement to the contrary, the Order constitutes an acceptance by the Client of CTL's offer to do business under these Terms and Conditions, and an agreement to be bound by these Terms and Conditions. No contrary or additional terms and conditions expressed in a Client's document shall be deemed to become a part of the contract created upon acceptance of these Terms and Conditions, unless accepted by CTL in advance of the start of the project and in writing.

**1. ORDERS AND RECEIPT OF SAMPLES** (Sample Acceptance Policy)

1.1 The Client may place the Order (i.e., specify a Scope of Work) either by submitting a purchase order to CTL in writing, by telephone (confirmed in writing) or by negotiated contract. Whichever option the Client selects for placing the Order, the Order shall not be valid unless it contains sufficient specification to enable CTL to carry out the Client's requirements. It is the policy of CT Laboratories that samples not meeting the acceptance criteria, outlined in the NELAC standards and Section 5.8.3.2 of the DOD QSM, will not be accepted by the laboratory or will be qualified on the final report. All samples submitted to the laboratory must: (1) be accompanied by proper, full and complete documentation, including sample identification, location, date and time of collection, the collector's name, type of preservation (if any), type of sample, any special comments concerning the sample and any additional pertinent fields on the chain-of-custody. In the absence of any of the required information, the laboratory will attempt to contact the client to obtain the information; if unable to obtain the necessary information, the final report will be qualified. (2) be labeled appropriately with a unique sample identification written with indelible ink on water resistant labels. If the laboratory cannot determine the identity of a sample, it will be rejected and the client will be contacted for further instructions or resampling. (3) be in an appropriate sample container. If the container is inappropriate, the client will be contacted for further instructions or resampling. If analysis is possible, the final report will be qualified. CT Laboratories can provide a sampling guide containing approved containers and preservations for analytical methods requested. (4) adhere to specified holding times. If samples are received with less than ½ the holding time remaining for the requested test, CT Laboratories will make its best effort to analyze the samples and notify the client. If holding times are exceeded, the final report will be qualified. (5) contain adequate sample volume to perform the necessary testing. If sufficient volume is not present, the sample will be rejected and the client will be contacted for further instructions or resampling. If samples show signs of damage, contamination or inadequate preservation, the client will be notified. If analysis can be performed, the final report will be qualified. If not, the samples will be rejected and the client notified for further instructions or resampling.

1.2 CT Laboratories must be supplied with complete written disclosure of the known or suspected presence of any hazardous substances, as defined by applicable federal or state law. Where any samples which were not accompanied by the required disclosure, cause interruptions in the lab's ability to process work due to contamination of instruments or work areas, the Client will be responsible for the costs of clean up and recovery.

1.3 Prior to Sample Acceptance, the entire risk of loss or damage to samples remains with the Client. In no event will CTL have any responsibility or liability for the action or inaction of any carrier shipping or delivering any sample to or from CTL's premises. Client is responsible to assure that any sample containing any hazardous substance which is to be delivered to CTL's premises will be packaged, labeled, transported and delivered properly and in accordance with applicable laws.

**2. PAYMENT TERMS**

2.1 Services performed by CTL will be in accordance with prices quoted and later confirmed in writing or as stated in the Price Schedule. Invoices may be submitted to Client upon completion of any sample delivery group. Payment in advance is required for all Clients except those whose credit has been established with CTL. For Clients with approved credit, payment terms are net 30 days from the date of invoice by CTL. All overdue payments are subject to an additional interest and service charge of one and one-half percent (1.5%) (or the maximum rate permissible by law, whichever is lesser) per month or portion thereof from the due date until the date of payment. All fees are charged or billed directly to the Client. The billing of a third party will not be accepted without a statement, signed by the third party that acknowledges and accepts payment responsibility. CTL may suspend work and withhold delivery of data under this order at any time in the event Client fails to make timely payment of its invoices. Client shall be responsible for all costs and expenses of collection including reasonable attorney's fees. CTL reserves the right to refuse to proceed with work at any time based upon an unfavorable Client credit report.

**3. CHANGE ORDERS, TERMINATION**

3.1 Changes to the Scope of Work, price, or result delivery date may be initiated by CTL after Sample Acceptance due to any condition which conflicts with analytical, QA or other protocols warranted in these Terms and Conditions. CTL will not proceed with such changes until an agreement with the Client is reached on the amount of any cost, schedule change or technical change to the Scope of Work, and such agreement is documented in writing.

3.2 Changes to the Scope of Work, including but not limited to increasing or decreasing the work, changing test and analysis specification or acceleration in the performance of the work may be initiated by the Client after sample acceptance. Such a change will be documented in writing and may result in a change in cost and turnaround time commitment. CTL's acceptance of such changes is contingent upon technical feasibility and operational capacity.

3.3 Suspension or termination of all or any part of the work may be initiated by the Client. CTL will be compensated consistent with Section 2 of these Terms and Conditions. CTL will complete all work in progress and be paid in full for all work completed.

**4. WARRANTIES AND LIABILITY**

4.1 Where applicable, CTL will use analytical methodologies which are in substantial conformity with published test methods. CTL has implemented these methods in its Laboratory Quality Manuals and referenced Standard Operating Procedures and where the nature or composition of the sample requires it, CTL reserves the right to deviate from these methodologies as necessary or appropriate, based on the reasonable judgment of CTL, which deviations, if any, will be made on a basis consistent with recognized standards of the industry and/or CTL's Laboratory Quality Manuals. Client may request that CTL perform according to a mutually agreed Quality Assurance Project Plan (QAPP). In the event that samples arrive prior to agreement on a QAPP, CTL will proceed with analyses under its standard Quality Manuals then in effect, and CTL will not be responsible for any resampling or other charges if work must be repeated to comply with a subsequently finalized QAPP.

4.2 CTL shall start preparation and/or analysis within holding times provided that Sample Acceptance occurs within 48 hours of sampling or 1/2 of the holding time for the test, whichever is less. Where resolution of inconsistencies leading to Sample Acceptance does not occur within this period, CTL will use its best efforts to meet holding times and will proceed with the work provided that, in CTL's judgment, the chain-of-custody or definition of the Scope of Work provide sufficient guidance. Reanalysis of samples to comply with CTL's Quality Manuals will be deemed to have met holding times provided the initial analysis was performed within the applicable holding time. Where reanalysis demonstrates that sample matrix interference is the cause of failure to meet any Quality Manual requirements, the warranty will be deemed to have been met.

4.3 CTL warrants that it possesses and maintains all licenses and certifications which are required to perform services under these Terms and Conditions provided that such requirements are specified in writing to CTL prior to Sample Acceptance. CTL will notify the Client in writing of any decertification or revocation of any license, or notice of either, which affects work in progress.

4.4 The warranty obligations set forth in Sections 4.1, 4.2 and 4.3 are the sole and exclusive warranties given by CTL in connection with any services performed by CTL or any Results generated from such services, and CTL gives and makes NO OTHER REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. No representative of CTL is authorized to give or make any other representation or warranty or modify this warranty in any way.

4.5 Client's sole and exclusive remedy for the breach of warranty in connection with any services performed by CTL, will be limited to repeating any services performed, contingent on the Client's providing, at the request of CTL and at the Client's expense, additional sample(s) if necessary. Any reanalysis requested by the Client generating Results consistent with the original Results will be at the Client's expense. If resampling is necessary, CTL's liability for resampling costs will be limited to actual cost or one hundred or one hundred fifty dollars ($150) per sample, whichever is less.

4.6 CTL's liability for any and all causes of action arising hereunder, whether based in contract, tort, warranty, negligence or otherwise, shall be limited to the lesser amount of compensation for the services performed or $100,000. All claims, including those for negligence, shall be deemed waived unless suit thereon is filed within one year after CTL's completion of the services. Under no circumstances, whether arising in contract, tort (including negligence), or otherwise, shall CTL be responsible for loss of use, loss of profits, or for any special, indirect, incidental or consequential damages occasioned by the services performed or by application or use of the reports prepared.

4.7 In no event shall CTL have any responsibility or liability to the Client for any failure or delay in performance by CTL which results, directly or indirectly, in whole or in part, from any cause or circumstance beyond the reasonable control of CTL. Such causes and circumstances shall include, but not be limited to, acts of God, acts of Client, acts or orders of any governmental authority, strikes or other labor disputes, natural disasters, accidents, wars, civil disturbances, equipment breakdown, matrix interference or unknown highly contaminated samples that impact instrument operation, unavailability of supplies from usual suppliers, difficulties or delays in transportation, mail or delivery services, or any other cause beyond CTL's reasonable control.

**5. RESULTS, WORK PRODUCT**

5.1 Data or information provided to CTL or generated by services performed under this agreement shall only become the property of the Client upon receipt in full by CTL of payment for the whole Order. Ownership of any analytical method, QA/QC protocols, software programs or equipment developed by CTL for performance of work will be retained by CTL, and Client shall not disclose such information to any third party.

5.2 Data and sample materials provided by Client or at Client's request, and the result obtained by CTL shall be held in confidence (unless such information is generally available to the public or is in the public domain or Client has failed to pay CTL for all services rendered or is otherwise in breach of these Terms and Conditions), subject to any disclosure required by law or legal process.

5.3 Should the Results delivered by CTL be used by the Client or Client's client, even though subsequently determined not to meet the warranties described in these Terms and Conditions, then the compensation will be adjusted based upon mutual agreement. In no case shall the Client unreasonably withhold CTL's right to independently defend its data.

5.4 CTL reserves the right to subcontract services ordered by the Client to another laboratory or laboratories, if, in CTL's sole judgment, it is reasonably necessary, appropriate or advisable to do so, and with the Client's permission. CTL will in no way be liable for any subcontracted services and all applicable warranties, guarantees and insurance are those of the subcontracted laboratory.

5.5 CTL shall dispose of the Client's samples 30 days after the analytical report is issued, unless instructed to store them for an alternate period of time or to return such samples to the Client, in a manner consistent with U.S. Environmental Protection Agency regulations or other applicable Federal, state or local requirements. Any samples for projects that are canceled or not accepted, or for which return was requested, will be returned to the Client at their own expense. CTL reserves the right to return to the Client any sample or unused portion of a sample that is not within CTL's permitted capability or the capabilities of CTL's designated waste disposal vendor(s).

5.6 Unless a different time period is agreed to in any order under these Terms and Conditions, CTL agrees to retain all records for five (5) years.

5.7 In the event that CTL is required to respond to legal process related to services for Client, Client agrees to reimburse CTL for hourly charges for personnel involved in the response and attorney fees reasonably incurred in obtaining advice concerning the response, preparation to testify, and appearances related to the legal process, travel and all reasonable expenses associated with the litigation.

**6. INSURANCE**

6.1 CTL shall maintain in force during the performance of services under these Terms and Conditions, Workers' Compensation and Employer's Liability Insurance in accordance with the laws of the states having jurisdiction over CTL's employees who are engaged in the performance of the work. CTL shall also maintain during such period, Comprehensive General and Contractual Liability (limit of $2,000,000 per occurrence/ aggregate), Comprehensive Automobile Liability, owned and hired, ($1,000,000 combined single limit), and Professional/Pollution Liability Insurance (limit of $5,000,000 per occurrence/aggregate). Any Client required changes to these limits or conditions may result in a change in cost to the Client.

**7. AUDIT**

7.1 Upon prior notice to CTL, the Client may audit and inspect CTL's records and accounts covering reimbursable costs related to work done for the Client, for a period of one (1) year after completion of the work. The purpose of any such audit shall be only for verification of such costs, and CTL shall not be required to provide access to cost records where prices are expressed as fixed fees or published unit prices

# Cooler Receipt Form

Ice Present YES NO

Temperature 5.6

IR Gun # 4

Initials JLR

Date 6/15/15 Time 1000

Cooler #: 3711

UPS Next Day Air®
UPS Worldwide Express℠
Shipping Document

| LTR | PAK | WEIGHT | DIMENSIONAL WEIGHT If Applicable | LARGE PACKAGE |
|---|---|---|---|---|
| ☐ | ☐ | 46 | | ☐ |

☐ EXPRESS (INT'L)
☐ DOCUMENTS ONLY
SATURDAY DELIVERY ☐

1230

SHIPMENT FROM
UPS ACCOUNT NO. RA1034
REFERENCE NUMBER 60289135-1.2
TELEPHONE
LANCE LINDBERG
AECOM
1230 WILSON ST
MARQUETTE, MI 49855

UPS Next Day Air® 1

DELIVERY TO
TELEPHONE
CT LABORATORIES
1230 LANGE CT
BARABOO, WI 53913

J455 345 0136
TRACKING NUMBER

DATE OF SHIPMENT 6/12/15

010191116 1/07 MW United Parcel Service, Louisville, KY

CUSTODY SEAL
DATE 6/11/15 @ 1700 EST
SIGNATURE [signature]
QEC Quality Environmental Containers
800-255-3950 • 304-255-3900

CUSTODY SEAL
DATE 6/11/15 @ 1700 EST
SIGNATURE [signature]
QEC Quality Environmental Containers
800-255-3950 • 304-255-3900

**Folder #: 111888**

# *PM LOGIN CONFIRMATION*

**Contract #:** 2806
**Project:** GULL ROCK
**PO Number:**
**Log Date:** 06/15/2015

**Company:** AECOM
**Project Phase:**
**Project Manager:** *PML* **Date Received:** 06/15/15

**Proj #:** 60289135
**Invoice #:** 112369

Report To: MICHELLE FREIMUND
558 MAIN STREET

OSHKOSH, WI 54901
Phone: :
Rep. E-Mail
Collected By:
Collector's Phone:

CC:
Fax:

Invoice To :ACCOUNTS PAYABLE
558 MAIN STREET

OSHKOSH, WI 54901
Phone:
EMail:
Arrival Temperature: 5.6 oC

CC:
Fax:

**SAMPLE #: 595902 DESCR: SW-1** **PRIMARY / DETAILED MATRIX:** AQUEOUS / SURFACE WATER **SAMPLED: 6/9/2015** **Time: 1010**
**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 203 | PH | (EPA 9040C) | | | | | 6/27/2015 | | Logged |
| 848 | ICP TOTAL QSM | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Total Lead | | | | | | |
| 988 | ALKALINITY QSM | (EPA 310.2) | | | | 6/23/2015 | 6/27/2015 | | Logged |
| 1017 | HARDNESS TOTAL QSM | (SM2340B/6010) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |

**SAMPLE #: 595903 DESCR: SW-2** **PRIMARY / DETAILED MATRIX:** AQUEOUS / SURFACE WATER **SAMPLED: 6/9/2015** **Time: 1005**
**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 203 | PH | (EPA 9040C) | | | ***DESIGNATED MATRIX SPIKE*** | | 6/27/2015 | | Logged |
| 848 | ICP TOTAL QSM | (EPA 6010C) | | | ***DESIGNATED MATRIX SPIKE*** | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Total Lead | | | | | | |
| 988 | ALKALINITY QSM | (EPA 310.2) | | | ***DESIGNATED MATRIX SPIKE*** | 6/23/2015 | 6/27/2015 | | Logged |

Folder #: 111888 Company: *AECOM* Project: GULL ROCK

**SAMPLE #: 595903 DESCR: SW-2** PRIMARY / DETAILED MATRIX: AQUEOUS / SURFACE WATER SAMPLED: 6/9/2015 Time: 1005

**CLIENT SAMPLE #:** DETAILED SITE/POINT ID INFORMATION:

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 1017 | HARDNESS TOTAL QSM | (SM2340B/6010) | | | ***DESIGNATED MATRIX SPIKE*** | 12/6/2015 | 6/27/2015 | | NeedPrep |

**SAMPLE #: 595904 DESCR: SW-3** PRIMARY / DETAILED MATRIX: AQUEOUS / SURFACE WATER SAMPLED: 6/9/2015 Time: 0957

**CLIENT SAMPLE #:** DETAILED SITE/POINT ID INFORMATION:

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 203 | PH | (EPA 9040C) | | | | | 6/27/2015 | | Logged |
| 848 | ICP TOTAL QSM | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Total Lead | | | | | | |
| 988 | ALKALINITY QSM | (EPA 310.2) | | | | 6/23/2015 | 6/27/2015 | | Logged |
| 1017 | HARDNESS TOTAL QSM | (SM2340B/6010) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |

**SAMPLE #: 595905 DESCR: SW-4** PRIMARY / DETAILED MATRIX: AQUEOUS / SURFACE WATER SAMPLED: 6/9/2015 Time: 0951

**CLIENT SAMPLE #:** DETAILED SITE/POINT ID INFORMATION:

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 203 | PH | (EPA 9040C) | | | | | 6/27/2015 | | Logged |
| 848 | ICP TOTAL QSM | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Total Lead | | | | | | |
| 988 | ALKALINITY QSM | (EPA 310.2) | | | | 6/23/2015 | 6/27/2015 | | Logged |
| 1017 | HARDNESS TOTAL QSM | (SM2340B/6010) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |

**SAMPLE #: 595906 DESCR: DUP-SW** PRIMARY / DETAILED MATRIX: AQUEOUS / SURFACE WATER SAMPLED: 6/9/2015

**CLIENT SAMPLE #:** DETAILED SITE/POINT ID INFORMATION:

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 203 | PH | (EPA 9040C) | | | | | 6/27/2015 | | Logged |
| 848 | ICP TOTAL QSM | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Total Lead | | | | | | |
| 988 | ALKALINITY QSM | (EPA 310.2) | | | | 6/23/2015 | 6/27/2015 | | Logged |

Folder #: 111888 Company: *AECOM* Project: GULL ROCK

**SAMPLE #: 595906 DESCR: DUP-SW** PRIMARY / DETAILED MATRIX: AQUEOUS / SURFACE WATER **SAMPLED: 6/9/2015**

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 1017 | HARDNESS TOTAL QSM | (SM2340B/6010) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |

**SAMPLE #: 595907 DESCR: SW-5** PRIMARY / DETAILED MATRIX: AQUEOUS / SURFACE WATER **SAMPLED: 6/9/2015** **Time: 1030**

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 203 | PH | (EPA 9040C) | | | | | 6/27/2015 | | Logged |
| 848 | ICP TOTAL QSM | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Total Lead | | | | | | |
| 988 | ALKALINITY QSM | (EPA 310.2) | | | | 6/23/2015 | 6/27/2015 | | Logged |
| 1017 | HARDNESS TOTAL QSM | (SM2340B/6010) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |

**SAMPLE #: 595908 DESCR: G-25** PRIMARY / DETAILED MATRIX: SOLID / SOIL **SAMPLED: 6/9/2015** **Time: 0955**

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 8 | SOLIDS,PERCENT | (EPA 8000C) | | | | 6/23/2015 | 6/27/2015 | | Logged |
| 817 | ICP QSM | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Lead | | | | | | |

**SAMPLE #: 595909 DESCR: G-25** PRIMARY / DETAILED MATRIX: AQUEOUS / TCLP **SAMPLED: 6/9/2015** **Time: 0955**

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 1045 | ICP QSM TCLP | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedExt |
| | | | Lead | | | | | | |

**Folder #:** 111888 **Company:** *AECOM* **Project:** GULL ROCK

**SAMPLE #:** 595910 **DESCR:** G-21 **PRIMARY / DETAILED MATRIX:** SOLID / SOIL **SAMPLED:** 6/9/2015 **Time:** 1005

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 8 | SOLIDS,PERCENT | (EPA 8000C) | | | | 6/23/2015 | 6/27/2015 | | Logged |
| 817 | ICP QSM | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Lead | | | | | | |

**SAMPLE #:** 595911 **DESCR:** G-21 **PRIMARY / DETAILED MATRIX:** AQUEOUS / TCLP **SAMPLED:** 6/9/2015 **Time:** 1005

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 1045 | ICP QSM TCLP | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedExt |
| | | | Lead | | | | | | |

**SAMPLE #:** 595912 **DESCR:** G-22 **PRIMARY / DETAILED MATRIX:** SOLID / SOIL **SAMPLED:** 6/9/2015 **Time:** 1015

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 8 | SOLIDS,PERCENT | (EPA 8000C) | | | | 6/23/2015 | 6/27/2015 | | Logged |
| 817 | ICP QSM | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedPrep |
| | | | Lead | | | | | | |

**SAMPLE #:** 595913 **DESCR:** G-22 **PRIMARY / DETAILED MATRIX:** AQUEOUS / TCLP **SAMPLED:** 6/9/2015 **Time:** 1015

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 1045 | ICP QSM TCLP | (EPA 6010C) | | | | 12/6/2015 | 6/27/2015 | | NeedExt |
| | | | Lead | | | | | | |

**SAMPLE #:** 595914 **DESCR:** G-26 **PRIMARY / DETAILED MATRIX:** SOLID / SOIL **SAMPLED:** 6/9/2015 **Time:** 0945

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|

**Folder #:** 111888 **Company:** *AECOM* **Project:** GULL ROCK

**SAMPLE #:** 595914 **DESCR:** G-26 **PRIMARY / DETAILED MATRIX:** SOLID / SOIL **SAMPLED:** 6/9/2015 **Time:** 0945

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 8 | SOLIDS,PERCENT | (EPA 8000C) | | | | 6/23/2015 | 6/27/2015 | | Logged |
| 817 | ICP QSM | (EPA 6010C) | Lead | | | 12/6/2015 | 6/27/2015 | | NeedPrep |

**SAMPLE #:** 595915 **DESCR:** G-26 **PRIMARY / DETAILED MATRIX:** AQUEOUS / TCLP **SAMPLED:** 6/9/2015 **Time:** 0945

**CLIENT SAMPLE #:** **DETAILED SITE/POINT ID INFORMATION:**

| TEST# | TEST | TEST METHOD | ANALYTE | TEST GROUP | SPECIAL REQUIREMENTS | HOLD DATE | ANALYSIS DUE | RUSH | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| 1045 | ICP QSM TCLP | (EPA 6010C) | Lead | | | 12/6/2015 | 6/27/2015 | | NeedExt |

**Invoice Number:** 112369 **Preliminary Invoice Estimate:**

| Item | Matrix | Quantity | Price | Expedited TAT Surcharge | Total |
|---|---|---|---|---|---|
| ALKALINITY QSM | SURFACE WATER | 6 | $ 0.00 | 0.00 | $ 0.00 |
| HARDNESS TOTAL QSM | SURFACE WATER | 6 | $ 0.00 | 0.00 | $ 0.00 |
| ICP QSM Lead | SOIL | 4 | | 0.00 | |
| ICP QSM TCLP Lead | TCLP | 4 | | 0.00 | |
| ICP TOTAL QSM Total Lead | SURFACE WATER | 6 | | 0.00 | |
| PH | SURFACE WATER | 6 | $ 10.00 | 0.00 | $ 60.00 |
| SOLIDS,PERCENT | SOIL | 4 | $ 0.00 | 0.00 | $ 0.00 |
| Temporary Fuel Surcharge on lab supplies and services (if applicable): | | | | | $ 0.00 |

Bottle Information

| Container | # Containers | Tests |
|---|---|---|
| **HNO3** | **8** | HRD,ICP |
| **SOLIDS** | **8** | ICP |
| **UNPRES PL** | **8** | ALK,pH |

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# Sample Condition Report

Folder #: 111888
Client: AECOM

Project Name: GULL ROCK
Project Phase:

Coolers: 3711
Custody Seals Present : Y

Seal Intact? Y
Ship Method: UPS NEXT DAY AIR
Adequate Packaging: Y

Print Date / Time: 06/15/2015 15:25
Received Date / Time / By: 06/15/2015 1000 TKR

Log-In Date / Time / By: 06/15/2015 1525 TKR
Project #: 60289135 PM: PML

Temperature: 5.6 C On Ice: N
COC Present:? Y Complete? Y

Numbers: DATED AND SIGNED
Tracking Number: J455 345 0136
Temp Blank Enclosed? Y

Notes: SAMPLES RECEIVED IN GOOD CONDITION, BUT IN MELT WATER ONLY.

2 CUSTODY SEALS PRESENT AND INTACT ON COOLER, DATED AND SIGNED.

PAGE 2 OF 2 OF THE COCS ONLY HAD A TRIP BLANK DOCUMENTED ON IT FOR VOC ANALYSIS. THERE WERE NO VOCS ASSOCIATED WITH THE GULL ROCK SAMPLES AND THUS IT WAS NOT LOGGED IN.

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| 595902 SW-1 | | | | |
| | UNPRES PL | 1 | / | ALK,pH |
| | **Total # of Containers of Type** | **( *UNPRES PL* ) = 1** | | |
| 595902 SW-1 | | | | |
| | HNO3 | 1 | Y / | HRD,ICP |
| | **Total # of Containers of Type** | **( *HNO3* ) = 1** | | |

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| 595903 SW-2 | | | | |
| | UNPRES PL | 1 | / | ALK,pH |
| | UNPRES PL | 1 | / | ALK,pH |
| | UNPRES PL | 1 | / | ALK,pH |
| | **Total # of Containers of Type** | **( *UNPRES PL* ) = 3** | | |
| 595903 SW-2 | | | | |
| | HNO3 | 1 | Y / | HRD,ICP |
| | HNO3 | 1 | Y / | HRD,ICP |
| | HNO3 | 1 | Y / | HRD,ICP |
| | **Total # of Containers of Type** | **( *HNO3* ) = 3** | | |

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| 595904 SW-3 | | | | |
| | UNPRES PL | 1 | / | ALK,pH |

111888

| | | | | |
|---|---|---|---|---|
| | **Total # of Containers of Type** | ***( UNPRES PL )* = 1** | | |
| **595904** SW-3 | | | | |
| | HNO3 | 1 | Y / | HRD,ICP |
| | **Total # of Containers of Type** | ***( HNO3 )* = 1** | | |

| **Sample ID / Description** | **Container Type** | **Cond. Code** | **pH OK?/Filtered?** | **Tests** |
|---|---|---|---|---|
| **595905** SW-4 | | | | |
| | UNPRES PL | 1 | / | ALK,pH |
| | **Total # of Containers of Type** | ***( UNPRES PL )* = 1** | | |
| **595905** SW-4 | | | | |
| | HNO3 | 1 | Y / | HRD,ICP |
| | **Total # of Containers of Type** | ***( HNO3 )* = 1** | | |

| **Sample ID / Description** | **Container Type** | **Cond. Code** | **pH OK?/Filtered?** | **Tests** |
|---|---|---|---|---|
| **595906** DUP-SW | | | | |
| | UNPRES PL | 1 | / | ALK,pH |
| | **Total # of Containers of Type** | ***( UNPRES PL )* = 1** | | |
| **595906** DUP-SW | | | | |
| | HNO3 | 1 | Y / | HRD,ICP |
| | **Total # of Containers of Type** | ***( HNO3 )* = 1** | | |

| **Sample ID / Description** | **Container Type** | **Cond. Code** | **pH OK?/Filtered?** | **Tests** |
|---|---|---|---|---|
| **595907** SW-5 | | | | |
| | UNPRES PL | 1 | / | ALK,pH |
| | **Total # of Containers of Type** | ***( UNPRES PL )* = 1** | | |
| **595907** SW-5 | | | | |
| | HNO3 | 1 | Y / | HRD,ICP |
| | **Total # of Containers of Type** | ***( HNO3 )* = 1** | | |

| **Sample ID / Description** | **Container Type** | **Cond. Code** | **pH OK?/Filtered?** | **Tests** |
|---|---|---|---|---|
| **595908** G-25 | | | | |
| | SOLIDS | 1 | / | %SOL,ICP |
| | **Total # of Containers of Type** | ***( SOLIDS )* = 1** | | |

| **Sample ID / Description** | **Container Type** | **Cond. Code** | **pH OK?/Filtered?** | **Tests** |
|---|---|---|---|---|
| **595909** G-25 | | | | |
| | SOLIDS | 1 | / | ICP |
| | **Total # of Containers of Type** | ***( SOLIDS )* = 1** | | |

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595910** G-21 | | | | |
| | SOLIDS | 1 | / | %SOL,ICP |
| | **Total # of Containers of Type ( *SOLIDS* ) = 1** | | | |

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595911** G-21 | | | | |
| | SOLIDS | 1 | / | ICP |
| | **Total # of Containers of Type ( *SOLIDS* ) = 1** | | | |

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595912** G-22 | | | | |
| | SOLIDS | 1 | / | %SOL,ICP |
| | **Total # of Containers of Type ( *SOLIDS* ) = 1** | | | |

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595913** G-22 | | | | |
| | SOLIDS | 1 | / | ICP |
| | **Total # of Containers of Type ( *SOLIDS* ) = 1** | | | |

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595914** G-26 | | | | |
| | SOLIDS | 1 | / | %SOL,ICP |
| | **Total # of Containers of Type ( *SOLIDS* ) = 1** | | | |

| Sample ID / Description | Container Type | Cond. Code | pH OK?/Filtered? | Tests |
|---|---|---|---|---|
| **595915** G-26 | | | | |
| | SOLIDS | 1 | / | ICP |
| | **Total # of Containers of Type ( *SOLIDS* ) = 1** | | | |

| *Condition Code* | *Condition Description* |
|---|---|
| 1 | Sample Received OK |

# Case Narrative

**Client:** AECOM
**Project:** Gull Rock, Michigan
**Sample Receipt Date:** 06/15/2015
**SDG #:** 111888

Six water and four soil samples were received for pH, alkalinity, hardness, and metals analysis. The assigned sample ID number, date sampled, and date received are indicated in the attached Project Summary. The samples were received intact and at a temperature within method specified acceptance limits. A breakdown of sample receipt information can be found on the Sample Condition Report located in the last section of the data package and any exceptions are noted below.

**Sample Analysis and Quality Control**

***Metals Analysis:***

The samples were analyzed using US EPA SW-846 methodology 6010C. All samples were analyzed within the holding time. The following summaries of quality control procedures are included:

Initial and Continuing Calibration Verification
Blanks Summary
ICP Interference Check Data
Spike Sample Recovery
Duplicates Data
Laboratory Control Sample Data
Analysis Run Log

All analysis results met the method specified quality control criteria with the following exceptions:

**ICP Metals Analyses**

Continuing Calibration Verification (CCV) standards were analyzed at two levels (CCV1 & CCV2) with potentially differing wavelengths. Data associated with CCV's were evaluated based on the concentration of the element in the samples and compared to the appropriate CCV level/wavelength.

Some samples may have been analyzed and/or reanalyzed diluted to obtain results for all target analytes within the calibration range of the instrument.

Analytical Run # 115833

The Serial Dilution (L) for sample # 595903 was not applicable for lead because the parent sample raw result was less than 50 times the Limit of Quantitation (LOQ). A Post Digestion Spike (PDS) was analyzed and was acceptable. The parent sample was reported and not qualified.

The Duplicate (DUP) for sample # 595903 was not applicable for lead because the parent sample result was less than five times the LOQ. A Matrix Spike Duplicate (MSD) was analyzed to demonstrate precision and was acceptable. The parent sample was reported and not qualified.

**Client:** AECOM
**Project:** Gull Rock, Michigan
**Sample Receipt Date:** 06/15/2015
**SDG #:** 111888

***Metals Analysis Continued:***

The Matrix Spike (MS) for sample # 595903 exceeded the recovery limit for lead. A PDS was analyzed and was acceptable. The parent sample was reported and not qualified.

Analytical Run # 115840

Magnesium was detected in the Method Blank (MB) greater than the Method Detection Limit (MDL) but less than ½ the Reporting Limit (RL). Samples were reported and not qualified because the MB result was less than $1/10^{th}$ of the sample results.

The L for sample # 595903 was not acceptable for magnesium because the result exceeded the Relative Percent Difference (RPD) limit. A PDS was analyzed and was acceptable. The parent sample was reported and not qualified.

Analytical Run # 115839

The L for sample # 595908 was not applicable for lead because the parent sample raw result was less than 50 times the LOQ. A PDS was analyzed and was unacceptable. The parent sample was reported and qualified with an "M" flag for lead.

The MS and MSD for sample # 595908 exceeded the recovery limit for lead. A PDS was analyzed and was unacceptable. The parent sample was reported and qualified with an "M" flag for lead.

Analytical Run # 115935

The L for sample # 595909 was not applicable for lead because the parent sample raw result was less than 50 times the LOQ. A PDS was analyzed and was acceptable. The parent sample was reported and not qualified.

The DUP for sample # 595909 was not applicable for lead because the parent sample result was less than five times the LOQ. An MSD was analyzed to demonstrate precision and was acceptable. The parent sample was reported and not qualified.

The MS and MSD for sample # 595909 exceeded the recovery limit for lead. A PDS was analyzed and was acceptable. The parent sample was reported and not qualified.

***Inorganic Analyses:***

The samples were analyzed using US EPA Methods 9040C and 310.2. All samples were analyzed within the holding time. The following summaries of quality control procedures are included:

**Client:** AECOM
**Project:** Gull Rock, Michigan
**Sample Receipt Date:** 06/15/2015
**SDG #:** 111888

***Inorganics Analysis Continued:***

Duplicate Analysis Data
Laboratory Control Spike Data
Method Blank Data
Initial Calibration Summary
Calibration Check Summary
Analysis Run Log
Prep Log

All analysis results met the method specified quality control criteria with the following exceptions:

**Alkalinity Analyses**

<u>Analytical Run # 115996</u>

The Matrix Spike (MS) and the Matrix Spike Duplicate (MSD) for sample # 595903 had a high recovery. The parent sample result was qualified with an "M" flag.

**pH Analyses**

<u>Analytical Run # 115827</u>

All analysis results for this SDG met the method/project specified quality control criteria.

**% Solids Analyses**

<u>Analytical Run # 115862</u>

All analysis results for this SDG met the method/project specified quality control criteria.

## Data Qualifiers

| Code | Description |
|---|---|
| A | Analyte averaged calibration criteria within acceptable limits. |
| B | Analyte detected in associated Method Blank. |
| C | Toxicity present in BOD sample. |
| D | Diluted Out. |
| E | Safe, No Total Coliform detected. |
| F | Unsafe, Total Coliform detected, no E. Coli detected. |
| G | Unsafe, Total Coliform detected and E. Coli detected. |
| H | Holding time exceeded. |
| J | Estimated value. |
| L | Significant peaks were detected outside the chromatographic window. |
| M | Matrix spike and/or Matrix Spike Duplicate recovery outside acceptance limits. |
| N | Insufficient BOD oxygen depletion. |
| O | Complete BOD oxygen depletion. |
| P | Concentration of analyte differs more than 40% between primary and confirmation analysis. |
| Q | Laboratory Control Sample outside acceptance limits. |
| R | See Narrative at end of report. |
| S | Surrogate standard recovery outside acceptance limits due to apparent matrix effects. |
| T | Sample received with improper preservation or temperature. |
| U | Analyte concentration was not above the detection level. |
| V | Raised Quantitation or Reporting Limit due to limited sample amount or dilution for matrix background interference. |
| W | Sample amount received was below program minimum. |
| X | Analyte exceeded calibration range. |
| Y | Replicate/Duplicate precision outside acceptance limits. |
| Z | Calibration criteria exceeded. |

## MANUAL INTEGRATION REASON CODES

CTLaboratories has identified four general cases with valid reasons supporting the use of manual integration techniques. These codes are used on chromatograms in this data package to document the reasons for manual integrations per CTLaboratories' SOP SS-10 current revision.

**#1: Data system failed to select the correct peak or missed the peak entirely.**
In some cases the chromatography system selects and integrates the "wrong peak". In this case the analyst must correct the selection and force the system to integrate the proper peak. In other instances the system may miss the peak completely. In this case the analyst manually integrated the peak

**#2: Data System Splits the Peak Incorrectly or Integrates a False Peak as a Rider Peak.**
This phenomenon is common at low concentrations where the signal to noise ratio is low. A single compound (peak) is incorrectly split into multiple peaks or integrated as a main peak with one or more rider peaks resulting in low or high area counts for the target compound.

**#3: Improperly Integrated Isomers and/or coeluting compounds.**
For when the system fails to distinguish coeluting compounds and or isomers. The integration areas and concentrations may be inaccurate, and they must be corrected by manual integration. Prime examples are compounds that are unresolved and integrated improperly when present at low concentrations in standards or samples.

**#4: System Established Incorrect Baseline.**
There are numerous situations in chromatography where the system establishes the baseline incorrectly. Some baseline errors will be obvious to the analyst and may be corrected via manual procedures.

**#5: Miscellaneous.**
Some situations involving integration errors may require in-depth review and technical judgment. These cases should be brought to the attention of the group supervisor. If the form of manual integration is not clearly covered by these four cases, then review and approval by the group supervisor or the *QA/QC* Supervisor will be required.

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6

***DUPLICATES***

Sample Description

**G-25**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solid for Sample: | | Concentration Units: | mg/L |
| Analytical Prep Batch # | 1 | Analytical Preparation Date/Time | 52930 |
| Analytical Run #: | 115935 | ICAL Calibration #: | |
| Sample #: | 597568 | Parent Sample #: | 595909 |

**Analysis Type** *Initial Analysis*

| Analyte | Analysis Date/Tim | | RPD Limit | Original Parent Conc. (S) | C | Duplicate Conc. (D) | C | RPD | Q | M | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lead | 06/19/2015 | 18:32 | 20 | 0.0030 | J | 0.00477 | | 46 | | P | *FAIL* |

RL: 0.0040 mg/L Difference < RL

GAM 07/08/15

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Sample Description

**SW-2**

9

***ICP SERIAL DILUTION***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

Matrix: LIQUID

SDG No.: 111888

Concentration Units: ug/L

Sample No.: 597421

Parent Sample No.: 595903

LIMS Run #: 115840

ICAL Calibration #:.:

**Analysis Type** --------- **Initial Analysis**

| Analyte | Analysis Date/Time | | Initial Sample Result (I) | C (I) | Serial Dilution Result (S) | C (S) | % Diff. | Q | M | |
|---|---|---|---|---|---|---|---|---|---|---|
| Calcium | 06/17/2015 | 16:04 | 12500. | | 13650 | | 9 | | P | |
| Magnesium | 06/17/2015 | 16:04 | 2720. | | 3295 | | 21 | | P | *FAIL* |

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5A

*SPIKE SAMPLE RECOVERY*

Sample Description: **SW-2**

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

Matrix: LIQUID

SDG No.: 111888

% Solids for Sample:

Concentration Units: mg/L

Sample No 598964

Parent Sample No.: 595903

Analytical Prep Batch # 0

Analytical Preparation Date/Time:

Analytical Run #: 115996

ICAL Calibration #: 06222015

**Analysis Type** *Initial Analysis* **Analysis Date:** 06/22/2015 **Analysis Time:** 14:19

| Analyte | Control Limit (%R) | Spike Result | C (Spike) | Parent Result | C (Parent) | Spike Amount | %R | Q | M | |
|---|---|---|---|---|---|---|---|---|---|---|
| Alkalinity | 92-107 | 164 | | 41 | | 100 | 123 | | AS | *FAIL* |

BDL = analyte concentration was below detection limit

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5C

***SPIKE DUPLICATE SAMPLE RECOVERY***

Sample Description

**SW-2**

Lab Name: CT Laboratories
Matrix: LIQUID
% Solids for Sample:
Sample No 598965
Analytical Prep Batch # 0
Analytical Run #: 115996

Contract: AECOM-GULL ROCK
SDG No.: 111888
Concentration Units: mg/L
Parent Sample No.: 598964
Analytical Preparation Date/Time:
ICAL Calibration #: 06222015

**Analysis Type** *Initial Analysis* **Analysis Date:** —— 06/22/2015 **Analysis Time:** —— 14:20

| Analyte | Control Limit (%R) | Spike Result | C (Spike) | Parent Result | C (Parent) | Spike Amount | %R | Q | M | |
|---|---|---|---|---|---|---|---|---|---|---|
| Alkalinity | 92-107 | 159 | | 41 | | 100 | 118 | | AS | *FAIL* |

BDL = analyte concentration was below detection limit

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Sample No

MB

3-3

***METHOD BLANKS***

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

SDG No.: 111888

Analytical Run #: 115840

Lab Sample ID: 596107

Analytical Prep Batch # 52893

Preparation Date/Time: 06/16/2015 12:00

ICAL Calibration #:

Concentration Units: mg/L

**Analysis Type: Initial Analysis**

| Analyte | Analysis Date/Time | Measured Concentration | C*** | Detection Limit** | Control Limit | |
|---|---|---|---|---|---|---|
| Calcium | 06/17/2015 15:37 | 0.0143 | U | 0.017 | 0.050 | |
| Magnesium | 06/17/2015 15:37 | 0.00790 | | 0.006 | 0.020 | FAIL |

** Detection Limit only reported if value was less than the control limit.
***A "U" indicates the analyte was not detected in the method blank at the detection limit or the Control Limit whichever was
less.

Sample Name: mbw52893 92 Acquired: 06/17/2015 15:37:32 Type: Unk
Method: DOD Calibration Updated 060614(v644) Mode: CONC Corr. Factor: 1.000000
User: NAH ICAP6500: Prep Batch: Post Digestion dilution: 1
Comment:

| Elem | Ag3280 | Al1670 | As1937 | Ba4554 | Be3130 | Ca3933 | Cd2265 | Co2286 | Cr2677 | Cu2247 | Fe2599 | Mg2802 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **-.931** | **-1.50** | **3.05** | **-.738** | **-.026** | **14.3** | **-1.43** | **-.111** | **-3.16** | **-.164** | **9.01** | **7.90** |
| Stddev | 2.71 | 1.51 | 1.66 | .063 | .109 | 6.4 | .13 | .127 | 1.59 | .142 | .98 | 2.43 |
| %RSD | 291. | 100. | 54.3 | 8.47 | 423. | 44.9 | 8.95 | 114. | 50.3 | 86.3 | 10.9 | 30.8 |

| Elem | Mn2576 | Mo2020 | Ni2316 | Pb2203 | Sb2175 | Se1960 | Tl1908 | V_2924 | Zn2138 |
|---|---|---|---|---|---|---|---|---|---|
| Units | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| Avg | **.344** | **-.418** | **.078** | **.823** | **.361** | **14.1** | **.634** | **-.263** | **.065** |
| Stddev | .209 | .373 | .298 | 1.28 | 2.51 | 9.1 | 3.73 | 2.48 | .230 |
| %RSD | 60.7 | 89.3 | 382. | 156. | 693. | 64.5 | 588. | 942. | 355. |

| Int. Std. | Y_2243 | Y_3710 |
|---|---|---|
| Units | Cts/S | Cts/S |
| Avg | **71785.** | **333030.** |
| Stddev | 448. | 10465. |
| %RSD | .62437 | 3.1424 |

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Sample Description

**G-25**

**5C**

***SPIKE DUPLICATE SAMPLE RECOVERY***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solids for Sample: | | Concentration Units: | mg/L |
| Sample No | 597570 | Parent Sample No.: | 597569 |
| Analytical Prep Batch # | 52930 | Analytical Preparation Date/Time: | 06/19/2015 07:00 |
| Analytical Run #: | 115935 | ICAL Calibration #: | |

| Analysis Type | *Initial Analysis* | Analysis Date: —— | 06/19/2015 | Analysis Time: —— | 18:42 |
|---|---|---|---|---|---|

| Analyte | Control Limit (%R) | Spike Result | C (Spike) | Parent Result | C (Parent) | Spike Amount | %R | Q | M | |
|---|---|---|---|---|---|---|---|---|---|---|
| Lead | 80-120 | 0.132 | | 0.0030 | J | 0.200 | 64 | | P | *FAIL* |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

5A

***SPIKE SAMPLE RECOVERY***

Sample Description

**G-25**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | SOLID | SDG No.: | 111888 |
| % Solids for Sample: | 95.1 | Concentration Units: | mg/kg |
| Sample No | 596031 | Parent Sample No.: | 595908 |
| Analytical Prep Batch # | 52891 | Analytical Preparation Date/Time: | 06/16/2015 10:00 |
| Analytical Run #: | 115839 | ICAL Calibration #: | |

| Analysis Type | *Initial Analysis* | Analysis Date: | 06/17/2015 | Analysis Time: | 01:25 |
|---|---|---|---|---|---|

| Analyte | Control Limit (%R) | Spike Result | C (Spike) | Parent Result | C (Parent) | Spike Amount | %R | Q | M | |
|---|---|---|---|---|---|---|---|---|---|---|
| Lead | 80-120 | 18.0 | | 3.3 | | 27.2 | 54 | | P | *FAIL* |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

5A

*SPIKE SAMPLE RECOVERY*

Sample Description

**SW-2**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solids for Sample: | | Concentration Units: | ug/L |
| Sample No | 596105 | Parent Sample No.: | 595903 |
| Analytical Prep Batch # | 52892 | Analytical Preparation Date/Time: | 06/16/2015 12:00 |
| Analytical Run #: | 115833 | ICAL Calibration #: | |

Analysis Type *Initial Analysis* Analysis Date: 06/17/2015 Analysis Time: 16:13

| Analyte | Control Limit (%R) | Spike Result | C (Spike) | Parent Result | C (Parent) | Spike Amount | %R | Q | M | |
|---|---|---|---|---|---|---|---|---|---|---|
| Total Lead | 80-120 | 155 | | BDL | U | 200 | 78 | | P | *FAIL* |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

Sample Description

**G-25**

**5A**

***SPIKE SAMPLE RECOVERY***

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solids for Sample: | | Concentration Units: | mg/L |
| Sample No | 597569 | Parent Sample No.: | 595909 |
| Analytical Prep Batch # | 52930 | Analytical Preparation Date/Time: | 06/19/2015 07:00 |
| Analytical Run #: | 115935 | ICAL Calibration #: | |

**Analysis Type** *Initial Analysis* **Analysis Date: ----** 06/19/2015 **Analysis Time: -------** 18:37

| Analyte | Control Limit (%R) | Spike Result | C (Spike) | Parent Result | C (Parent) | Spike Amount | %R | Q | M | |
|---|---|---|---|---|---|---|---|---|---|---|
| Lead | 80-120 | 0.126 | | 0.0030 | J | 0.200 | 62 | | P | *FAIL* |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

5B

**POST DIGESTION SPIKE SAMPLE RECOVERY**

Sample Description

**SW-2**

Lab Name: CT Laboratories

Contract: AECOM-GULL ROCK

Matrix: LIQUID

SDG No.: 111888

% Solids for Sample:

Concentration Units: ug/L

Sample No 597442

Parent Sample No.: 595903

Analytical Prep Batch # 0

Analytical Preparation Date/Time:

Analytical Run #: 115833

ICAL Calibration #:

**Analysis Type** *Initial Analysis* **Analysis Date:** — 06/17/2015 **Analysis Time:** — 16:22

| Analyte | Control Limit (%R) | Spike Result | C (Spike) | Parent Result | C (Parent) | Spike Amount | %R | Q | M |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 80-120 | 877 | | BDL | U | 1000 | 88 | | P |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

5B

**POST DIGESTION SPIKE SAMPLE RECOVERY**

Sample Description: **G-25**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | SOLID | SDG No.: | 111888 |
| % Solids for Sample: | 95.1 | Concentration Units: | ug/L |
| Sample No | 597682 | Parent Sample No.: | 595908 |
| Analytical Prep Batch # | | Analytical Preparation Date/Time: | |
| Analytical Run #: | 115839 | ICAL Calibration #: | |

**Analysis Type** *Initial Analysis* **Analysis Date:** 06/17/2015 **Analysis Time:** 01:33

| Analyte | Control Limit (%R) | Spike Result | C (Spike) | Parent Result | C (Parent) | Spike Amount | %R | Q | M | |
|---|---|---|---|---|---|---|---|---|---|---|
| Lead | 80-120 | 677 | | 124 | | 1000 | 55 | | P | *FAIL* |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

5B

***POST DIGESTION SPIKE SAMPLE RECOVERY***

Sample Description

**G-25**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solids for Sample: | | Concentration Units: | mg/L |
| Sample No | 598453 | Parent Sample No.: | 595909 |
| Analytical Prep Batch # | 0 | Analytical Preparation Date/Time: | |
| Analytical Run #: | 115935 | ICAL Calibration #: | |

**Analysis Type** *Initial Analysis* **Analysis Date:** 06/19/2015 **Analysis Time:** 18:47

| Analyte | Control Limit (%R) | Spike Result | C (Spike) | Parent Result | C (Parent) | Spike Amount | %R | Q | M |
|---|---|---|---|---|---|---|---|---|---|
| Lead | 80-120 | 0.885 | | 0.0030 | J | 1 | 88 | | P |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

5C

***SPIKE DUPLICATE SAMPLE RECOVERY***

Sample Description

**G-25**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | SOLID | SDG No.: | 111888 |
| % Solids for Sample: | 95.1 | Concentration Units: | mg/kg |
| Sample No | 596032 | Parent Sample No.: | 596031 |
| Analytical Prep Batch # | 52891 | Analytical Preparation Date/Time: | 06/16/2015 10:00 |
| Analytical Run #: | 115839 | ICAL Calibration #: | |

**Analysis Type** *Initial Analysis* **Analysis Date:** 06/17/2015 **Analysis Time:** 01:29

| Analyte | Control Limit (%R) | Spike Result | C (Spike) | Parent Result | C (Parent) | Spike Amount | %R | Q | M | |
|---|---|---|---|---|---|---|---|---|---|---|
| Lead | 80-120 | 16.5 | | 3.3 | | 25.4 | 52 | | P | *FAIL* |

BDL = analyte concentration was below detection limit

CT LABORATORIES
delivering more than data from your environmental analyses

5C

*SPIKE DUPLICATE SAMPLE RECOVERY*

Sample Description

**SW-2**

| | | | |
|---|---|---|---|
| Lab Name: | CT Laboratories | Contract: | AECOM-GULL ROCK |
| Matrix: | LIQUID | SDG No.: | 111888 |
| % Solids for Sample: | | Concentration Units: | ug/L |
| Sample No | 596106 | Parent Sample No.: | 596105 |
| Analytical Prep Batch # | 52892 | Analytical Preparation Date/Time: | 06/16/2015 12:00 |
| Analytical Run #: | 115833 | ICAL Calibration #: | |

**Analysis Type** *Initial Analysis* **Analysis Date:** ---- **06/17/2015** **Analysis Time:** ---- **16:17**

| Analyte | Control Limit (%R) | Spike Result | C (Spike) | Parent Result | C (Parent) | Spike Amount | %R | Q | M |
|---|---|---|---|---|---|---|---|---|---|
| Total Lead | 80-120 | 160 | | BDL | U | 200 | 80 | | P |

BDL = analyte concentration was below detection limit

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# Appendix E – Risk Evaluation

## Appendix E

## Risk Evaluation of Soil on Gull Rock

### Introduction

The United States Coast Guard's Gull Rock Light Station (Site) is located on Gull Rock in Lake Superior, approximately 2.5 miles east of Keweenaw Point on the Keweenaw Peninsula in Michigan's Upper Peninsula (Figure 1). The light was automated in 1913, and the site is generally no longer occupied. A risk evaluation was conducted to determine potential risks to public health and the environment due to lead-based paint contamination in soil and surface water. A Project Action Limit (PAL) of 400 mg/kg for lead was established as a concentration in soil below which human health would be protected. This value is based on a residential scenario, which is an unlikely scenario for this site since it is not used for long term human occupancy and is mainly unoccupied. Therefore, the risk evaluation identified alternative cleanup levels (ACLs) to determine if lead concentrations in site soils pose a risk to human health or the natural environment, based on current and reasonably anticipated future land-use scenarios at the site.

### Background

A Phase I Environmental Site Assessment (ESA) was conducted for the Gull Rock Light Station in 1997 (Woodward-Clyde Federal Services, November 1997), followed by a Phase II ESA in 2004 (ENSR, February 2005*)*. The Phase II ESA included 17 shallow hand auger borings (G-1 through G-17) that were advanced around the Gull Rock Light Station structure (Figure 2). An x-ray fluorescence (XRF) analyzer was used for field screening of lead in 17 soil samples collected from 0 to 6 inches below ground surface (bgs). Based on these XRF screening results, 11 of these 17 soil samples (G-1 through G-11) were submitted for laboratory analysis of lead. Based on the results of the Phase II ESA, the only chemical of concern at the Site is lead, which originated from the historical use of lead-based paint at the Site.

In order to delineate and characterize the documented lead impacts in soil discovered during the 2004 Phase II activities, additional soil samples were collected at the Site in June 2015. Surface water samples were also collected from around the island to evaluate potential impacts from lead on the aquatic environment of Lake Superior.

Soil and surface water samples were collected on June 9, 2015 from locations shown on Figure 3 and analyzed for lead. Only four soil samples could be collected in this area because the island consists almost entirely of rock. Lead was not detected in any of the five surface water samples collected; therefore, any potential effects from lead in surface water are considered minimal, and it is not evaluated further.

A PAL for lead in soil was established in the United States Environmental Protection Agency (USEPA) approved Quality Assurance Project Plan (QAPP) (AECOM, April 2015). The PAL was based on the USEPA Regional Screening Level (RSL) and the Michigan Department of Environmental Quality (MDEQ) criterion for lead in soil in a residential scenario. The more conservative of the two values (400 mg/kg) was established as the PAL. Although lead concentrations detected in the four soil samples collected in 2015 did not exceed the PAL, several concentrations detected in the locations sampled in 2004 did exceed the PAL (Table 1). Because the PAL is conservatively based on protection of human health in a residential scenario, an unlikely occurrence at this site, risk-based ACLs were identified in order to determine if lead concentrations in the soil on the Site pose a risk to human health or the natural environment. ACLs for both human and ecological receptors are identified in the following sections.

## Exposure Assessment

The Gull Rock Light Station was constructed in 1867. Gull Rock island is approximately 150 feet wide and 250 feet long. The station originally consisted of a keeper's dwelling (built as a one and one half-story, square, wood-frame, brick building with an adjoining light tower), oil house (built in 1906), boat house, and a brick privy. The oil house and boat house structures have since been demolished. In 1901, a 40-foot long retaining wall was constructed around the northeast corner of the keeper's dwelling/light tower to prevent wave damage. The light was automated in 1913 and has been converted to solar/battery power. Currently, no one resides on the island full-time, and the site is generally unoccupied. Under existing and future land use conditions, receptors with the potential to be exposed to site contamination include a person who visits the site during the warmer months of summer and fall for recreational purposes. The person might visit the site to explore the lighthouse and grounds or fish from the shoreline or picnic on the grounds.

For development of the alternative land use scenario, the assumption is made that each of these individuals might conservatively visit the site one day per week during the three month period of warmest weather, spending one or two hours at most during each visit. Potential pathways for recreational visitors to be exposed to surface soil include incidental ingestion, dermal absorption, and inhalation of particulates. Exposure factors, including exposure frequency, duration, and time, would be similar for both types of recreational visitors.

## Human Health Risk Evaluation

USEPA considers lead a special-case chemical and evaluates human exposure to it by the use of blood-lead modeling to relate soil lead intake to blood lead concentrations. For the Gull Rock Light Station, two USEPA models were considered: The Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children (USEPA, 2007) and the Adult Lead Methodology (ALM; USEPA, 2009). The IEUBK model estimates blood lead levels in children exposed to lead, and the ALM focuses on estimating fetal blood lead concentrations in non-resident adults. Based on the location and site characteristics of the Site, an adult visiting the Site to fish or picnic is considered the most likely receptor, and the ALM was chosen as the best model to use in evaluating that receptor.

The ALM relates soil lead intake to blood lead concentrations in women of child-bearing age. As a result of exposure to lead, a female worker or visitor may develop a "body burden" that may be transferred to a fetus several years after exposure ends. It is assumed that a cleanup goal protective of the fetus would also be protective of a male or female adult. A blood lead level of 10 micrograms per deciliter (µg/dL) has been designated by USEPA (November 2013) as a level of concern to protect sensitive populations (children) as well as adults. USEPA's stated goal for lead is that children exposed to a risk-based cleanup level would have no more than a five percent probability of exceeding the 10 µg/dL level of concern. The ALM extends this concept to develop cleanup goals preventive of fetal risk.

The ALM model was used to determine a screening level for the Site (Table 2). This screening level is the lead concentration in soil that would result in no more than a 5 percent probability of a fetal blood lead level exceeding 10 µg/dL. Most default values in the model were retained, as they are supported by the most current studies and literature. However, the default values are based on a worker exposure, and several of the exposure factors are not representative of a recreational exposure. Therefore, the default averaging time of 365 days per year was revised to 90 days per year, based on the length of time (three months) a receptor would be able to visit the Site over the course of a year due to climatic conditions. The exposure frequency of 219 days per year was revised to 13 days per year, reflecting one weekly visit to the same Site over the course of three months. Using these factors, the model calculated a lead screening level for soil of 9,303 mg/kg.

This value of 9,303 mg/kg can be used as an ACL for the Site. Any concentrations less than 9,303 mg/kg will not pose a risk to human receptors under current and reasonably anticipated future land use scenarios. However, the default residential value of 400 mg/kg is still the standard by which unrestricted use/No Further Action (NFA) should be measured.

Table 1 presents a comparison of the soil lead concentrations to both the PAL and the ACL for human health. Seven locations have lead concentrations that exceed the PAL, but none exceed the ACL. USEPA's ProUCL software was used to calculate summary statistics for the data set, including the mean, maximum, and 95 percent upper confidence level of the mean (95% UCL). As shown on Table 1, each of these values exceeds the PAL but does not exceed the ACL.

As mentioned above, seven of the locations (G-1, G-4, G-5, G-8, G-9, G-10, and G-11) have lead concentrations that exceed the PAL (400 mg/kg). However, not all locations will need to be remediated in order to achieve the PAL. A desktop virtual remediation exercise was conducted to determine which locations would need to be remediated in order to achieve the PAL of 400 mg/kg. The rationale for this is based on the potential receptor exposure to site contamination. The assumption is that a receptor would be equally exposed to contamination throughout the Site and therefore the exposure potential is best represented by a sitewide mean concentration (conservatively estimated based on the 95 percent upper confidence level of the mean [95% UCL]). The desktop virtual remediation was conducted by ranking all Site concentrations from high to low and then removed the highest concentration locations one-by one and re-running the 95% UCL concentrations until the point where the sitewide concentration is below the PAL. This exercise determined that remediation of six of these locations (G-1, G-4, and G-5 along the western wall of the main structure; and G-8, G-10, and G-11 along the southern wall of this structure) would produce a 95% UCL that is below the unrestricted residential level of 400 mg/kg.

## Ecological Risk Evaluation

Gull Rock Light Station is an irregularly shaped, rocky island with an area of approximately 0.7 acre. The limited soil present generally consists of silt to a depth of approximately six inches bgs. The weathered bedrock is a sandstone conglomerate. The center of the island is covered by the brick lighthouse/former keeper's dwelling and privy. Vegetation on the island is very sparse. In areas where vegetation is present, such as around the lighthouse, the plants species identified were typical of disturbed areas and consist of herbs and a few shrubs.

A rare species review by the Michigan Natural Features Inventory identified no recorded occurrences of federally listed species within 1.5 mile of the island. The state listed or state special concern species within this area include herbaceous plants and the bald eagle. None of these species is known to occur on the Site. A field survey completed on June 9, 2015 found no threatened or endangered species present on the Site. In addition, this survey found no evidence of avian nesting activities.

Ecological receptors on the Site potentially could be exposed directly to the contaminant identified in surface soil, lead. Transport of lead from soil to surface water surrounding the island potentially could occur through soil erosion; however, lead was not detected in surface water. The ecological receptors observed on the island are relatively common vegetation species typical of disturbed areas. As such, these few plants are not considered to warrant identification as assessment endpoints. Another category of receptors with the potential to occur on the island occasionally during the summer are birds, particularly piscivorous shorebirds such as gulls and terns. Therefore, these shorebirds are identified as assessment endpoints. Birds have not been observed nesting on the island. Ingestion of soil to obtain grit for digestion is the only pathway by which shorebirds visiting the Site may have the potential for exposure to lead in soil.

USEPA has developed Ecological Soil Screening Levels (Eco-SSLs) to be used as conservative screening levels protective of ecological receptors that commonly come into contact with soil or ingest biota that live in or on soil (USEPA 2005). Eco-SSLs were derived separately for plants, soil invertebrates, mammals, and birds. Only the Eco-SSLs for birds are relevant to the assessment endpoint for the Site. Avian Eco-SSLs were derived for three avian receptor groups: herbivores (dove), ground insectivores (woodcock), and carnivores (hawk).

The Eco-SSL for the hawk is the most relevant SSL to a shorebird. However, there are significant differences between the exposure pathways and frequencies assumed in calculation of the hawk SSL and the potential exposures of shorebirds to lead in soil on the Site. For example, derivation of the hawk SSL assumed a diet consisting entirely of small mammals that are exposed to lead-contaminated soil and 100 percent use of the Site as a source for the hawk's diet. In contrast, shorebirds feed on fish and other aquatic organisms that are not exposed to soil, and the Site would be expected to provide no more than a small proportion of the soil ingested for grit given the very small area of the island relative to the large foraging ranges of shorebirds and their infrequent use of the island during only a portion of the year. Thus, the Eco-SSL based on a hawk is an extremely conservative basis for screening lead levels in soil on the Site.

The Eco-SSL for the hawk (avian carnivore) is 510 mg/kg in soil. This SSL is exceeded by the mean lead level in the soil samples collected on the Site (716 mg/kg). Calculation of a hazard quotient (HQ) based on the mean and the SSL yields an HQ of 1.4. Calculation of an HQ based on the maximum detected concentration (2,350 mg/kg) yields an HQ of 4.6. Seven soil samples adjacent to the walls of the lighthouse/former keeper's dwelling exceed the SSL. None of the eight soil samples from other parts of the island away from the dwelling exceed the SSL. Thus, the mean concentration only slightly exceeds the SSL, and the maximum detected concentration and other exceedances of the SSL occur at locations adjacent to the structure. If the exposure concentrations for a shorebird on Gull Rock were modified by an area use factor that reflects its infrequent use of the island but is still conservative (e.g., 20 percent), the resulting mean (143 mg/kg) and maximum concentration (470 mg/kg) would be less than the SSL. This remains a highly conservative comparison because USEPA's derivation of the SSL assumes a diet 100 percent contaminated by lead from the site. In reality, lead was not detected in surface water around the island, and the aquatic organisms (fish and invertebrates) consumed by shorebirds would not come in contact with lead in terrestrial soil on the island. Thus, the food consumed by shorebirds would not be expected to contain elevated levels of lead from island soil.

In summary, the potential for exposures of ecological receptors to the small area of contaminated soil on the Site is minimal. The avian receptors evaluated as assessment endpoints have a very limited potential for exposure to lead-contaminated soil on the island and would be present for only the warmer portion of the year. The results of the screening of soil concentrations and consideration of the basis of the SSLs indicate that the lead concentrations in soil on the Site do not pose significant risk to ecological assessment endpoints. Remedial activities would not need to be conducted to be protective of ecological receptors.

## References


AECOM, 2015. *Quality Assurance Project Plan - Gull Rock Light Station CERCLA Investigation*. March 18.

ENSR, 2005. *Phase II Environmental Site Assessment for the USCG Gull Rock Light in Copper Harbor, Michigan*. February 4.

United States Environmental Protection Agency (USEPA), 2005. *Ecological Soil Screening Levels (Eco-SSLs)*, OSWER Directive 9285.7-70.

United States Environmental Protection Agency (USEPA), 2007. *User's Guide for the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK)*. EPA-9285.7-42. May.

United States Environmental Protection Agency (USEPA), 2009. *Update of the Adult Lead Methodology's Default Baseline Blood Lead Concentration and Geometric Standard Deviation Parameters*. OSWER 9200.2-82. June.

United States Environmental Protection Agency (USEPA), 2013. *Frequent Questions from Risk Assessors on the Adult Lead Methodology (ALM)*. Last updated November 25, 2013.

Woodward-Clyde Federal Services, 1997. *Phase I Environmental Site Assessment: Gull Rock Light, Keweenaw County, Michigan*. November 21.

**Attachment 1**
**ProUCL Output**
**United States Coast Guard - Gull Rock Light Station**

UCL Statistics for Uncensored Full Data Sets

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | 10/3/2015 9:23:38 AM |
| From File | gull rock data for Pro UCL.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operatio | 2000 |

Lead

General Statistics

| | | | |
|---|---|---|---|
| **Total Number of Observations** | **15** | Number of Distinct Observations | 14 |
| | | Number of Missing Observations | 0 |
| Minimum | 3.3 | **Mean** | **715.9** |
| **Maximum** | **2350** | Median | 330 |
| SD | 774.1 | Std. Error of Mean | 199.9 |
| Coefficient of Variation | 1.081 | Skewness | 1.197 |

Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.835 | Shapiro Wilk GOF Test |
| 5% Shapiro Wilk Critical Value | 0.881 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.224 | Lilliefors GOF Test |
| 5% Lilliefors Critical Value | 0.229 | Data appear Normal at 5% Significance Level |

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

| | | | |
|---|---|---|---|
| 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
| 95% Student's-t UCL | 1068 | 95% Adjusted-CLT UCL (Chen-1995) | 1111 |
| | | 95% Modified-t UCL (Johnson-1978) | 1078 |

Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.317 | Anderson-Darling Gamma GOF Test |
| 5% A-D Critical Value | 0.788 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.122 | Kolmogrov-Smirnoff Gamma GOF Test |
| 5% K-S Critical Value | 0.233 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.572 | k star (bias corrected MLE) | 0.502 |
| Theta hat (MLE) | 1252 | Theta star (bias corrected MLE) | 1427 |
| nu hat (MLE) | 17.15 | nu star (bias corrected) | 15.05 |
| MLE Mean (bias corrected) | 715.9 | MLE Sd (bias corrected) | 1011 |
| | | Approximate Chi Square Value (0.05) | 7.299 |
| Adjusted Level of Significance | 0.0324 | Adjusted Chi Square Value | 6.643 |

Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 1477 | 95% Adjusted Gamma UCL (use when n<50) | 1622 |

**Attachment 1**
**ProUCL Output**
**United States Coast Guard - Gull Rock Light Station**

| | | | |
|---|---|---|---|
| Lognormal GOF Test | | | |
| Shapiro Wilk Test Statistic | 0.851 | Shapiro Wilk Lognormal GOF Test | |
| 5% Shapiro Wilk Critical Value | 0.881 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.208 | Lilliefors Lognormal GOF Test | |
| 5% Lilliefors Critical Value | 0.229 | Data appear Lognormal at 5% Significance Level | |
| Data appear Approximate Lognormal at 5% Significance Level | | | |
| | | | |
| Lognormal Statistics | | | |
| Minimum of Logged Data | 1.194 | Mean of logged Data | 5.485 |
| Maximum of Logged Data | 7.762 | SD of logged Data | 2.132 |
| | | | |
| Assuming Lognormal Distribution | | | |
| 95% H-UCL | 36539 | 90% Chebyshev (MVUE) UCL | 4677 |
| 95% Chebyshev (MVUE) UCL | 6063 | 97.5% Chebyshev (MVUE) UCL | 7986 |
| 99% Chebyshev (MVUE) UCL | 11765 | | |
| | | | |
| Nonparametric Distribution Free UCL Statistics | | | |
| Data appear to follow a Discernible Distribution at 5% Significance Level | | | |
| | | | |
| Nonparametric Distribution Free UCLs | | | |
| 95% CLT UCL | 1045 | 95% Jackknife UCL | 1068 |
| 95% Standard Bootstrap UCL | 1028 | 95% Bootstrap-t UCL | 1212 |
| 95% Hall's Bootstrap UCL | 1185 | 95% Percentile Bootstrap UCL | 1052 |
| 95% BCA Bootstrap UCL | 1120 | | |
| 90% Chebyshev(Mean, Sd) UCL | 1316 | 95% Chebyshev(Mean, Sd) UCL | 1587 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1964 | 99% Chebyshev(Mean, Sd) UCL | 2705 |
| | | | |
| **Suggested UCL to Use** | | | |
| **95% Student's-t UCL** | **1068** | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

**Table 1**
**Lead in Soil**
**United States Coast Guard - Gull Rock Light Station**

**Analytical Results**

| Sample ID<br>Date Collected | G-1<br>2004 | G-2<br>2004 | G-3<br>2004 | G-4<br>2004 | G-5<br>2004 | G-6<br>2004 | G-7<br>2004 | G-8<br>2004 | G-9<br>2004 | G-10<br>2004 | G-11<br>2004 | G-21<br>6/9/2015 | G-22<br>6/9/2015 | G-23<br>6/9/2015 | G-24<br>6/9/2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lead | 760 | 300 | 330 | 1360 | 1270 | 120 | 330 | 2240 | 540 | 2350 | 920 | 194 | 18.4 | 3.3 | 3.4 |

**Statistics [1]**

| Sample ID<br>Date Collected | PAL | ACL | Mean | Max | 95%<br>UCL |
|---|---|---|---|---|---|
| Lead | 400 | 9303 | 716 | 2350 | 1068 |

Notes:
[1] Statistics calculations are shown on Attachment 1.
All concentrations are in mg/kg (parts per million)
ACL - Alternative Cleanup Level
PAL - Project Action Limit
Shading indicates an exceedance of the PAL.

**Table 2**
**Calculation of Alternative Cleanup Level for Lead in Soil**
**United States Coast Guard - Gull Rock Light Station**

| Variable | Description of Variable | Units | $GSD_i$ and $PbB_o$ from Analysis of NHANES 1999-2004 |
|---|---|---|---|
| $PbB_{fetal, 0.95}$ | 95th percentile PbB in fetus | ug/dL | 10 |
| $R_{fetal/maternal}$ | Fetal/maternal PbB ratio | -- | 0.9 |
| BKSF | Biokinetic Slope Factor | ug/dL per ug/day | 0.4 |
| $GSD_i$ | Geometric standard deviation PbB | -- | 1.8 |
| $PbB_0$ | Baseline PbB | ug/dL | 1.0 |
| $IR_S$ | Soil ingestion rate (including soil-derived indoor dust) | g/day | 0.050 |
| $AF_{S, D}$ | Absorption fraction (same for soil and dust) | -- | 0.12 |
| $EF_{S, D}$ | Exposure frequency (same for soil and dust) | days/year | 13 |
| $AT_{S, D}$ | Averaging time (same for soil and dust) | days/year | 90 |
| **ACL** | | **ppm** | **9,303** |

**Notes:**
ACL - alternative cleanup level
PbB - blood lead level
NHANES - National Health and Nutrition Examination Survey
g/day - grams per day
ppm - parts per million
ug/dL - micrograms per deciliter
ug/day - micrograms per day
$EF_{S,D}$ was revised from 219 days/year to 13 days/year reflecting one weekly visit to the same site over the course of 3 months
$AT_{S,D}$ was revised from 365 days/year to 90 days/year reflecting 3 months of warm weather during which the site might be visited.

**Source:**
U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee, version date 6/21/09

# Appendix F – Applicable or Relevant and Appropriate Correspondence

**U.S. Department of Homeland Security**

**United States Coast Guard**

Commanding Officer
United States Coast Guard
Civil Engineering Unit Cleveland

1240 East Ninth Street
Room 2179
Cleveland Ohio 44199-2060
Staff Symbol:ER
Phone: (216) 902-6219
Fax: (216) 902-6277
Email:
Gregory.O.Carpenter@uscg.mil

11000

SEP 08 2015

Michigan Department of Environmental Quality
Remediation and Redevelopment Division
Mr. Robert Wagner
Constitution Hall, South Tower, 5th Floor
525 West Allegan Street
PO Box 30426
Lansing, Michigan 48909-7926

Dear Mr. Wagner:

The purpose of this letter is to request the identification of specific requirements that are considered applicable or relevant and appropriate (ARAR) for the investigation and possible remediation of metals and petroleum in soil at United States Coast Guard (USCG) Gull Rock Lighthouse (Facility ID 42000019) and USCG Manitou Island Lighthouse (Facility ID 42000020), both located in Keweenaw County, Michigan.

As provided in Executive Order 12580 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the USCG is acting as the lead agency for removal response actions planned at USCG Gull Rock Lighthouse and USCG Manitou Island Lighthouse. At this time, the USCG anticipates remediation could include localized removal of surface soils. The reasonably anticipated future use of the site is divestiture to a public or private organization.

This request is made pursuant to 40 CFR Section 300.400(g)(5) of the NCP. As provided in the NCP, we request a response from you within 30 working days of the receipt of this letter. The ARARs provided will be addressed in an Engineering Evaluation and Cost Analysis (EE/CA) to be completed and made available for public review and comment prior to remediation. It is our current intention to complete the assessment this fall and begin remediation in summer 2016 or 2017. If you have any questions, please contact Mr. Wayne Kean of my staff at (216) 902-6258 or wayne.e.kean@uscg.mil. Thank you for your assistance.

Sincerely,

G. O. C.

Gregory O. Carpenter
Chief, Environmental Compliance
By direction of the Commanding Officer

Copy: Mr. Owen Thompson, USEPA Region V

RICK SNYDER
GOVERNOR

DAN WYANT
DIRECTOR

September 28, 2015

United States Department of Homeland Security
United States Coast Guard
Attn: Mr. Gregory Carpenter
1240 East Ninth Street, Room 2179
Cleveland, OH 44199-2060

Dear Mr. Carpenter:

SUBJECT: Michigan Department of Environmental Quality (MDEQ) Identification of Applicable, Relevant, and Appropriate Requirements (ARARs) United States Coast Guard (USCG) Manitou Island and Gull Island Lighthouse Sites, Keweenaw County, MI

Thank you for your recent letter to Mr. Robert Wagner, Chief, Remediation and Redevelopment Division, requesting that the MDEQ identify all ARARS in regards to the anticipated response activities at the subject sites. Mr. Wagner has referred your concerns to me for a response.

The anticipated activities should comply with the State regulations identified in the enclosed table. Which regulations directly apply will depend on what response activities are selected.

There may also be other County, State, and/or Federal regulations, including CERCLA, which may be applicable or relevant and appropriate for the activities to be undertaken at the Gull Island and Manitou Island Lighthouse sites.

If you have any questions or if there is anything I can help with, please let me know.

Sincerely,

Amy Keranen

Amy Keranen
Senior Environmental Quality Analyst
Remediation and Redevelopment Division
Calumet Field Office
906.337.0389
keranena@michigan.gov

Enclosure

## Michigan's Chemical, Action and Location Specific Response Actions Summary (Revision : December 29, 2014)

**Disclaimer:**

**This Response Actions Summary Table has been developed for use in Michigan Department of Environmental Quality- Remediation and Redevelopment Division Programs to help identify applicable State laws, regulations, and/or requirements that apply to response activities under Part 201, Environmental Remediation, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). This table should not be substituted for reading the actual State regulations and rules that apply to response activities. Other State, federal, and local laws, regulations and requirements may also apply that are not summarized in this table.**

**Chemical Specific Response Actions**

| Contact Agency | Regulation/Citation | Description | Rationale |
|---|---|---|---|
| • Office of Drinking Water & Municipal Assistance | Michigan Safe Drinking Water Act<br><br>Public Act 399 of 1976, as amended. (Michigan Compiled Laws (MCL) 325.1001)<br><br>Michigan Administrative Code:<br>R 325.10101, R 325.10601, et. seq. | Regulates all waters used or potentially used for drinking water. Adopts Federal Maximum Contaminant Levels as state drinking water standards. Ensures that acceptable concentrations of chemical constituents in groundwater do not exceed drinking water standards. | Applied when releases of hazardous substances may impact groundwater and/or surface waters used for private and/or public water supplies. |
| • Remediation and Redevelopment Division<br>• Water Resources Division | Part 31, Water Resources Protection, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.3101, et seq.)<br><br>Michigan Administrative Code:<br>R 324.3103, et. seq.<br><br>• Part 1: General provisions provide purpose, i.e., implementation of the act and definitions (R 323.1001, etc., and other applicable rules.);<br>• Part 4: Michigan water quality standards for surface waters to protect public health and welfare, enhance and maintain water quality, and protect the state's natural resources (R 323.1041-1117);<br>• Part 5: Spillage of oil and polluting materials addresses spill containment, prevention, clean-up, and reporting (R 323.1158, etc., and other applicable rules);<br>• Part 6: Cleaning agents and water conditioners (R 323.1171, etc., and other applicable rules);<br>• Part 8: Water quality based effluent limits for toxic chemicals (R 323.1201-1221);<br>• Part 10: Treatment plant operators;<br>• Part 21: Wastewater discharge permits identifies NPDES and State groundwater discharge requirements, including procedures for permit application, permit issuance, and denial (R 323.2106, R 323.2108-9, R 323.2114, R 323.2117-2119, R 323.2128, R 323.2136, R 323.2145, R 323.2149-2151, R 323.2154-2155, R 323.2162-2164, and R 323.2190-2192);<br>• Part 22: Groundwater quality rules R 323.2201-2211); and<br>• Part 23: Pretreatment (R 323.2301, etc., and other applicable rules).<br><br>Formerly known as Act 245 (1929) | These rules address discharges to both surface waters and groundwater of the State. Part 31 prohibits direct or indirect discharge to ground or surface waters of the state that are or may become injurious to the environment or public health. Regulates water and wastewater discharges with standards for discharge to groundwater. Defines effluent guidelines based on actual water quality, receiving stream properties, and other appropriate water quality criteria. Provides criteria and standards for the National Pollutant Discharge Elimination System (NPDES) and effluent standards for toxic pollutants. This is the implementing statute for the federally delegated NPDES program. | Applied to sites where treated and/or contaminated groundwater and/or wastewater are discharged to surface water or groundwater. Ensures that chemical constituents do not exceed water quality standards. Relevant and appropriate for response activities which will discharge wastewater, treated and/or contaminated groundwater to surface waters of the state. Establishes standards for discharge to groundwater. Cites specific requirement for discharges of bioaccumulative compounds. For CERCLA remedial actions that take place entirely on-site, discharge requirements may be identified through issuance of a Substantive Requirements Document for CERCLA remedial actions that take place entirely on-site. |

**Chemical Specific Response Actions (continued)**

## Michigan's Chemical, Action and Location Specific Response Actions Summary (Revision : December 29, 2014)

| Contact Agency | Regulation/Citation | Description | Rationale |
|---|---|---|---|
| • Air Quality Division | Part 55, Air Pollution Control, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.55, et seq.)<br><br>Michigan Administrative Code:<br>R 324.5501, R 336.1101, R 336.1123, R 336.1127, R 336.1201-1207, R 336.1209-1229, R 336.1230-1241, R 336.1278-1290, and R 336.1299 (Part 2 Air Use Approval), R 336.1301-1331, R 336.1370-1372 (Part 3 Emissions Limitations & Prohibitions), R 336.1701–1702 (Part 7 Emissions Limitations and Prohibitions- New Sources of Volatile Organic Compound Emissions), R 336.1901, R 336.2001–2007, et. seq.<br><br>Formerly known as Act 348 (1965) | Defines air quality standards for potential air emission sources. Prohibits the emissions of air contaminants in quantities that cause injurious effects to human health, animal life, plant life of significant economic value, and/or property or that interfere with the enjoyment of life or property in the state. | Applicable for remedial alternatives that would generate air emissions, i.e., dust, fumes, gas, mist, odor, smoke, vapor, or any combination thereof. For CERCLA remedial actions that take place entirely on-site, discharge requirements could be identified through the issuance of a Substantive Requirements Document. |
| • Office of Waste Management and Radiological Protection | Part 111, Hazardous Waste Management, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.111, et seq.)<br><br>Michigan Administrative Code:<br>R 299.9202-9208, R 299.9212, R 299.9228, R 299.9301-9312, R 299.9401-9413, R 299.9501-9523, R 299.9601-9634, R 299.9701-9713, R 299.9801-9816, and R 299.11001-11008, et. seq..<br><br>• Part 1: General Provisions;<br>• Part 2: Identification and Listing of Hazardous Waste;<br>• Part 3: Generators of Hazardous Waste;<br>• Part 4: Transporters of Hazardous Waste;<br>• Part 5: Construction Permits and Operating Licenses;<br>• Part 6: Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities;<br>• Part 7: Financial Capability;<br>• Part 8: Management of Specific Hazardous Wastes, Specific Types of Hazardous Waste<br>• Management Facilities, and Used Oil;<br>• Part 9: Hazardous Waste Service Fund; and<br>• Part 10: Availability of Referenced Materials.<br><br>Formerly known as Act 64 (1979) | Defines hazardous waste and establishes requirements for hazardous waste generators, transporters, and treatment/storage/disposal facilities. It is the implementing statute for the federally delegated program under the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments (HSWA). Regulates the generation, transport, treatment, storage, and disposal of hazardous wastes from site remediation. Regulates closure, post-closure, and corrective action for hazardous waste treatment, storage and disposal facilities.<br><br>Note: The State of Michigan has authorization to administer Federal RCRA Subtitle C in the state. | Must be complied with by persons engaging in activities, which would generate, transport, treat, store or dispose of hazardous waste in this state. Administrative Rules define hazardous waste based on analytical procedures, usage, and process of generation. Response activities may generate waste residuals that may be classified as hazardous waste. Used for characterizing and identifying hazardous wastes and determining appropriate treatment and disposal. |
| • Remediation and Redevelopment Division | Part 201, Environmental Remediation, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.201, et seq.)<br><br>Michigan Administrative Code:<br>R 299.5511(3)(d), et. seq.<br><br>Formerly known as Act 307 (1982) | In part, protects the environment and natural resources of the state; regulates the discharge of certain substances into the environment; regulates the use of certain lands, waters, and other natural resources of the state; and prescribes the powers and duties of certain state and local agencies and officials. | Establishes cleanup criteria for sites of environmental contamination based on current and future land use. Regulates cleanup of releases of hazardous substances in concentrations that constitute a facility as that term is defined in Section 20101(o) of Act 451 to soil and groundwater. |

## Michigan's Chemical, Action and Location Specific Response Actions Summary (Revision : December 29, 2014)

**Action Specific Response Actions**

| Contact Agency | Regulation/Citation | Description | Rationale |
|---|---|---|---|
| • Michigan State Police Motor Carrier Division | Michigan Motor Carrier Safety Code<br><br>Public Act 181 of 1963, as amended. (MCL 480.11, et seq.)<br><br>Michigan Administrative Code:<br>Transportation of Hazardous Materials (R 480.11-21). | Rules governing the transportation of hazardous materials. | Used to protect the public, first responders to hazardous incidents and the environment from hazardous materials. |
| • Michigan Department of Transportation<br>• Michigan State Police Motor Carrier Division | Michigan Vehicle Code<br><br>Public Act 300 of 1949, as amended. (MCL 257.722, et seq.)<br><br>Michigan Administrative Code:<br>Size, Weight and Load (R 257.716-726). | Rules governing the reduction of maximum axle loads during springtime frost periods. Maximum Gross Vehicle Weight (GVW) is not to exceed 25-35% of normal GVW. County road jurisdiction- County Road Commission and state roads and highway jurisdiction- MDOT. Motor Carrier enforces the above. | Used to prevent vehicular damage to roadways from transporting heavy materials and equipment. Remedial action and construction may require heavy loads of equipment, fill dirt, contaminated media, etc. to be transported over roadways; however, this is not allowed during frost periods. |
| • Department of Licensing and Regulatory Affairs | The Michigan Occupational Safety and Health Act (MIOSHA)<br><br>Public Act 154 of 1974, as amended.<br><br>Michigan Administrative Code:<br>• Safety Standards for General Industry;<br>• Health Standards for General Industry;<br>• Safety Standards for Construction;<br>• Health Standards for Construction;<br>• Administrative Rules for General Industry, Construction Health, and Agricultural Operations (R 408.1001-1094). | Occupational safety and health standards adopted to provide safe and healthful employment or places of employment, which may include medical monitoring. Provides safety standards for hazards, air contaminants, physical hazards, health hazard control measures, illumination, sanitation, employee right-to-know, and others. Regulations containing worker health and safety standards for construction and general industry operations and requirements for worker training specifically "Hazardous Waste Operations and Emergency Response (HAZWOPER)." This is the statute adopted by Michigan from the Federal OSHA. Rules contain a list of permissible exposure limits in the work place for more than 600 chemical compounds. | On-site remedial actions have the potential to expose workers to contaminants found in affected media, i.e., soil, air and water. Construction, excavation and other site actions may present potential health hazards to nearby workers. Human labor will likely be required to construct remedial systems as well as provide long-term routine/non-routine maintenance on the systems. Such activities are governed by worker safety and health standards under this act and are applicable to all site actions and activities. |
| • Office of Drinking Water and Municipal Assistance | Public Health Code<br><br>Public Act 368 of 1978, as amended. (MCL 333.1101, et seq.)<br><br>Michigan Administrative Code:<br>• Part 127: Groundwater Quality Control (R 325.1601, etc.); and<br>• Part 138: Medical Waste (No administrative rules) | Regulates construction of private drinking water wells. Water supply well standards and requirements which regulate the construction and abandonment of private drinking water wells. Establishes distance requirements from pollution sources. | Provides general guidelines and requirements on how a well is constructed and abandoned to prevent leakage to aquifers of the state. May apply to response activities affecting water supply wells, |
| • All DEQ Divisions | Part 17, Environmental Protection, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.17, et seq.)<br><br>Michigan Administrative Code:<br>R 324.1701, et. seq.<br><br>Formerly known as Act 127 (1970) | Provides for the protection of natural resources. The protection of state resources prohibits any action that pollutes, impairs, or destroys the state's natural resources, due to any activities conducted at a site of environmental contamination. | Applied in remedial investigation, remedial design, response activity and remedial action activities. |

## Michigan's Chemical, Action and Location Specific Response Actions Summary (Revision : December 29, 2014)

**Action Specific Response Actions (continued)**

| Contact Agency | Regulation/Citation | Description | Rationale |
|---|---|---|---|
| • Water Resources Division | Part 31, Water Resources Protection, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.3104, et seq.)<br><br>Michigan Administrative Code:<br>R 324.3103, et. seq.<br><br>• Part 1: General provisions provide purpose, i.e., implementation of the act and definitions (R 323.1001, et. seq.);<br>• Part 4: Michigan water quality standards for surface waters to protect public health and welfare, enhance and maintain water quality, and protect the state's natural resources (R 323.1041-1117);<br>• Part 5: Spillage of oil and polluting materials addresses spill containment, prevention, clean-up, and reporting (R 323.1158, et. seq.);<br>• Part 6: Cleaning agents and water conditioners (R 323.1171, et. seq.);<br>• Part 8: Water quality based effluent limits for toxic chemicals (R 323.1201-1221);<br>• Part 9: Wastewater Reporting (R 299.9001, et. seq.);<br>• Part 10: Treatment plant operators;<br>• Part 21: Wastewater discharge permits identifies NPDES and State groundwater discharge requirements, including procedures for permit application, permit issuance, and denial (R 323.2106, R 323.2108-9, R 323.2114, R 323.2117-2119, R 323.2128, R 323.2136, R 323.2145, R 323.2149-2151, R 323.2154-2155, R 323.2162-2164, and R 323.2190-2192);<br>• Part 22: Groundwater quality rules R 323.2201-2240); and<br>• Part 23: Pretreatment (R 323.2301 et. seq.).<br><br>Formerly known as Act 245 (1929) | These rules address discharges to both surface waters and groundwater of the State. Part 31 prohibits direct or indirect discharge to ground or surface waters of the state that are or may become injurious to the environment or public health. Regulates water and wastewater discharges with standards for discharge to groundwater. Defines effluent guidelines based on actual water quality, receiving stream properties, and other appropriate water quality criteria. Provides criteria and standards for the National Pollutant Discharge Elimination System (NPDES) and effluent standards for toxic pollutants. This is the implementing statute for the federally delegated NPDES program. Also includes the Industrial Pre-treatment Program (IPP) and Publicly Owned Treatment Works (POTW) requirements. | Remedial action may result in the discharging of remediated and unremediated contaminated groundwater into waters of the state, i.e., groundwater, surface water, or any other water course. Applicable for remedial alternatives which will treat and/or discharge wastewater to surface waters of the state. Cites specific requirements for the discharge of bioaccumulative chemicals. Discharge requirements can be identified through a substantive requirements document (SRD). Prevents concentrations in surface water of taste and odor producing substances. Prevents acutely and chronically toxic substances from entering surface water based on the LC50 toxicity criteria. Prevents degradation of water quality. Restricts levels of turbidity, color, oil films, floating solids, foams, settling and suspended solids, and deposits. |
| • Water Resources Division | Part 41, Sewerage Systems, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.41, et seq.)<br><br>Michigan Administrative Code:<br>R 324.4105, et. seq.<br><br>Formerly known as Act 98 (1913) | Regulates construction and operation of sewerage systems. Requires that treatment facility operators be certified and describes the minimum requirements for certification. The rules prescribe the procedures and requirements for the operation and maintenance of sewerage systems. | May be applied to environmental sites of contamination with treatment systems proposed to discharge treated or untreated effluent to the sewer system. |

Action Specific Response Actions (continued)

| Contact Agency | Regulation/Citation | Description | Rationale |
|---|---|---|---|
| • Air Quality Division | Part 55, Air Pollution Control, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.55, et seq.)<br><br>Michigan Administrative Code:<br>R 324.5501, R 336.1101, R 336.1123, R 336.1127, R 336.1201-1207, R 336.1209-1229, R 336.1230-1241, R 336.1278-1290, and R 336.1299 (Part 2 Air Use Approval), R 336.1301-1331, R 336.1370-1372 (Part 3 Emissions Limitations & Prohibitions), R 336.1701–1702 (Part 7 Emissions Limitations and Prohibitions- New Sources of Volatile Organic Compound Emissions), R 336.1901, R 336.2001–2007, et. seq.<br><br>Formerly known as Act 348 (1965) | Requires permitting for air emission sources and air monitoring during activities that may cause contaminant releases to air. Remedial actions may introduce contaminants into the air. Prohibits the emissions of air contaminants from wastes on site in quantities, which cause injurious effects to human health, animal life, plant life of significant economic value, and/or property. | Applicable for remedial alternatives that generate air emissions, i.e., soil excavation, landfill passive gas vent wells, etc. where fugitive dust or air emissions may adversely affect human health and the environment. Requires air emissions to have "non-injurious effects" and is enforced through permitting and monitoring of air pollution sources such as site work when airborne contaminants or dust can be released. These rules address air use, particulate emission limitations, sulfur-bearing compound limitations, volatile organic emissions, and several miscellaneous prohibitions. It also addresses testing, sampling, etc. Requires the issuance of a permit prior to installation or construction of equipment which may be a source of air contamination. The regulations provide for permit application requirements, air quality modeling, and permit exemptions and waivers. For CERCLA remedial actions taking place entirely on-site, requirements may be identified through issuance of a Substantive Requirements Document (SRD). Defines and describes the general provisions for new sources of volatile organic compound emissions. The regulations contain the criteria for conducting performance tests and include detailed emission test methods. |
| • Water Resources Division | Part 91, Soil Erosion and Sedimentation Control, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.9101, et seq.)<br><br>Michigan Administrative Code:<br>R 323.1701, et. seq.<br><br>Formerly known as Act 347 (1972) | Requires a soil erosion control and sedimentation plan for any earth changes of one or more acres and/or any earth changes within 500 feet of a lake or stream. Establishes rules prescribing soil erosion and sedimentation control plans, procedures, and measures. | Remedial action may involve capping, construction of a discharge pipe, etc. Consideration of soil erosion and sedimentation control will be necessary to prevent sediment impacts to waters of the state more than 1 acre in area or within 500 feet of a lake or stream, and preserve topsoil loss. May be applied to site activity where earthwork is conducted. |

## Michigan's Chemical, Action and Location Specific Response Actions Summary (Revision : December 29, 2014)

**Action Specific Response Actions (continued)**

| Contact Agency | Regulation/Citation | Description | Rationale |
|---|---|---|---|
| • Office of Waste Management and Radiological Protection | Part 111, Hazardous Waste Management, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.111, et seq.)<br><br>Michigan Administrative Code:<br>R 299.9202-9208, R 299.9212, R 299.9228, R 299.9301-9312, R 299.9401-9413, R 299.9501-9523, R 299.9601-9634, R 299.9701-9713, R 299.9801-9816, R 299.11001-11008, et. seq.<br><br>• Part 1: General Provisions;<br>• Part 2: Identification and Listing of Hazardous Waste;<br>• Part 3: Generators of Hazardous Waste;<br>• Part 4: Transporters of Hazardous Waste;<br>• Part 5: Construction Permits and Operating Licenses;<br>• Part 6: Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities;<br>• Part 7: Financial Capability;<br>• Part 8: Management of Specific Hazardous Wastes, Specific Types of<br>• Hazardous Waste Management Facilities, and Used Oil;<br>• Part 9: Hazardous Waste Service Fund; and<br>• Part 10: Availability of Referenced Materials.<br><br>Formerly known as Act 64 (1979) | Defines hazardous waste and establishes requirements for hazardous waste generators, transporters, and for owners and operators of treatment/storage/disposal facilities. Regulates the generation, transport, treatment, storage, and disposal of hazardous wastes from site remediation. Regulates closure, post-closure, and corrective action for hazardous waste treatment, storage and disposal facilities.<br><br>Note: The State of Michigan has authorization to administer Federal RCRA Subtitle C in the state. | Remedial action may generate hazardous waste and involve management of hazardous waste. May be applied to off-site disposal of hazardous waste. Used for determining how and in what type of disposal facility contaminated media may be removed to. May be applied to construction and operation of on-site treatment, storage or disposal units relative to requirements for characterization and handling of hazardous waste. Applied to the excavation of certain contaminated media. May be applicable to remedial actions in landfills and in the construction of landfill cells. |
| • Office of Waste Management and Radiological Protection | Part 115, Solid Waste Management, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.115, et seq.)<br><br>Michigan Administrative Code:<br>R 324.11501, et. seq.<br><br>Formerly known as Act 641 (1978) | Addresses solid waste management including general landfill design requirements as promulgated in the administrative rules of the Michigan Solid Waste Management Regulations. Regulates the construction and operation of sanitary landfills, solid waste transfer facilities, and solid waste processing plants. Specifies liner and capping requirements for solid waste landfills. Requirements for the operation and closure of non-hazardous waste treatment, storage, and disposal and groundwater quality performance standards. Also imposes geographic limitations on where non-hazardous solid waste can be disposed. | Regulates the disposal of non-hazardous solid waste. Provides requirements for closure and post-closure of non-hazardous solid waste treatment, storage, and disposal facilities. Provides groundwater quality performance standards. Remedial action may produce non-hazardous solid waste, which must be disposed of in accordance with Part 115. Used for determining the process and type of disposal facility that solid waste or contaminated media may be removed to. May apply to closure (capping) of a landfill. May serve as a basis of design for containment of non-hazardous solid waste on-site. |
| • Office of Waste Management and Radiological Protection | Part 121, Liquid Industrial Wastes, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.121, et seq.)<br><br>Michigan Administrative Code:<br>R 324.12101, et. seq.<br><br>Formerly known as Act 136 (1969) | Regulates liquid industrial waste generators, transporters and designated facilities. Transporters are required to be registered and permitted in accordance with the hazardous materials transportation act. Requires a registered and permitted liquid industrial waste transporter to remove any liquid waste off-site. Records are required to be kept by those who generate such waste, under Section 3a. Liquid industrial waste is defined as "any liquid waste, other than unpolluted water." | Remedial action may require the storage, transportation and disposal of liquid industrial wastes. Applies to the on and off-site management of liquid industrial wastes. |

## Michigan's Chemical, Action and Location Specific Response Actions Summary (Revision : December 29, 2014)

**Action Specific Response Actions (continued)**

| Contact Agency | Regulation/Citation | Description | Rationale |
|---|---|---|---|
| • Remediation and Redevelopment Division | Part 201, Environmental Remediation, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.201, et seq.)<br><br>Michigan Administrative Code:<br>R 299.5109, R 299.5505; R 299.5511, R 299.5513, R 299.5515, R 299.5519, R 299.55601, et. seq.<br><br>Formerly known as Act 307 (1982) | In part, protects the environment and natural resources of the state; to regulate the discharge of certain substances into the environment; to regulate the use of certain lands, waters, and other natural resources of the state; and to prescribe the powers and duties of certain state and local agencies and officials. Note: Under Section 20118(2) of Part 201 of Act 451, remedial action plan provisions apply to the maintenance and proper abandonment of groundwater monitoring and recovery wells. The ERD recommends that monitor well abandonment be performed in accordance with ASTM Standard D5299-92 "Standard Guide for the Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Bore Holes, and Other Devices for Environmental Activities." The Drinking Water & Radiological Protection Division regulates water well drillers and construction. Their requirements may apply to test and recovery well construction near municipal water supply wells or near well head protection program areas. | Applies to response activities taken at sites of environmental contamination which are facilities as that term is defined in Section 20101(o) of Act 451. Provides risk based site cleanup criteria based on land-use, and other factors necessary to protect the public health, safety, welfare and the environment. |
| • Department of Licensing and Regulatory Affairs – Fire Services Bureau | Part 211, Underground Storage Tank Regulations, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.211, et seq.)<br><br>Michigan Administrative Code:<br>R 29.2103, et. seq. | Provides technical standards for underground storage tank (UST) systems including corrosion protection, release detection, spills and overfill protection, and compliance reporting schedules. | Applicable where USTs are discovered during construction and remedial action activities. The rules have special requirements for new UST systems installed in approved delineated wellhead protection areas. |
| • Remediation and Redevelopment Division | Part 213, Leaking Underground Storage Tanks, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.213, et seq.)<br><br>Michigan Administrative Code:<br>R 324.21301a, et. seq. | Regulates and provides for corrective action due to releases from leaking underground storage tank systems. Prescribes the powers and duties of certain state agencies and officials; and provides for penalties and remedies. Also regulates the inspection, abandonment, replacement and installation of underground storage tanks. | Applicable where sites of environmental contamination include underground storage tanks.<br><br>Note: The State of Michigan has authorization to administer Federal RCRA Subtitle I in the state. |
| • Department of Licensing and Regulatory Affairs – Fire Services Bureau<br>• Remediation and Redevelopment Division | Part 215, Underground Storage Tank Financial Assurance, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.215, et seq.)<br><br>Michigan Administrative Code:<br>R 324.21501, et. seq. | Provides for the certification of underground storage tank consultants and professionals. | Part 213 requires tank owners and operators to hire a qualified Underground Storage Tank (UST) consultant from the State's approved list for conducting remedial action activities at leaking underground storage tank facilities. |

# Michigan's Chemical, Action and Location Specific Response Actions Summary (Revision : December 29, 2014)

**Action Specific Response Actions (continued)**

| Contact Agency | Regulation/Citation | Description | Rationale |
|---|---|---|---|
| • Department of Natural Resources | Part 305, Natural Rivers, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.305, et seq.)<br><br>Michigan Administrative Code:<br>R 324.30501, et. seq.<br><br>Formerly known as Act 231 (1970) | Regulates activities within 500 feet of a designated natural river. The purpose of these zoning rules is to promote public health and prevent ecological damage due to unwise development or construction within a natural river district. The rules also protect the free-flowing conditions, fish and wildlife, water quality, and recreational values of natural rivers and adjoining land. | Remedial action may take place within 500 feet of a designated natural river. |
| • Water Resources Division | Part 315, Dam Safety, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.31501, et. seq.)<br><br>Michigan Administrative Code:<br>R 281.1301, et. seq. | Regulates dam and/or surface water impoundment structures at or greater than 6 feet in height. | May be applied to environmental sites of contamination where response activities may affect existing dams or where surface water impoundments greater than 6 feet in height are constructed. |
| • Department of Natural Resources | Part 365, Endangered Species Protection, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.365, et seq.)<br><br>Michigan Administrative Code:<br>R 324.36501, et. seq.<br><br>Formerly known as Act 203 (1974) | Establishes rules to provide for conservation, management, enhancement, and protection of species either endangered or threatened with extinction. | Remedial action may take place and adversely impact endangered species and other habitat. |
| • Office of Oil, Gas, and Minerals | Part 615, Supervisor of Wells, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.615, et seq.)<br><br>Michigan Administrative Code:<br>R 324.61501, et. seq.<br><br>Formerly known as Act 61 (1939) | Requires that a permit be obtained prior to drilling oil, gas, brine disposal, and deep well injection wells. Regulates the drilling requirements, which includes well construction, inspection, plugging and abandonment. | Applied to remedial actions utilizing deep well disposal. |

## Michigan's Chemical, Action and Location Specific Response Actions Summary (Revision : December 29, 2014)

Location Specific Response Actions

| Contact Agency | Regulation/Citation | Description | Rationale |
|---|---|---|---|
| • All DEQ Divisions | Part 17, Environmental Protection Act, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.17, et seq.)<br><br>Michigan Administrative Code:<br>Not applicable.<br><br>Formerly known as Act 127 (1970) | Provides for the protection of natural resources; prohibits any action that pollutes, impairs, or destroys the state's natural resources, due to any activities conducted at a site of environmental contamination. | Applied in remedial investigation, remedial design, and remedial action activities. |
| • Water Resources Division | Part 31, Water Resources Protection, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.3101, et seq.)<br><br>Michigan Administrative Code:<br>R 324.3101, et. seq.<br><br>• Part 1: General provisions provide purpose, i.e., implementation of the act and definitions (R 323.1001, et. seq.);<br>• Part 4: Michigan water quality standards for surface waters to protect public health and welfare, enhance and maintain water quality, and protect the state's natural resources (R 323.1041-1117);<br>• Part 5: Spillage of oil and polluting materials addresses spill containment, prevention, clean-up, and reporting (R 323.1158, et. seq.);<br>• Part 6: Cleaning agents and water conditioners (R 323.1171, et. seq.);<br>• Part 8: Water quality based effluent limits for toxic chemicals (R 323.1201-1221);<br>• Part 10: Treatment plant operators;<br>• Part 13: Floodplains and floodways (R 323.1311-1315 and R 323.1329);<br>• Part 21: Wastewater discharge permits identifies NPDES and State groundwater discharge requirements, including procedures for permit application, permit issuance, and denial (R 323.2106, R 323.2108-9, R 323.2114, R 323.2117-2119, R 323.2128, R 323.2136, R 323.2145, R 323.2149-2151, R 323.2154-2155, R 323.2162-2164, and R 323.2190-2192);<br>• Part 22: Groundwater quality rules R 323.2201-2240); and<br>• Part 23: Pretreatment (R 323.2301 et. seq.).<br><br>Formerly known as Act 245 (1929) | These rules address discharges to both surface waters and groundwater of the State. Part 31 prohibits direct or indirect discharge to ground or surface waters of the state that are or may become injurious to the environment or public health. Regulates water and wastewater discharge standards for discharge to groundwater. Defines effluent guidelines based on actual water quality, receiving stream properties, and other appropriate water quality criteria. Provides criteria and standards for the National Pollutant Discharge Elimination System (NPDES) and effluent standards for toxic pollutants. This is the implementing statute for the federally delegated NPDES program. Also includes the Industrial Pre-treatment Program (IPP) and Publicly Owned Treatment Works (POTW) requirements. | Remedial action may result in the discharging of remediated and unremediated contaminated groundwater into waters of the state, i.e., groundwater, surface water, or any other water course. Applicable for remedial alternatives which will treat and/or discharge wastewater to surface waters of the state. Cites specific requirements for the discharge of bioaccumulative chemicals. Discharge requirements can be identified through a substantive requirements document (SRD). Prevents concentrations in surface water of taste and odor producing substances. Prevents acutely and chronically toxic substances from entering surface water based on the LC50 toxicity criteria. Prevents degradation of water quality. Restricts levels of turbidity, color, oil films, floating solids, foams, settling and suspended solids, and deposits. |
| • Water Resources Division | Part 91, Soil Erosion and Sedimentation Control, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.9101, et seq.)<br><br>Michigan Administrative Code:<br>R 323.1701 et. seq.<br><br>Formerly known as Act 347 (1972) | Requires a soil erosion control and sedimentation plan for any earth changes of one or more acres and/or any earth changes within 500 feet of a lake or stream. Establishes rules prescribing soil erosion and sedimentation control plans, procedures, and measures. | Requires a soil erosion control and sedimentation plan for any earth changes of one or more acres and/or any earth changes within 500 feet of a lake or stream. Establishes rules prescribing soil erosion and sedimentation control plans, procedures, and measures. |

## Michigan's Chemical, Action and Location Specific Response Actions Summary (Revision : December 29, 2014)

**Location Specific Response Actions (continued)**

| Contact Agency | Regulation/Citation | Description | Rationale |
|---|---|---|---|
| • Remediation and Redevelopment Division | Part 201, Environmental Remediation, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.201, et seq.)<br><br>Michigan Administrative Code:<br>R 299.5511(3)(a), et. seq.<br><br>Formerly known as Act 307 (1982) | In part, protects the environment and natural resources of the state; regulates the discharge of certain substances into the environment; regulates the use of certain lands, waters, and other natural resources of the state; and prescribes the powers and duties of certain state and local agencies and officials. | Establishes cleanup criteria for sites of environmental contamination based on current and future land use. Regulates cleanup of releases of hazardous substances in concentrations that constitute a facility as that term is defined in Section 20101(o) of Act 451 to soil and groundwater. |
| • Department of Licensing and Regulatory Affairs – Fire Services Bureau | Part 211, Underground Storage Tank Regulations, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.211, et seq.)<br><br>Michigan Administrative Code:<br>R 29.2103, etc., et. seq. | Provides technical standards for underground storage tank (UST) systems including corrosion protection, release detection, spills and overfill protection, and compliance reporting schedules. | Applicable where USTs are discovered during construction and remedial action activities. The rules have special requirements for new UST systems installed in approved delineated wellhead protection areas. |
| • Remediation and Redevelopment Division | Part 213, Leaking Underground Storage Tanks, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.213, et seq.)<br><br>Michigan Administrative Code:<br>R 324.21301a, et. seq. | Regulates and provides for corrective action due to releases from leaking underground storage tank systems. Prescribes the powers and duties of certain state agencies and officials; and provides for penalties and remedies. Also regulates the inspection, abandonment, replacement and installation of underground storage tanks. | Applicable where sites of environmental contamination include underground storage tanks.<br><br>Note: The State of Michigan has authorization to administer Federal RCRA Subtitle I in the state. |
| • Department of Licensing and Regulatory Affairs – Fire Services Bureau<br>• Remediation and Redevelopment Division | Part 215, Underground Storage Tank Financial Assurance, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.215, et seq.)<br><br>Michigan Administrative Code:<br>R 324.21501, et. seq. | Provides for the certification of underground storage tank consultants and professionals. | Part 213 requires tank owners and operators to hire a qualified Underground Storage Tank (UST) consultant from the State's approved list for conducting remedial action activities at leaking underground storage tank facilities. |
| • Water Resources Division | Part 301, Inland Lakes and Streams, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.30101, et seq.)<br><br>Michigan Administrative Code:<br>R 281.811, etc., et. seq.<br><br>Formerly known as Act 346 (1972) | Except as provided in this part, a person without a permit from the department shall not do any of the following: a) Dredge or fill bottomland; b) Construct, enlarge, extend, remove, or place a structure on bottomland; c) Erect, maintain, or operate a marina; d) Create, enlarge, or diminish an inland lake or stream; e) Structurally interfere with the natural flow of an inland lake or stream; f) Construct, dredge, commence, extend, or enlarge an artificial canal, channel, ditch, lagoon, pond, lake, or similar waterway where the purpose is ultimate connection with an existing inland lake or stream, or where any part of the artificial water way is located within 500 feet of the ordinary high-water mark of an existing inland lake or stream; and g) Connect any natural or artificially constructed waterway, canal, channel, ditch, lagoon, pond, lake, or similar water with an existing inland lake or stream for navigation or any other purpose. | Applicable where remedial action may involve response actions, i.e., construction, excavation or filling within 500 feet of an inland lake or stream. |

Location Specific Response Actions (continued)

| Contact Agency | Regulation/Citation | Description | Rationale |
|---|---|---|---|
| • Water Resources Division | Part 303, Wetland Protection, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.30301, et seq.)<br><br>Michigan Administrative Code:<br>R 281.921, et. seq.<br><br>Formerly known as Act 203 (1979) | Prohibits the construction, operation, or maintenance of any use or development in regulated wetlands (324.30301(d)) without a permit. Prohibited activities include draining, dredging, filling, or maintaining a use or development in a wetland. Regulates permit applications. | May be applied to environmental sites of contamination where remedial actions may affect regulated wetlands. |
| • Department of Natural Resources | Part 305, Natural Rivers, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.203, et seq.)<br><br>Michigan Administrative Code:<br>R 324.30501 et. seq.<br><br>Formerly known as Act 231 (1970) | Regulates activities within 500 feet of a designated natural river. The purpose of these zoning rules is to promote public health and prevent ecological damage due to unwise development or construction within a natural river district. The rules also protect the free-flowing conditions, fish and wildlife, water quality, and recreational values of natural rivers and adjoining land. | Remedial action may take place within 500 feet of a designated natural river. |
| • Water Resources Division | Part 315, Dam Safety, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.31501, et. seq.)<br><br>Michigan Administrative Code:<br>R 281.1301, et. seq. | Regulates dam and/or surface water impoundment structures at or greater than 6 feet in height. | May be applied to environmental sites of contamination where response activities may affect existing dams or where surface water impoundments greater than 6 feet in height are constructed. |
| • Water Resources Division | Part 323, Shorelands Protection and Management, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.32301, et seq.)<br><br>Michigan Administrative Code:<br>R 281.21, et. seq.<br><br>Formerly known as Act 245 (1970) | Regulates the alteration of the soil and vegetation within a Great Lakes shoreland environmental area without a permit. Regulates activities in high-risk erosion areas and flood risk areas (administered by local units of government through the federal flood insurance program) as well as environmental areas. | May be applied to environmental sites of contamination that may affect the protection and management of Great Lake shoreland areas. |
| • Water Resources Division | Part 325, Great Lakes Submerged Lands, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.32501, et seq.)<br><br>Michigan Administrative Code:<br>R 322.1001, et. seq.<br><br>Formerly known as Act 247 (1974) | Regulates activities in unpatented lake bottomlands and unpatented made lands in the Great Lakes at elevations below the international Great Lakes datum of 1955: Lake Superior, 601.5 feet; Lakes Michigan and Huron, 579.8 feet; Lake St. Clair, 574.7 feet; and Lake Erie, 571.6 feet. | May be applied to remedial alternatives that affect unpatented lands in the Great Lakes such as dredging or capping of contaminated sediments or waste disposal areas. |
| • Office of the Great Lakes | Part 327, Great Lakes Preservation, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.327, et seq.)<br><br>Michigan Administrative Code:<br>R 324.32701, et. seq. | The waters of the state are valuable public natural resources held in trust by the state, and the state has a duty as trustee to manage its waters effectively for the use and enjoyment of present and future residents and for the protection of the environment. The waters of the Great Lakes within the boundaries of this state shall not be diverted out of the drainage basin of the Great Lakes. | May be applied to site remediation that would affect the diversion or consumptive use of waters of the Great Lakes. |

## Michigan's Chemical, Action and Location Specific Response Actions Summary (Revision : December 29, 2014)

**Location Specific Response Actions (continued)**

| Contact Agency | Regulation/Citation | Description | Rationale |
|---|---|---|---|
| • Office of the Great Lakes | Part 329, Great Lakes Protection, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.329, et seq.)<br><br>Michigan Administrative Code:<br>R 324.32901, et. seq. | Careful management of the Great Lakes will permit the rehabilitation and protection of the lakes, their waters, and their ecosystems, while continuing and expanding their use for industry, food production, transportation, and recreation. | May be applied to site remediation that would affect the Great Lakes. |
| • Department of Natural Resources | Part 351, Wilderness and Natural Areas, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.351, et seq.)<br><br>Michigan Administrative Code:<br>R 324.35101, et. seq.<br><br>Formerly known as Act 241 (1972) | Enacted to designate, protect and preserve wilderness and natural areas. Prohibits removing, cutting, picking, or otherwise altering vegetation, except as necessary for appropriate public access, the preservation or restoration of a plant or wildlife species, or the documentation of scientific values and with written consent of the department, except as provided in subsection (2), granting an easement for any purpose. | May be applied to environmental sites of contamination located in or near designated wilderness and natural areas. |
| • Water Resources Division | Part 353, Sand Dunes Protection and Management, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.35301, et seq.)<br><br>Michigan Administrative Code:<br>None for critical dune areas. | Regulates the protection and management of sand dunes only in designated critical dune areas. The Geological Survey Division regulates sand mining in dune areas under Part 637. | May be applied to site remediation to protect and prevent site contamination or remediation activities from impacting critical dunes. |
| • Department of Natural Resources | Part 361, Farmland and Open Space Preservation, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.361, et seq.)<br><br>Michigan Administrative Code:<br>R 324.36101, et. seq. | Regulates activities to prevent the destruction of farmland and open spaces. | May be applied to any activity that materially alters or affects the existing conditions or use of any farmland or open spaces. |
| • Department of Natural Resources | Part 365, Endangered Species Protection, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.365, et seq.)<br><br>Michigan Administrative Code:<br>R 324.36501, R 299.1021 – R 299.1028, et. seq.<br><br>Formerly known as Act 203 (1974) | Establishes rules to provide for conservation, management, enhancement, and protection of species either endangered or threatened with extinction. Habitat listed on the Michigan Natural Features Inventory and Part 365 will need to be protected. The rules contain a listing of the fish, wildlife, and plant species that have been determined to be endangered or threatened. | Remedial action may take place and adversely impact endangered species and other habitat. |
| • Department of Natural Resources | Part 401, Wildlife Conservation, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.401, et seq.)<br><br>Michigan Administrative Code:<br>R 324.40102, et. seq. | Regulates wildlife conservation. | May be applied to identifying wildlife habitat near environmental sites of contamination where an ecological risk assessment(s) may be conducted. May be used in conjunction with the Michigan Features Inventory List to identify habitat where an environmental site of contamination may impact wildlife. |
| • Department of Natural Resources | Part 411, Protection and Preservation of Fish, Game, and Birds, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.411, et seq.)<br><br>Michigan Administrative Code:<br>R 324.41101, et. seq. | Regulates the protection and preservation of fish, game, and birds. | May be applied to site remediation to protect and preserve fish, game and birds. |

## Michigan's Chemical, Action and Location Specific Response Actions Summary (Revision : December 29, 2014)

**Location Specific Response Actions (continued)**

| Contact Agency | Regulation/Citation | Description | Rationale |
|---|---|---|---|
| • Department of Natural Resources | Part 479, Fisheries Contamination, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). (MCL 324.479, et seq.)<br><br>Michigan Administrative Code:<br>R 324.47903-47905, et. seq. | Used to ensure the protection of aquatic species within waters of the state. A person shall not put into any stream, pond, or lake any sand, coal, cinders, ashes, log slabs, decayed wood, bark, sawdust, or filth. | May be applied to site remediation to protect and/or restore aquatic life. |

**Disclaimer:**

**This Response Actions Summary Table has been developed for use in Michigan Department of Environmental Quality- Environmental Response Division Programs to help identify applicable State laws, regulations, and/or requirements that apply to response activities under Part 201, Environmental Remediation, of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). This table should not be substituted for reading the actual State regulations and rules that apply to response activities. Other State, federal, and local laws, regulations and requirements may also apply that are not summarized in this table.**

# Appendix G – Threatened and Endangered Species Assessment Correspondence

MICHIGAN STATE UNIVERSITY | Extension

Mr. Travis Anderson
AECOM
1050 Wilson Street
Marquette, MI 49855
906.228.2333

June 8, 2015

**Re: Rare Species Review #1647 – US Coast Guard Remediation Project, Gull and Manitou Islands, Keweenaw County, MI (T58N, R26W Sections 15 & 18).**

Hello:

The location for the proposed project was checked against known localities for rare species and unique natural features, which are recorded in the Michigan Natural Features Inventory (MNFI) natural heritage database. This continuously updated database is a comprehensive source of existing data on Michigan's endangered, threatened, or otherwise significant plant and animal species, natural plant communities, and other natural features. Records in the database indicate that a qualified observer has documented the presence of special natural features. The absence of records in the database for a particular site may mean that the site has not been surveyed. The only way to obtain a definitive statement on the status of natural features is to have a competent biologist perform a complete field survey.

Under Act 451 of 1994, the Natural Resources and Environmental Protection Act, Part 365, Endangered Species Protection, "a person shall not take, possess, transport, …fish, plants, and wildlife indigenous to the state and determined to be endangered or threatened," unless first receiving an Endangered Species Permit from the Michigan Department of Natural Resources (MDNR), Wildlife Division. Responsibility to protect endangered and threatened species is not limited to the lists below. Other species may be present that have not been recorded in the database.

According to the natural heritage database several legally protected species have been documented within 1.5 miles of the project sites, therefore it is **likely** that negative impacts will occur. Keep in mind that **MNFI cannot fully evaluate this project without visiting the project site.** MNFI offers several levels of Rare Species Reviews, including field surveys which I would be happy to discuss with you.

Sincerely,

*Michael A. Sanders*

Michael A. Sanders
Rare Species Review Specialist
Michigan Natural Features Inventory

MICHIGAN STATE UNIVERSITY Founded 1855

MSU EXTENSION

Michigan Natural Features Inventory

PO Box 13036
Lansing MI 48901

(517) 284-6200
Fax (517) 373-9566

mnfi.anr.msu.edu

**Comments for Rare Species Review #1647:** It is important to note that it is the applicant's responsibility to comply with both state and federal threatened and endangered species legislation. Therefore, if a state listed species occurs at a project site, and you think you need an endangered species permit please contact: Lori Sargent, Nongame Wildlife Biologist, Wildlife Division, Michigan Department of Natural Resources, P.O. Box 30444, Lansing, MI 48909, 517-284-6216, or SargentL@michigan.gov. If a federally listed species is involved and, you think a permit is needed, please contact Barb Hosler, Endangered Species Program, U.S. Fish and Wildlife Service, East Lansing office, 517-351-6326, or Barbara_Hosler@fws.gov.

### Table 1: Legally protected species within 1.5 miles of RSR #1647

| SNAME | SCOMNAME | G_RANK | S_RANK | Firstobs | Lastobs | USESA | SPROT | ELCAT |
|---|---|---|---|---|---|---|---|---|
| *Viola epipsila* | Northern marsh violet | G4 | SH | 1950 | 1950-06-17 | | E | Plant |
| *Moehringia macrophylla* | Big-leaf sandwort | G4 | S1 | 1972-07-18 | 1972-07-18 | | T | Plant |
| *Osmorhiza depauperata* | Sweet Cicely | G5 | S2 | 1950 | 1950-06-17 | | T | Plant |
| *Castilleja septentrionalis* | Pale Indian paintbrush | G5 | S2S3 | 1972 | 2005/08/21 | | T | Plant |
| *Carex media* | Sedge | G5T5? | S2S3 | 1996-07-01 | 1996-07-01 | | T | Plant |
| *Senecio indecorus* | Northern ragwort | G5 | S1 | 2005-07-06 | 2005-07-06 | | T | Plant |
| *Polygonum viviparum* | Alpine bistort | G5 | S1S2 | 1996-07-01 | 2005-07-06 | | T | Plant |
| *Luzula parviflora* | Small-flowered wood rush | G5 | S1 | 1996-07-01 | 2005-07-06 | | T | Plant |
| *Poa alpina* | Alpine bluegrass | G5 | S1S2 | 1996-07-01 | 2005-08-20 | | T | Plant |
| *Viburnum edule* | Squashberry or mooseberry | G5 | S2S3 | 1996-07-01 | 2005-07-06 | | T | Plant |
| *Polygonum viviparum* | Alpine bistort | G5 | S1S2 | 2005-05-29 | 2005-07-06 | | T | Plant |
| *Senecio indecorus* | Northern ragwort | G5 | S1 | 2005-08-20 | 2005-08-21 | | T | Plant |
| *Polygonum viviparum* | Alpine bistort | G5 | S1S2 | 2005-07-03 | 2005-08-21 | | T | Plant |
| *Poa alpina* | Alpine bluegrass | G5 | S1S2 | 1996-07-01 | 1996-07-01 | | T | Plant |
| *Carex media* | Sedge | G5T5? | S2S3 | 2005-07-04 | 2005-07-04 | | T | Plant |
| *Luzula parviflora* | Small-flowered wood rush | G5 | S1 | 1996-07-01 | 2005-08-20 | | T | Plant |
| *Castilleja septentrionalis* | Pale Indian paintbrush | G5 | S2S3 | 1950 | 2005/07/06 | | T | Plant |
| *Calamagrostis lacustris* | Northern reedgrass | G3Q | S1 | 2005-08-21 | 2005-08-21 | | T | Plant |

### Table 2: Special Concern Species and other Rare Natural Features within 1.5 miles of RSR #1647

| SNAME | SCOMNAME | G_RANK | S_RANK | Firstobs | Lastobs | USESA | SPROT | ELCAT |
|---|---|---|---|---|---|---|---|---|
| *Draba arabisans* | Rock whitlow grass | G4 | S3 | 1950 | 2005-07-05 | | SC | Plant |
| *Dryopteris filix-mas* | Male fern | G5 | S3 | 1950 | 1950-06-17 | | SC | Plant |
| *Haliaeetus leucocephalus* | Bald eagle | G5 | S4 | 1987 | 2012 | | SC | Animal |
| Volcanic Bedrock Lakeshore | | G4G5 | S2 | 1996-07-01 | 2007-07-20 | | | Community |
| *Draba arabisans* | Rock whitlow grass | G4 | S3 | 1996-07-01 | 2005-08-21 | | SC | Plant |
| *Trisetum spicatum* | Downy oat-grass | G5 | S2S3 | 2005-05-29 | 2005-07-06 | | SC | Plant |
| *Trisetum spicatum* | Downy oat-grass | G5 | S2S3 | 2005-07-03 | 2005-08-21 | | SC | Plant |
| *Huperzia selago* | Fir clubmoss | G5 | S3 | 2005-05-28 | 2005-05-28 | | SC | Plant |
| *Dryopteris filix-mas* | Male fern | G5 | S3 | 2005-08-21 | 2005-08-21 | | SC | Plant |
| Volcanic Lakeshore Cliff | | GU | S1 | 1996-07-01 | 2007-07-20 | | | Community |

Of concern…the state threatened **big-leaf sandwort** (*Moehringia macrophylla*) has been known to occur along the eastern end of Manitou Island. This perennial forb inhabits sandy or rocky wooded slopes and shorelines in the western Upper Peninsula.   Flowering occurs from May to August.

The state threatened **pale indian paintbrush** (*Castilleja septentrionalis*) has been observed on the eastern end of Manitou Island. Pale Indian paintbrush is essentially an eastern North American subarctic species, inhabiting rock crevices, ledges, openings, thin woods, and sandy banks near Lake Superior.  Pale Indian paintbrush blooms June to August.

The state threatened **squashberry** or **mooseberry** (*Viburnum edule*) has been observed on the western end of Manitou Island. This shrub reaches 3-6' in height.  The twigs are brownish-purple and often angled or ridged.  The leaves are opposite.  The flowers are small and creamy-white in few-flowered, stalked clusters about 1 inch wide.  Flowering is in June or July.  The fruit is a round drupe, yellow at first, ripening to orange or red.  Squashberry grows in boreal forests, rocky streambanks, and lakeshores, in open or partly shaded conditions.

The state threatened **alpine biswort** (*Polygonum viviparum*) has been known to occur on the west end of Mantou Island. Alpine biswort is found in rock crevices on bedrock shores of Isle Royale and the Keweenaw along Lake Superior. It can occur in both sun and shade conditions.  Flowering occurs in July.

The state special concern **bald eagle** (*Haliaeetus leucocephalus*) has been known to nest along the western shores of Manitou Island.  **Special concern** species and natural communities are not protected under endangered species legislation but efforts should be taken to minimize any or all impacts.  Species classified as special concern are species whose numbers are getting smaller in the state. If these species continue to decline they would be recommended for reclassification to threatened or endangered status.  Please note eagles are protected under the Bald and Golden Eagle Protection Act: Bald Eagle which prohibits anyone from "taking" bald eagles, including their parts, eggs or nests.

Please consult MNFI's Rare Species Explorer for additional information regarding the listed species: http://mnfi.anr.msu.edu/explorer/search.cfm.

## Codes to accompany Tables:

**State Protection Status Code Definitions (SPROT)**
E:  Endangered
T: Threatened
SC: Special concern

**Federal Protection Status Code Definitions (USESA)**
LE = listed endangered
LT = listed threatened
LELT = partly listed endangered and partly listed threatened
PDL = proposed delist
E(S/A) = endangered based on similarities/appearance
PS = partial status (federally listed in only part of its range)
C = species being considered for federal status

**Global Heritage Status Rank Definitions (GRANK)**
The priority assigned by NatureServe's national office for data collection and protection based upon the element's status throughout its entire world-wide range. Criteria not based only on number of occurrences; other critical factors also apply. Note that ranks are frequently combined.
G1 = critically imperiled globally because of extreme rarity (5 or fewer occurrences range-wide or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
G2 = imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
G3: Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g. a single western state, a physiographic region in the East) or because of other factor(s) making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 to 100.
G4: Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
G5: Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
Q: Taxonomy uncertain

**State Heritage Status Rank Definitions (SRANK)**
The priority assigned by the Michigan Natural Features Inventory for data collection and protection based upon the element's status within the state. Criteria not based only on number of occurrences; other critical factors also apply. Note that ranks are frequently combined.
S1: Critically imperiled in the state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation in the state.
S2: Imperiled in state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.
S3: Rare or uncommon in state (on the order of 21 to 100 occurrences).
S4 = apparently secure in state, with many occurrences.
S5 = demonstrably secure in state and essentially ineradicable under present conditions.
SX = apparently extirpated from state.

# Michigan

## Federally-listed Threatened, Endangered, Proposed, and Candidate Species

*Updated September 2015*

| 0 | A AB | 0 B A | / A A |
|---|---|---|---|
| : : : | | | |
| N N N f e *(Lynx canadensis)* | AU RNaR R | **0b R a a 0ba** . N N N f e d N RPR a f Pb R aR V aUR B R =R V b NAUR P b aVR VaR UR R UNcR aUR UVTUR a aR aVN S f e R R PR'. TR /N NTN UV Rd N1 R aN1 VP V 4 TROVP bTUa Rd RR Nd bPR: NP V NP: N bRaaR: R V RR a NT PU P NSa | ; aUR S R a |
| 4 Nf d S *Canis lupus* | N TR R | . TR /N NTN UV Rd N1 R aN1 VP V 4 TROVP bTUa Rd RR Nd bPR: NP V NP: N bRaaR: R V RR a NT PU P NSa | ; aUR S R aR N RN |
| VN NONa *(Myotis sodalis)* | N TR R | . RTN /N f/Nf/R gVR/R VR / N PU NU b N V a Na 4R R RR4 NaV a V N R b TUN VN NP NN Ng R a N RR RR N Nb R Nd RR VcV T a : NP O: N VaRR: N : R: aPN : b RT N N PRN N aaNd N NTV Nd a R U N VNP UVNd N RR a NVAb P NCN /b R D N UaR Nd N D Nf R | b R UNOVaNa V P b R N a R Vb VcR N a RN P V d VaU d R RcR R V N VN d ( d a d VaUV a VR S N a R Vb VcR N a RN (N b N S R a NcR N V R N UVOR NPb N |
| ; aUR T RN R ONa *Myotis septentrionalis* | AU RNaR R | aNaRd V R | VOR NaR V PNcR N V R d N V T V b b V T d R N RN V Nbab a N S NTR V b N S R a b V T V T N b R |
| / 1 | | | |
| VaN d N O R *Setophaga kirtlandii* *Dendroica kirtlandii* | N TR R | . P N. TR . a V /N NTN UV Rd N N R Nd S 1 R aN4 N A NcR R P N N N bPR: N bRaaR: a R Pf TR Nd P N a RT = R bR R P PU P NSa | / RR V T V VNP V R |
| =V V T cR *(Chradrius melodus)* | N TR R | . TR . R N/R gVR/R VR UN Rc Ve URO fTN UV Rd N1 R aN Ra RR N Nb bPR: NP V NP: N VaRR: N : b RT = R bR R PU P NSa | / RNPUR N T U R V R SaUR 4 RNa N R |
| =V V T cR *(Chradrius melodus)* | VaPN NOVaNa | . TR /R gVR UN Rc Ve URO fTN UV Rd N Ra P RR N Nb bPR: NP V NP: N : b RT = R bR R PU P NSa | / RNPUR N T U R V R SaUR 4 RNa N R |

| | | | |
|---|---|---|---|
| bSN R a *(Calidris canutus rufa)* | AU RNaR R | **Yf NPa aUNa PPb NY T P N aNYN RN b T aUR R a T Na f d d S: A : / S aUR S Yf d T P b aR**<br><br>. P N. TR . RTN . R N. a V . R NP/N NTN/Nf/R gVR /R VR UN Rc Ve URO f TN UV Rd N1 R aN Ra4 TROVP4 N A NcR R bTUa b P Rd RR Nd RR N Nb bPR: NP V NP : NP O: N VaRR: N bRaaR: N : R V RR: R : b RT PRN N a NT aaNd N= R bR R N VNP PU P NSa a NV Ab P N CN / b R D Nf R<br><br>**Yf NPa aUNa PPb YN TR d RaYN P YReR b T aUR R a T Na f d d S: A : / S aUR S Yf d T P b aR**<br><br>: V N NTV Nd UVNd N RR | N aN N RN N N TR d Ra N P ReR |
| **A** | | | |
| R OR f d NaR N R *(Nerodia erythrogaster neglecta)* | AU RNaR R | / N PU NU b N Na V NR a R U | D R N R N R a f d Ra N RN bPU N eO d bTU O b Uf VaPUR N S NV d |
| N aR N N NbTN *Sistrurus catenatus* | = R N AU RNaR R | . P N. RTN . R N. a V . R NP/N f/R VR / N PU NU b N URO f TN N R V a Nd S Na Raa4 R R RR 4 N A NcR R V NR b TUN VN P NP NN Ng N N N R a N R N RR R Nd RR VcV T a : NP V NP : NP O: N VaRR: N : V Nb RR: aPN : a R Pf : b RT ; Rd NfT N N P N= R bR R NTV Nd a R U UVNd N RR CN / b R D N UaR Nd D Nf R | 4 N V V V NaR N a P b VaVR SR R TR RN d RNa N d Ra NVVR R d N N U bO N |
| **0A** | | | |
| V R R R N NT Sf *(Somatochlora hineana)* | N TR R | . P N. R N: NP V NP: R V RR= R bR R | V T SR d Ra N d Ra RN d N N UR ( PN PN R b a RN N PVNaR d Ra N cR f V T VaR OR P |
| b TR S P Nd V T d NaR ORRa R *(Brychius hungerfordi)* | N TR R | Ra: a R Pf P N= R bR R | VSS R S P RN VTUa f N N V R a RN ( d a PPb V SVcR a RN V aUR : VPUVTN |
| N R ObR ObaaR Sf *(Lycaeides melissa samuelis)* | N TR R | . RTN VN R a N R: N : RP aN: R: aPN : b RT ; Rd NfT PRN N | =V R ON R N N NcN N N f V N P aNV V T d V b V R *(Lupinus perennis)* aUR f d S N a S N cNR |

| | | | |
|---|---|---|---|
| : VaPUR Naf *(Neonympha mitchellii mitchellii)* | N TR R | /N f /R VR / N PU N NP NN Ng a R U CN /b R D N UaR Nd | 3R ( d Ra N PUN NPaR VgR Of PN PN R b V d UVPU N R SR Of PN O NaR VPU d NaR S RR N V T |
| = d R UVR V R V T *Oarisma poweshiek* | N TR R VaPN NOVaNa | V NR NP R Nd RR VcV T a N N N D N UaR Nd<br>: N S R P VaPN UNOVaNa V : VPUVTN Na<br>d d d Sd T c V d R a R N TR R V RPa S N PU: S | D Ra NVVR N SR |
| **: B** | | | |
| bO UR *(Pleurobema clava)* | N TR R | V NR | 3 b V P N R N N T NcR N RN S b N VSSR d VaUV a RN N N VcR |
| ; aUR VSSR UR *(Epioblasma torulosa rangiana)* | N TR R | : R N VNP D Nf R | N TR a RN N N VcR V SV N S VSSR N RN ( N PPb V N R VR |
| NfR /RN *Villosa fabalis* | N TR R | N N a NV | /R R / NP V a N =V R VcR |
| bSSO e *Epioblasma triquetra* | N TR R | 4 NaV a VN R a VcV T a N N a NV D N UaR Nd | N a R Vb VgR P RR V N RN d VaU N d VSa Pb R a N R N TR VcR |
| **A** | | | |
| . R VPN UN a a TbR SR *(Asplenium scolopendrium* cN *americanun = Phyllitis japonica* *a.)* | AU RNaR R | UV Rd N : NP V NP | V R a R V U R V Nab R UN d S R a |
| 1 d N S N R VV *(Iris lacustris)* | AU RNaR R | . R N UN Rc Ve URO f TN UV Rd N 1 R aN Ra : NP V NP : R V RR = R bR R PU P NSa | =N aVN f UN R N f T NcR f V N R U R |
| N aR NVVR S V TR PUV *(Plantathera leucophaea)* | AU RNaR R | /Nf URO f TN V a Na 4 R R RR 4 NaV a b VcV T a : R NTV Nd a NV a R U Ab P N D N UaR Nd D Nf R | : R VPa d Ra NVVR N RN d |

| | | | |
|---|---|---|---|
| bTUa  T R *(Solidago houghtonii)* | AU RNaR R | UN Rc Ve URO f TN UV Rd N NdS Ra N N N: NP V NP = R bR R PU P NSa | N f SNa N T 4 RNa N R U R |
| N R V R NVf *(Hymenoxy acaulis var. glabra)* | AU RNaR R | : NP V NP | 1 f P f NVVR TN N b R NV Of V R a R |
| : VPUVTN Rf S dR *(Mimulus michiganesis)* | N TR R | / R gVR UN Rc Ve URO f TN Ra RR N Nb: NP V NP | V Nab NaR dVaU P S dVT VT dNaR (Sb N T RR NTR a RN N N R U R |
| =VaPUR aUVaR *(Cirsium pitcheri)* | AU RNaR R | . P N. TR . RTN . R N. aV . R NP/ R gVR/ R VR UN Rc Ve URO f TN UV RdN1 R aN Ra4 N A NcR R b P RR N Nb: NP V NP: N VaRR: N : b RT PRN N aaNdN= R bR R PU P NSaCN / b R | aNOVVgR b R N O d baNRN |
| N dU R T VN *(Isotria medeoloides* | AU RNaR R | / R VR | 1 f d N ( b N VaR V VeR S R a RP aUV T daU aNTR |

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1230 Wilson Street
Marquette, MI 49855

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906.226.8371 fax

# Memorandum

| | | | |
|---|---|---|---|
| To | U.S. Coast Guard | Page | 1 |
| CC | Michelle Freimund, Project Geologist, AECOM | | |
| Subject | Section 7 Endangered Species Act Consultation<br>Lead Impacted Soil Remediation at the Gull Rock Lighthouse<br>Keweenaw County, Michigan | | |
| From | Travis Anderson, Project Engineer, AECOM | | |
| Date | November 5, 2015 | | |

The United States Coast Guard (USCG) is in the process of completing an Environmental Assessment (EA) for soil remediation activities due to lead paint impacts at the USCG Gull Rock Lighthouse, Keweenaw County, Michigan.

AECOM has reviewed the U.S. Fish and Wildlife Service (USFWS) Section 7 technical assistance website (http://www.fws.gov/midwest/Endangered/section7/index.html) for federally listed threatened and endangered species. The following four (4) species are listed that may be present in close proximity to the project area: Canada lynx (*Lynx canadensis*), gray wolf (*Canis lupus*), northern long-eared bat (*Myotis septentrionalis*), and rufa red knot (*Calidris canutus rufa*). Note, no critical habitat locations were identified on the species list for Keweenaw County. The table below summaries the preferred habitats for the four (4) species and if the known habitat exists within the project area:

| Species | Preferred Habitat | Habitat within the project area on-site: |
|---|---|---|
| Canada lynx | The Canada lynx lives in northern boreal spruce-fir forests with high hare populations. | No |
| Gray wolf | The gray wolf lives in a wide range of habitats including northern forests. | No |
| Northern long-eared bat | The northern long-eared bat hibernates in caves and mines – swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during spring and summer. | No |
| Rufa red knot | The rufa red knot can be found in coastal areas and large wetland complexes during its migration. | Potential May 1 – Sept 30; “no effect” |

A field survey was completed on June 9, 2015 to verify the presence of threatened and endangered species. AECOM has concluded that the proposed project to excavate impacted soils from around the lighthouse at the Gull Rock site will have “no effect” on the listed species or their habitats.

If you have any questions regarding the Section 7 Endangered Species Act Consultation process completed for this project, please call Michelle Freimund or Travis Anderson at (920)-236-6712 or (906)-290-0723, respectively.

Sincerely yours,

**Travis Anderson**
Project Engineer II
(906)-290-0723
travis.anderson@aecom.com

# Appendix H – Phase I Archaeological Investigation

AECOM

# Phase I Archaeological Investigation
# U.S. Coast Guard
# Gull Rock Light Station CERCLA Project
# Keweenaw County, Michigan



AECOM Project Number: 60289135
December 16, 2016

## Quality information

| Prepared by | Reviewed by | Checked by |
| --- | --- | --- |
| Lynn M. Gierek, M.A., RPA<br>Project Cultural Resources Specialist | Andrew York<br>Associate Principal/Senior Archaeologist | Michelle L. Freimund, P.G.<br>Sr. Project Manager/Program Manager |

## Revision History

| Revision | Revision date | Details | Authorized | Name | Position |
| --- | --- | --- | --- | --- | --- |
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## Prepared for:

USCG Civil Engineering Unit Cleveland

## Prepared by:

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# Table of Contents



# Appendices



# List of Figures (See Appendix A)

# Executive Summary

AECOM Technical Services, Inc. (AECOM) was retained by the U.S. Coast Guard (USCG) to perform a Phase I archaeological investigation in advance of a proposed environmental investigation at the Gull Rock Light Station, located on Gull Rock in Lake Superior, Keweenaw County, Michigan (herein after referred to as the “Project Area”). The Project Area is comprised of the entire islet of Gull Rock, located in Lake Superior approximately 2.5 miles (4.02 kilometers [km]) east of Keweenaw Point on the Keweenaw Peninsula, Michigan. Comprising approximately 0.72 acres, the Project Area occupies a portion of the southwest quarter of the southwest quarter of Section 18, Township 58 North, Range 25 West (SW ¼, SW ¼, of Sec. 18, T58N, R25W). The Project Area location is presented in **Figure 1** in **Appendix A**.

As provided in Executive Order 12580 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the USCG is acting as the lead agency in implementing a Site Investigation (SI) under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) at the USCG Gull Rock Light Station Project Area. The SI is being conducted in accordance with the United States Environmental Protection Agency’s (USEPA’s) Guidance for Preliminary Assessments Under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (USEPA 1991, 540/G-91/013) and Federal Facilities Remedial Preliminary Assessment Summary Guide (USEPA 2005) to determine the extent of impacts of hazardous substances at the USCG Gull Rock Light Station property from current and historic operations and to develop a remedial strategy (the “Project”).

This Phase I archaeological survey was conducted on behalf of USCG. The National Historic Preservation Act (NHPA) and its implementing regulations (Section 106 - 36 CFR 800) require federal agencies to take into account the effects of their undertakings on *historic properties*, as defined, and to afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment. The NHPA and the regulations also require federal agencies to consult with the appropriate State Historic Preservation Offices (SHPOs) or a Tribal Historic Preservation Office (THPO) for projects on tribal lands, federal land managing agencies, federally recognized Native American tribes, and other parties (as defined by 36 CFR 800.2(c) (5)) for undertakings with the potential to cause effects to historic properties. By definition, *historic properties* are any properties listed in or eligible for listing in the National Register of Historic Places (NRHP).

An undertaking as defined by 36 CFR 800.16 (y) of Section 106 is any activity using federal funds, requiring federal permits, or involving Federal properties that may affect historic properties. In Michigan, the Michigan State Housing Development Authority (MSHDA) serves as the SHPO. Therefore, consultations regarding cultural resources, whether they are NRHP listed or eligible or State-significant, would be with MSHDA. Historical lighthouses are also protected under the National Historic Lighthouse Preservation Act (NHLPA) of 2000.

The Gull Rock Light Station was constructed in 1867 on Gull Rock. Gull Rock is an islet that is approximately 150-foot-wide and 250-foot-long, and currently contains two structures, including a 1.5-story, square wood frame and brick keeper’s dwelling and a brick privy. Former structures include an oil house (possibly built in 1896) and a boat house built in 1906. The oil house and boat house structures have since been demolished. In 1901, a 40-foot long retaining wall was constructed around the northeast corner of the keeper’s dwelling/light tower to prevent wave damage. The light was automated in 1913 and maintained by the keepers of the Manitou Island Light Station; Manitou Island is a larger island located to the east of Gull Rock. The Gull Rock Light Station is listed on the NRHP, with listing number 84001751.

A Phase I Environmental Site Assessment (Phase I ESA) was conducted on the Gull Rock Light Station property in 1997, which revealed areas of potential environmental contamination (Woodward-Clyde 1997). The report indicated that based on the age of the facility, lead-based paint (LBP) is suspected to be present in the light tower/dwelling structure and possibly in soil surrounding the existing and former structures. Additionally, asbestos containing materials may be present in the keeper's dwelling.

ENSR International (now part of AECOM), performed a Phase II Environmental Site Assessment (Phase II ESA) at the lighthouse property in 2004 (ENSR 2005). The Phase II ESA included the advancement of 17 shallow hand borings that were advanced around the Gull Rock Light structure. Seventeen soil samples were collected for field screening of lead utilizing an X-ray fluorescence (XRF) analyzer. Eleven of the 17 soil samples were submitted for laboratory analysis of lead. The results of the Phase II ESA documented that the soil type encountered generally consisted of silt to the termination depth (refusal) of the borings, approximately 6 inches (15.24 centimeters) below ground surface (cmbgs), where weathered bedrock (sandstone conglomerate) was encountered. Paint chips were also observed in the soil samples collected adjacent to the lighthouse structure, at an approximate depth of 2 inches (5.08 centimeters) below ground surface (cmbgs). Lead concentrations measured with the XRF ranged from 115±120 parts per million (ppm) to 2,340±240 ppm; lead concentrations from laboratory samples ranged from 120 milligrams per kilogram (mg/kg) to 2,350 mg/kg; lead concentrations in six of the 11 soil samples were above the Michigan Department of Environmental Quality (MDEQ) direct contact criteria for residential properties of 400 mg/kg. In general, the highest lead concentrations were documented in soil samples collected from the southeast (downwind) corner of the lighthouse keeper's dwelling. The report also states that the lead impact in soil was not delineated and further site investigation was recommended.

To commence the Phase I archaeological study, AECOM completed background research and records review at the MSHDA in Lansing, Michigan on June 8, 2015. The research was completed by Ms. Amanda Jenkins under the supervision of the Project's Principal Investigator, Ms. Lynn M. Gierek, RPA of AECOM. Field work was completed on June 9, 2015 by Ms. Gierek. During the time of AECOM's archaeological fieldwork, AECOM's environmental team conducted environmental soil and lake sediment sampling in the Project Area as well.

As previously stated, the Gull Rock Light Station is listed on the NRHP (listing number 8400175). However, based on review of the site file background research, AECOM determined that no previous archaeological surveys had been conducted within the Project Area and no archaeological sites have been recorded.

AECOM's archaeological field work covered the entirety of Gull Rock, including areas immediately surrounding the lighthouse structure **(Figure 2 in Appendix A).** The field methodology utilized included pedestrian survey methodology on two- to five-meter (two to five yards) transect intervals. No cultural materials were found as a result of the survey. Additionally, the prominent conglomerate rocks on Gull Rock were visually surveyed for any evidence of rock art; however, no evidence was found.

No further work is warranted in the Project Area and AECOM recommends that a finding of "No Historic Properties Affected" for archaeological resources for the Project as presently designed. AECOM assumes that there will be no disturbance to the structures themselves from the Project as planned and that remediation work will be temporary in nature. Therefore, AECOM recommends that a finding of "No Adverse Effect" for the NRHP-listed Gull Rock Light Station (listing number 84001751).

In the event that artifact concentrations, archaeological features, or human remains or burials are discovered as a result of Project activities, the Project must issue a stop-work in the immediate area and the USCG and MSHDA must be contacted for consultations prior to resuming any activities.

# 1. Introduction

AECOM Technical Services, Inc. (AECOM) was retained by the U.S. Coast Guard (USCG) to perform a Phase I archaeological investigation in advance of a proposed environmental investigation at the Gull Rock Light Station, Gull Rock in Lake Superior, Keweenaw County, Michigan (herein after referred to as the "Project Area"). The Project Area is comprised of the entire islet of Gull Rock, which is approximately 0.72 acres, located approximately 2.5 miles (4.02 kilometers [km]) east of Keweenaw Point on the Keweenaw Peninsula, Michigan, in Lake Superior. The Project Area occupies a portion of the southwest quarter of the southwest quarter of Section 18, Township 58 North, Range 25 West (SW ¼, SW ¼, of Sec. 18, T58N, R25W). The Project Area location is presented in **Figure 1** in **Appendix A**.

The Gull Rock Light Station was constructed in 1867 on Gull Rock. Gull Rock is an islet that is approximately 150-foot-wide and 250-foot-long, and currently contains two structures, including a 1.5-story, square wood frame and brick keeper's dwelling and a brick privy. Former structures include an oil house (possibly built in 1896) and a boat house built in 1906. The oil house and boat house structures have since been demolished. In 1901, a 40-foot long retaining wall was constructed around the northeast corner of the keeper's dwelling/light tower to prevent wave damage. The light was automated in 1913 and maintained by the keepers of the Manitou Island Light Station; Manitou Island is a larger island located to the east of Gull Rock. The Gull Rock Light Station is listed on the NRHP, with listing number 84001751.

## 1.1 Project Description and Environmental Background

As provided in Executive Order 12580 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the USCG is acting as the lead agency in implementing a Site Investigation (SI) under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) at the USCG Gull Rock Light Station Project Area. The SI is being conducted in accordance with the United States Environmental Protection Agency's (USEPA's) Guidance for Preliminary Assessments Under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (USEPA 1991, 540/G-91/013) and Federal Facilities Remedial Preliminary Assessment Summary Guide (USEPA 2005) to determine the extent of impacts of hazardous substances at the USCG Gull Rock Light Station property from current and historic operations and to develop a remedial strategy (the "Project").

A Phase I Environmental Site Assessment (Phase I ESA) was conducted on the Gull Rock Light Station property in 1997, which revealed areas of potential environmental contamination (Woodward-Clyde 1997). The report indicated that based on the age of the facility, lead-based paint (LBP) is suspected to be present in the light tower/dwelling structure and possibly in soil surrounding the existing and former structures. Additionally, asbestos containing materials may be present in the keeper's dwelling.

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## 1.2 Cultural Resources Investigations

This Phase I archaeological survey was conducted on behalf of USCG. The National Historic Preservation Act (NHPA) and its implementing regulations (Section 106 - 36 CFR 800) require federal agencies to take into account the effects of their undertakings on *historic properties*, as defined, and to afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment. The NHPA and the regulations also require federal agencies to consult with the appropriate State Historic Preservation Offices (SHPOs) or a Tribal Historic Preservation Office (THPO) for projects on tribal lands, federal land managing agencies, federally recognized Native American tribes, and other parties (as defined by 36 CFR 800.2(c) (5)) for undertakings with the potential to cause effects to historic properties. In Michigan, the Michigan State Housing Development Authority (MSHDA) serves as the SHPO. Therefore, consultations regarding cultural resources, whether they are NRHP listed or eligible or State-significant, would be with MSHDA By definition, *historic properties* are any properties listed in or eligible for listing in the National Register of Historic Places (NRHP).

An undertaking as defined by 36 CFR 800.16 (y) of Section 106 is any activity using federal funds, requiring federal permits, or involving Federal properties.

A review of available data indicates that the Project does not cross any Native American tribal lands; however, the Project Area and the nearby Keweenaw Peninsula are generally located in an area of Ojibwe tribal interest. Consultations with Native American Tribes are not part of the scope of work.

# 2. Environmental History

The Project Area is located on Gull Rock, an approximately 0.72-acre islet located on Lake Superior approximately 3.0 miles (4.83 kilometers) east offshore of the Keweenaw Peninsula. It is an extension of the massive basalt outflow that formed the Keweenaw Peninsula to the west and Manitou Island to the east approximately 1.5 billion years ago. Today, the Upper Peninsula (UP) of Michigan is surrounded by three of the Great Lakes – Superior, Michigan, and Huron. The topography of the Lake Superior Basin is largely the result of glaciation and is marked by ground-moraine deposits. The present environment reflects past geological, pedological, and ecological processes that are described below.

## 2.1 Geology

The geology of Michigan spans more than 3.5 billion years, from Late Precambrian bedrock formed from volcanic eruptions to loose, unconsolidated drift left behind by the continental ice sheets of the Pleistocene Epoch. The igneous and metamorphic bedrock of the western UP comprises the Precambrian, or Canadian, Shield, the original core (craton) of the North American continent (Sommers 1984) and the largest exposure of Precambrian rock anywhere in the world. The igneous rocks are hard, crystalline, resistant to erosion, and are largely made up of granites; the metamorphic rocks are mainly gneisses and schists.

The western UP is located in the Superior Upland Province, a physiographic region that is the only portion of the Canadian Shield in the United States (US). This geological province is the southern extension of the Laurentian Upland Province (USGS 2014).

The Keweenaw Peninsula is on the margin of the Lake Superior segment of the Midcontinent rift system, which extends northeast from Kansas to Lake Superior and then southeast through lower Michigan. In the Late Precambrian, basalt flows were extruded from the rift system. Up to 30,000 feet (9.14 kilometers) thick, about 400 distinct lava flows and minor clastic rocks covered a large area and now comprise the Portage Lake Volcanics (Albert et al. 1994). Post-volcanic Precambrian sedimentary rocks include 20 to 30 interbedded conglomerate and sandstone layers, comprising the Copper Harbor Conglomerate and Freda Sandstone, respectively (Huber 1975).

The mass of the thick Keweenawan rocks caused a general sinking of the land, and formed a very large geosyncline, referred to as the Lake Superior Syncline. Some faulting also was associated with the downward sagging (Warburton 2000). The Project Area lies near the Keweenaw Fault (Sommers 1984).

The higher areas in the UP, such as the Porcupine and Huron mountains in the western UP, are the remnants of ancient peaks that have been worn down over millions of years by the erosive action of wind, water, and moving ice. Across the UP, bedrock is overlain by unconsolidated material deposited during continental glaciation. Pleistocene glaciation moved down, and sometimes across, the Lake Superior Syncline, scooping out earlier deposits and exposing Precambrian rock. Consequently, in the western portion of the UP, a considerable amount of bedrock is visible. As the glaciers retreated, morainal deposits were left at the southwest end of Lake Superior, one of the very few non-Precambrian deposits in this location. The more resistant underlying rocks were left as prominent hills, including Isle Royale and the islands around it. After the glaciers melted, the Lake Superior Syncline filled with water. Presently, Lake Superior is 602 feet (0.18 kilometers) above sea level. Old, wave-cut terraces or beach terraces are considerably above the modern lake level, which are the product of isostatic rebound. The weight of the glaciers had depressed the rock beneath it. Once the weight was removed, the land began to rise, and continues to do so today, in a process called “glacial rebound” (Warburton 2000). Today, elevations throughout the UP range from approximately 600 feet (.18 kilometer) along the Great Lakes to 1,900 feet (.58 kilometer) inland (Jerome 2006).

The western UP contains valuable deposits of several minerals, but is mostly widely known for iron ore and copper. In fact, three major iron ranges are located in the vicinity of the Keweenaw Peninsula: the Marquette and Iron River/Crystal Falls ranges of Michigan’s UP and the Gogebic Range of northern

Wisconsin. During the first part of the Precambrian, thick sediments were laid down in a shallow sea that covered the Lake Superior region. Over the sand, great masses of iron minerals accumulated, either by chemical action or by the work of iron-forming bacteria, or both and/or other means, until vast thicknesses of sand and iron sediments had accumulated. After the Early Proterozoic (about 2 billion years ago), the deposition of iron-formation ceased, and this distinctive rock type is essentially absent from younger geological sequences. It now is commonly accepted that this transition was the result of a *major change in the chemistry of the Earth's surface environment*. Most geologists now believe the major change was the development of an *oxygen-bearing atmosphere* on Earth since iron is relatively soluble in an oxygen-deficient environment (e.g., the Early Precambrian) and could be present in large amounts in ocean waters. In oxygen-rich environments, like the Earth's present atmosphere, iron is incredibly insoluble, and is not present in quantity in ocean waters (Schaetzl n.d.).

### 2.1.1 Landform and Soils

Landforms in the UP are a product of glaciers that occupied the region during the Pleistocene Epoch (last Ice Age). During the Wisconsinan glacial stage, the entire UP was covered with a thick ice sheet that carried glacial drift. The variety of landforms visible on today's ground surface is the result of massive deposition of glacial drift as the ice sheet melted and receded northward. Approximately 11,000 to 9,500 years ago, Glacial Lake Duluth covered a large portion of the western UP. Numerous areas of sandy or clayey lacustrine deposits are associated with this glacial lake (i.e., glaciolacustrine deposits). Some of the deposits were covered later by outwash from the melting glacier to the north (i.e., glaciofluvial deposits). Glacial Lake Nippising was the last lake stage to occupy the UP from 6,000 to 4,000 years ago (Jerome 2006). Its shoreline is the closest to the present Great Lakes and an easily recognized ridge or bluff near the present-day beaches is present in many areas. The Quaternary landform of the Project Area is the Bedrock Ridge Complex. It consists of bedrock ridges, outcrops, benches, beach ridges and terraces and exhibits a trellis drainage pattern (Jerome 2006).

The sediments of the Project Area are thin to discontinuous over bedrock and composed mainly of medium- to coarse-textured tills (Farrand and Bell 1982). The spotty, shallow, rocky soils that cover Gull Rock are formed from locally derived glacial drift. The soil complex mapped for Gull Rock is the Rock Outcrop Complex, which consists of 90 to 100 percent rock outcrops with 2 to 35 percent slopes and very high surface runoff (NRCS 2015).

The U.S. Department of Agriculture (USDA)-Natural Resource Conservation Service (NRCS) has mapped the soil series in the Project Area (NRCS 2015). **Table 1** below summarizes the mapped soil series within the Project Area and their attributes.

**Table 1 Soils of the Project Area as Mapped by the USDA-NRCS**

| Soil Series | Soil Order | Soil Suborder | Description | Comments |
|---|---|---|---|---|
| Arcadian | Spodosols | Lithic Haplorthods | Very gravelly fine sandy loam formed in gravelly or cobbly loamy material overlying igneous, metamorphic or conglomerate bedrock. Shallow, well drained, moderately permeable soils on rocky knolls and ridges, on moraines, on till plains and on post glacial lake shorelines. Slopes range 1-90%. | No Ab horizon. |

| Soil Series | Soil Order | Soil Suborder | Description | Comments |
|---|---|---|---|---|
| Nipissing | Spodosols | Typic Haplorthods | Moderately deep, well drained soils on bedrock benches. They formed in gravelly and cobbly loamy and sandy material overlying igneous, metamorphic, or conglomerate bedrock. Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. Slope ranges from 0 to 35 percent. | No Ab horizon. |
| Rock Outcrop | N/A | N/A | Escarpments on benches, escarpments on moraines, hills on benches, hills on moraines, ridges on benches, ridges on moraines; 0 inches to lithic bedrock | No Ab horizon. |

## 2.2 Flora and Fauna

In the past, the range of available faunal and floral resources associated with the western portion of Michigan's UP depended in large part upon prevailing climatic conditions, which at times have experienced significant changes. Beginning approximately 13,000 years before present (yr B.P.), the climate began to warm as glaciers retreated, and conifers, together with megafauna, such as mammoth, dominated much of the Upper Midwest's landscape.

During the following 3,000 years, the region continued to experience a warming trend that resulted in spruce showing a sharp decline in dominance by 9,500 yr B.P. (Kapp 1999:51), to be replaced by jack and red pines. White pine would arrive in the area by 8,300 yr B.P., followed by hemlock by approximately 6,400 yr B.P. and beech by sometime before 3,000 yr B.P. (Kapp 1999:53).

Across the eastern United States, the climate became even warmer and drier, beginning circa 9,500 yr B.P. Continuing through 1,500 yr B.P., this trend had a significant influence on vegetation (Kapp 1999:53); however, depending upon the characteristics of a locale's soil, the warmer and drier conditions could have either accentuated or ameliorated shifts in vegetation. In Michigan, the warmer, drier period dates from about 9,000 yr B.P. to at least 2,500 yr B.P., and while these conditions influenced cyclical changes between the more xerophytic oak forests and mesophytic beech-maple-basswood-mixed hardwood forests of southern Lower Michigan, in northern Lower Michigan and the UP, the period, even at its maximum, is not clearly marked in pollen records. In some areas, an increase in white pines appears to mark a period of dryness beginning about 8,000 yr B.P. and lasting until approximately 5,000 yr B.P. (Kapp 1999:55), but the presence of the pines may be attributed to other factors. An increase in pines across the UP during the drier, warmer conditions may have restricted the availability of subsistence resources, and made the area less desirable to inhabit, especially if more abundant resources could be reaped along coastal zones.

Beginning between 3,400 to 3,000 yr B.P., a major vegetation shift occurred throughout the UP with northern hardwood forests (birch, hemlock, maple, and other deciduous species together with white pine) expanding into areas where soils accommodated the trees with good drainage but enough clay to retain moisture during droughts. In addition, a rising water table coupled with increased precipitation encouraged the creation of widespread marsh formation, as well as the creation of extensive, shallow peat deposits (Kapp 1999:57). This shift marks the onset of cooler conditions, which after 3,000 yr B.P., resulted in the creation of a vegetative cover that existed at the arrival of Euro-Americans Only later, after the 1840s, did Euro-American settlers really begin to develop the UP and subsequently remove much of the historic vegetation through agricultural and commercial activities, especially lumbering and mining.

The original northern hardwood forests in the western UP generally supported a greater diversity of conifers than today, providing structural complexity and a diversity of wildlife habitats (Albert 1995). According to Albert (1995), smaller areas of fire-dependent ecosystems such as white pine-red pine forest and jack pine barrens also occurred within this ecoregion. The region continues to support a diversity of wetland natural communities including bog, northern fen, northern wet meadow, hardwood-conifer swamp, rich conifer swamp, and extensive areas of muskeg and patterned fen (Albert 1995).

Data from the General Land Office (GLO) survey indicates that vegetation recorded in the Project Area circa 1845 consisted of yarrow and mountain ash. Prehistoric and historic peoples visiting Gull Rock would have found little floral and faunal subsistence resources available for use and nearly no animal resources other than aquatic species that could be fished. Accordingly, there is no evidence that prehistoric or historic peoples did much more than stop on Gull Rock for brief periods of time.

Today's climate in the UP is influenced by the proximity of the Great Lakes (Jerome 2006). Average annual temperature is 39-43 degrees Fahrenheit. Average daily summer high is 71 degrees Fahrenheit; average daily winter low is19 degrees Fahrenheit. Average annual precipitation is 30-36 inches (.76-.91 meters). Heavy lake-effect snowfalls, ranging from 140 to 200 inches (3.56-5.08 meters), characterize the region. A relatively cool growing season ranges from 110 to 130 days and is longest near Lake Superior (Albert 1995). About 95 percent of the UP is forested, with approximately 42% of the forestland in federal or state ownership (Jerome 2006).

Gull Rock is a bedrock island with no documented rare plant species. Low summer temperatures and fogs along the Lake Superior shore create arctic-alpine-like climatic conditions, and in combination with volcanic bedrock along the shoreline, provide habitat similar to that found farther north, where these plants are more common. Gull Rock's bedrock/cobble shoreline and light station grounds support approximately 13 vascular plant species, about half of which are non-native species. Non-native plant species are confined to disturbed areas in the vicinity of the light station. Non-native species on Gull Rock included shepherd's-purse (*Capsella bursa-pastoris*), quack grass (*Elymus repens*), Canada bluegrass (*Poa compressa*), dandelion (*Taraxacum officinale*), and strawberry-weed (*Potentilla norvegica*), the latter of which has native and non-native forms. Native plant species include yarrow (*Achillea millefolium*), showy mountain-ash, chokecherry (*Prunus virginiana*), and red-berried elder (*Sambucus racemosa*) (Marr et al. 2009).

# 3. Culture History

Occupation or use of the general region spans the prehistoric through historic periods. As a result of the paucity of existing site data for the Project Area and its immediate vicinity, this section provides information on historic contexts generalized for the entire state, with particular emphasis on the UP. Specific site data are presented wherever appropriate. However, there is no evidence that prehistoric or historic peoples did much more than stop on Gull Rock for brief periods of time. Prehistoric and historic peoples visiting Gull Rock would have found little floral and faunal subsistence resources available for use and nearly no animal resources other than aquatic species that could be fished. Additionally, Lake Superior's most violent storms occur in the area of the Keweenaw Peninsula and these storms, in combination with the extensive shoals in the area, create numerous navigational hazards. Gull Rock is a very small and often invisible low bedrock islet that was a hazard to vessels heading toward the Keweenaw Peninsula's prior to the construction of the Gull Rock Light Station.

## 3.1 Paleo-Indian Tradition: 13,400 to 10,000 yr B.P.

The earliest inhabitants of Michigan are recognized as nomadic hunters and gatherers, who archaeologists refer to as Paleo-Indians. This group's subsistence base was heavily slanted toward the exploitation of Pleistocene mega-fauna such as mammoth, mastodon, bison, and caribou. In addition, limited contextual data, combined with ethnographic data about extant hunter-gatherer groups (Cleland 1966:49), suggests that their diet also included significant proportions of native plant foods and a variety of small mammals, reptiles, birds, and fish.

Currently, the Paleo-Indian period is subdivided into Early and Late stages. The temporal division separating the two is based upon a transition from fluted-to-non-fluted, lanceolate points (Mason 1981:111-112; Mason 1986:192; Mason 1997:98). Frequent indicators of a Paleo-Indian association with an area are isolated finds of distinctive projectile point styles: Clovis, Folsom, Scotsbluff, Eden, Agate Basin, and several others. While the fluted Clovis and Folsom points define the presence of Early Paleo-Indian inhabitants in many regions of North America, within Michigan, fluted points are further recognized as Enterline, Gainey, Barnes, Crowfield, or Holcombe points based on specific fluting and morphological attributes (Shott 1999). Much of what is known about Michigan's Paleo-Indian tradition is derived from sites reported from the state's Lower Peninsula (Buckmaster and Paquette 1988; Shott 1999). As a result, archaeologists are not in a position to offer detailed discussions about UP regional subsistence, settlement, or land use practices.

Until recently, archaeologists have postulated that Paleo-Indians primarily inhabited the Marquette, Michigan area to the southeast of the Project Area, because of its lake basins and open tundra. However, a recent fortuitous find (Paleo-Indian biface) by a private landowner was unearthed near Hermansville, Michigan, which is located approximately 100 miles (160.93 kilometers) south of Marquette. This area was reportedly much less hospitable, since it had no lake basins and was much more forested with large expanses of wetlands.

No Paleo-Indian materials are reported for the vicinity of the Project Area. The presence of such materials on the Keweenaw Peninsula, however, suggests Paleo-Indian people were acquainted with the area. Whether early American Indians actually visited Gull Rock remains unknown.

## 3.2 Archaic Tradition: 10,000 to 2,500 yr B.P.

The Archaic tradition followed that of the Paleo-Indian and is marked by a subsistence shift oriented toward smaller game and a broader range of plant species. Archaeologically, Archaic sites are frequently defined by the absence of pottery containers, the presence of burials in natural knolls or flat cemeteries as opposed to man-made mounds, and the recovery of faunal and floral remains representing a more generalized or diversified subsistence base (Stoltman 1986, 1997).

Changes in, or the broadening of the subsistence base is linked to climatic conditions, which became ameliorated as glaciers retreated.  This shift in resource utilization is frequently reflected in stone tool assemblages, which show a trend toward greater diversity of projectile point/knife styles and an increase in proportions of ground stone, woodworking, and seed and nut processing implements.  In addition, more emphasis is placed on fishing and the harvesting of riverine shellfish.  Finally, copper objects become more common.  To facilitate discussion of these changes and the tradition in general, the Archaic tradition is often divided into three stages: Early (10,000-8, 000 yr B.P.), Middle (8,000-5,000 yr B.P.), and Late (5,000-2500 yr B.P.).  These stages are defined primarily on changing projectile point/knife styles.

Archaic settlement patterns were typically influenced by mobility strategies coupled with paleo-environmental and demographic conditions (Shott and Wright 1999).  Across Michigan, Archaic peoples moved through the landscape pursuing residential or logistical mobility strategies and created settlement patterns that are currently poorly understood but partially reflected by recorded sites located in open-air settings.  Representative cultural resource types typically consist of isolated finds, base camps, transient camps, faunal and floral resource procurement stations, and processing sites.  While the defined site types span the entire tradition, the frequency of each type may have changed in response to shifting mobility strategies linked to evolving natural and social conditions.  Through time, these conditions encouraged or discouraged the establishment of certain site types as people adapted to their changing environment.

In the western UP, the Archaic is represented primarily by the Shield Archaic culture.  Known more readily from the region to the north of the Great Lakes, the southern territory of the Shield Archaic culture stretched to the south of Lake Superior and included the area of the Project Area.  The Shield Archaic appears to have its roots in the Paleo-Indian period and is known to have persisted in remote areas of the UP even beyond the Archaic period and up to European contact, suggesting that the Shield Archaic tradition may have developed in situ from the Late Paleo-Indian tradition in the region (Mason 2002).

The Archaic tradition associated with the UP is documented by isolated surface finds and sites dating from the Early through Late sub-traditions.  Absent from the combined studies is an UP Middle Archaic presence, a sub-tradition that is best known from Lower Peninsula sites (Lovis 1999:87).  The Late Archaic sites indicate that at least during the end of the Archaic tradition, people were utilizing both coastal and interior environments (Robertson et al. 1999:109), and were present in the region during summer and winter seasons (Fitting 1979:111; Hill 1994:48; Robertson et al. 1999:109). The mining and use of copper by these groups have been documented in the Early Archaic with such items as copper fishhooks.  The presence of copper artifacts in sites expands greatly all over the Great Lakes during the Late Archaic period.  Numerous types of copper items were manufactured by the Late Archaic inhabitants of the Great Lakes region, including tools such as projectile points and knives, awls, gorges, fishhooks, and jewelry items such as beads, bracelet.  The copper source existed right in the vicinity of the Project Area, on the Keweenaw Peninsula, Isle Royale, and in nearby northwestern Wisconsin (Mason 2002).  It is these same sources of copper that Euro-Americans came to mine extensively in the region several thousand years later.

No Archaic Period materials are reported for the Project Area.  While the temporal distribution of sites indicates that the region of the Keweenaw Peninsula was utilized by people during the entire Archaic period, the quantity and quality of the data provide few insights about group size, mobility, organization, or social interactions within the region (Shott and Wright 1999).  In summary, Archaic tradition people are known to have occupied and exploited the western  portion of the UP just as Paleo-Indian groups did, but specific details about the nature and the intensity of the local Archaic occupation awaits further study.

## 3.3 Woodland Tradition: 2,800 to 750-700 yr B.P.

Adaptations characterizing the Archaic tradition generally continued into   the early Woodland, subsequently developing into a variety of behaviors responding to environmental, subsistence, and social conditions.  Well-defined traits marking the tradition are the presence of ceramics, the construction of earthen mounds for burials, and the cultivation of plants.  In addition, population size increased, exotic goods reflecting extensive trade networks became more frequent, and burial customs grew more elaborate during this period. Material culture reflects these changes with new projectile point types, distinctive ceramic forms, greater variety of trade goods, and more decorative elements placed on implements. In spite of these characteristics and innovations, subsistence practices remained rooted for a long period to cycles of hunting and gathering as horticulture became progressively more important and cultigens played a larger role in subsistence strategies. Coupled with this gradual shift toward cultigens was a shift from seasonal, nomadic settlement patterns to occupations of large, semi-permanent villages in addition to seasonal resource procurement camps. Similar to the Archaic tradition, the Woodland may be divided into stages designated Early (2,500-2,000 yr B.P.), Middle (2,000-1,600 yr B.P.), and Late (1,600-400 yr B.P.).

In the absence of radiocarbon dates, these stages are identified archaeologically on the basis of specific projectile point and ceramic styles. Within Michigan, the full temporal spectrum of Woodland tradition sites is present, but site distribution is uneven with segments of the tradition poorly understood in some areas, for example, the Early Woodland in the UP (Garland and Beld 1999:130), due to a lack of excavated sites and published reports. While numerous surface finds of diagnostic projectile point styles have been reported, and sites have been recorded, these data are area specific and cannot be used to synthesize an adequate regional perspective about Woodland subsistence, settlement, or land use practices. While characteristic mounds are present within the western UP, their numbers are few.

Early Woodland stage sites on the UP, when recognized, are marked by the presence of the oldest regional ceramic type known as Lake Nokomis Trailed and by projectile points that most frequently show contracting- or straight-stemmed forms. These materials have also been used to define the Early/Middle Woodland transitional phase known as Nokomis (Salzer 1969, 1974).

Of the three stages that compose the Woodland tradition, the Middle and Late stages are more frequently represented by sites. An apparent increase in Middle Woodland sites relative to earlier and later stages is attributed to the development of the loose trade and cultural network known at the Hopewell Interaction Sphere (HIS). This network, which dominated much of the lower Ohio and Mississippi River valleys but extended north into Michigan, brought exotic goods and ideas to the area and fueled the extraction of certain raw materials such as copper. The HIS stylistic influence was strongest during the earliest stages of the Middle Woodland (Fitting 1979:112), and then waned; however, as long as the HIS functioned, the regional extraction and export of copper brought people to the region, where they created and left archaeological sites. With the decline of the HIS, utilization of the area appears to have declined and Late Woodland sites appear fewer in number.

Similar to Early and Middle stage sites, those of the Late stage are recognized primarily by distinctive ceramic styles of the Blackduck complex (Fitting 1978). her parts of the greater region. In the UP, several sub-phases are also defined that distinguish this area from other parts of the western Great Lakes region. For the western portion of the UP, Late Woodland sites are not well understood, but exhibit some characteristics that relate to the Lakes phase as well as Blackduck. The Lakes phase evolved slowly over the entire Late Woodland period. Data is more prevalent from sites dating to the Late stage; however, it is clear that influences from other groups in the region were felt, especially Blackduck phases to the north (Mason 2002; Brose 1978).

No Woodland Period materials are reported for the Project Area. The distribution of Woodland tradition sites across the UP's western half suggests sites from all stages exist in the region. In addition, the sites indicate that Woodland people, as did people of traditions preceding them were familiar with the region and the resources it offered, although the nature and intensity of the occupation or use remains poorly understood. With the arrival of Europeans, use of the region by American Indians was modified, and from the 17th century onward human use of the area is better documented and understood.

## 3.4 Historic American Indian Occupation

The western portion of the UP (including the Keweenaw Peninsula and the Project Area) was traditionally considered the home territory of the Ojibwa (a.k.a. Chippewa) (Tanner 1987) although other groups may have occasionally made incursions into the region. Despite the complications of understanding the 16th- and early 17th-century use of the region by American Indians due to depopulation by European-introduced diseases and by the migration of eastern groups to the area, the region does not appear as much of a mystery regarding tribal affiliation. In fact, it could be argued that the Ojibwa at the time of European contact were those who descended from the Late Woodland Blackduck groups. After the arrival of Europeans, the developing fur trade of the 17th and 18th centuries created social and economic changes that influenced the nature of the occupation, as did the shifting regional political claims by French, British, and American interests (Ritzenthaler 1978).

Due to the U.S. Government's continued efforts to acquire land for mining due to the newly-discovered copper and iron lodes, by 1842 the Ojibwa had ceded most of their claims to lands in the western portion of the UP to the U.S. Government and withdrawn westward or settled on reservations (Stone and Chaput 1978). The Ojibwa reserved some rights to hunt and fish on lands until they were required for settlement. The 31 July 1855 *Treaty with the Ottawa and Chippewa* made provisions to allow the U.S. government to withdraw public lands not sold or conveyed to private interests, and offered these lands to the Ottawa and Chippewa for their use.

American Indian rights and access to land have been further expanded or enforced by 21st-century decrees upholding American Indians hunting and fishing rights on public lands (Cleland 1992).

Early accounts in the mid-17th Century made by Euro-American explorers and by the Jesuits indicate that the Ojibwa were present on the Keweenaw Peninsula and knew much about it and its resources, such as the copper deposits. Once fur trading posts were established, Euro-American contact with the Ojibwe increased and more stories and descriptions of the Ojibwa on the Keweenaw Peninsula began to circulate. During the mid-1800s, several accounts indicate that the Ojibwa avoided Keweenaw Point, believing it to be a place of powerful supernatural beings, known as Manitous. In fact, according to an 1827 account by Thomas McKenney, the first Superintendent of Indian Affairs who visited the southern shores of Lake Superior, the Ojibwa told of a traditional story (perhaps of 100 years old) of how a group of their people attempted to make a visit to what is now Manitou Island to the east of Gull Rock, and when they approached it, there appeared a form of a woman that grew in size until the being was so large and overpowering that they fled from it and believed it to be a sign that they should never again approach the island (Deegan et al. 2007).

It is likely that the limited size and lack of many resources on Gull Rock as well as the hazardous nature of Lake Superior and the surrounding shoals prevented any type of long term occupation of the islet by Native Americans. No prehistoric sites or historic Native American occupations have been found on Gull Rock.

## 3.5 Euro-American Settlement and Development

The UP is known for vast deposits of copper and iron as well as lush forests and a great supply of fish and mammals (UP Engineers & Architects 2006:7). Euro-American settlement of the region first occurred for religious, military, and economic reasons. Due to poor agricultural conditions, including short growing seasons, large-scale farming was not widely pursued. Rather, the area was developed or exploited for its natural resources, which first included fur-bearing animals, and later lumber and mining.

Through time, the French, British, and Americans took an interest in the economic benefits of the region. Of these, only the Americans have occupied the region for a sufficiently long duration to take the most advantage of the region's other natural resources. Despite accounts of occasional forays made by fisherman beyond the Gulf of St. Lawrence into the Upper Great Lakes during the 1500s, the Europeans credited for first visiting and exploring the UP were the French Explorers and Catholic missionaries arrived in the UP in the early 1600s. Etienne Brulé of France was probably the first European to visit the

UP, crossing the St. Mary's River around 1620 in search of a route to the Far East. In 1634, Jean Nicolet explored parts of the UP. Missionaries arrived and established a mission at Keweenaw Bay in 1660. In 1668, Father Jacques Marquette established the first permanent settlement of Michigan at Sault Sainte Marie. By 1700, missionaries had explored much of the region and built missions and trading posts.

The French were also the first to establish land claims in the UP. Following the end of the French and Indian War in 1763, it became British territory. Shortly after, American Indian groups who had been allies of the defeated French found themselves increasingly dissatisfied with the British occupation and the new policies imposed by the victors. While the French had long cultivated alliances among the Indians, the British post-war approach was essentially to treat the Indians as a conquered people. The resulting Pontiac's Rebellion included the capture of Fort Michilimackinac, near present-day Mackinaw City, Michigan, which was then the principal fort of the British in the Michilimackinac region.

Although the UP nominally became US territory with the 1783 Treaty of Paris, the British did not give up control until 1797 under terms of the Jay Treaty. As an American territory, the UP was still dominated by the fur trade. John Jacob Astor founded the American Fur Company on Mackinac Island in 1808; however, the industry began to decline in the 1830s. As the fur trade waned, commercial interests turned to the forests for lumber, specifically white pine in the region containing the Project Area.

The Michigan Territory originally included only the Lower Peninsula and the eastern portion of the UP. In 1819, the territory was expanded to include the remainder of the UP, all of Wisconsin, and part of Minnesota (previously included in the Indiana and Illinois Territories).

When Michigan was preparing for statehood in the 1830s, the boundaries proposed corresponded to the original territorial boundaries, with some proposals even leaving the UP out entirely. Meanwhile, the territory was involved in a border dispute with the State of Ohio in a conflict known as the Toledo War. The people of Michigan approved a constitution in May 1835 and had elected state officials in late autumn 1835. Although the state government was unrecognized by the United States Congress, the territorial government effectively ceased to exist. A constitutional convention of the state legislature refused a compromise to accept the full UP in exchange for ceding the Toledo Strip to Ohio. A second convention, hastily convened by Governor Stevens Thomson Mason consisting primarily of Mason supporters, finally agreed to accept the UP in exchange for the Toledo Strip in December 1836.

In January 1837, the U.S. Congress admitted Michigan as a state of the Union. At the time, Michigan was considered the losing party in the deal because the land in the UP seemed much less valuable than the land in the Toledo strip, and was described in a federal report of the time as a "sterile region on the shores of Lake Superior destined by soil and climate to remain forever a wilderness."

This feeling was soon reversed when rich mineral deposits of primarily copper and iron were discovered in the 1840s. Though not initially profitable, the UP's mines would eventually produce more mineral wealth than the California Gold Rush, especially after shipping was simplified with the opening of the Soo Locks in 1855 and docks in Marquette in 1859. The UP supplied 90 percent of America's copper by the 1860s. It would be the largest supplier of iron ore by the 1890s, though mining declined sharply after peaking in the 1920s. The last copper mine closed in 1965, though some iron mining continues near Marquette.

In 1837, there were six UP counties with the region being part of Ontonagon County. In 1846, Houghton County was created out of Ontonagon County encompassing Baraga, Keweenaw and present Houghton Counties. In 1861, Keweenaw County was founded with Eagle River as its County Seat. Thousands of Americans and immigrants moved to the Keweenaw area during the mining boom, prompting the federal government to create Fort Wilkins near Copper Harbor to maintain order. The first waves were the Cornish, with centuries of mining experience, followed by Irish, Germans, and French Canadians. Finnish immigrants began settling in large numbers during the 1890s. Upon formation, the County was divided into seven townships, one of which is Grant Township of which Gull Rock is a part. In 1870, the first census of this County, reported that Grant Township had a population of 152. By 1880, this population had grown to 365.  By 1890, the population has dropped to 100 and current population based on the 2000 census indicates that the population is 172, demonstrating the population spike due to the mining boom (Keweenaw County 2015).

Historical activity is represented in the Project Area only by the Gull Rock Light Station, which was (and continues to be) important as a navigational aid in the infamously hazardous waters of Lake Superior near the Keweenaw Peninsula.  The history and historical significance of Gull Rock Light Station is provided in the following Section 4.0.

# 4. Previous Investigations

## 4.1 Previously-Recorded Archaeological Sites and Surveys

AECOM's site file search at the MSHDA revealed that no previous archaeological investigations have been conducted on Gull Rock (MSHDA 2015). One previous investigation was conducted on nearby Manitou Island to the east in 2006 by the Industrial Heritage and Archaeology Program of Michigan Technological University (MTU). The study was requested by the Bureau of Land Management (BLM) as a precursor to a land ownership transfer from the BLM, which was the current manager/owner at the time, to the Michigan Department of Natural Resources. MTU's study was a shoreline survey in three main locations on the island, including the North Bay Inlet, the South Bay, and Fisherman's Bay (Deegan et al. 2007). Of these three study locations, North Bay Inlet and South Bay are located at the west end of Manitou Island and the Fisherman's Bay study area is located on the southeastern portion of Manitou Island.

As a result of the 2006 study, five historic period archaeological sites were recorded, including three ephemeral fishing villages (20KE55, 20KE56, and 20KE57); one historic trash midden site (320KE58); and a small copper mining site (20KE59). Field methodology consisted of largely pedestrian survey supplemented with shovel test (ST) survey. No significant cultural materials or sites were found in the South Bay study area. Sites 20KE55 and 20KE56 are located along the North Shore Bay Inlet. Site 20KE55 is described as log house ruins located on the west side of the North Bay Inlet, including two structures, a root cellar, several pruned trees, and artifact scatters amongst the structure features. Inscriptions within one of the buildings and a large ceramic clay stove pipe found in the other structure suggest 1920s, 1930s, and 1940s occupations. Site 20KE56 is described as two structures and associated artifact scatters located on the east side of the North Bay Inlet. Both sites are situated near the beach, but no evidence of boat ramps was found. According to MTU's report, an earlier report written by Fadner in 2003 indicated of log cabins and camps in these locations suggested that they were "built by fisherman" over 50 years ago and were "used by them on days when they set their fish nets in the lake near the island" (Deegan et al. 2007).

Sites 20KE57 and 20KE58 were found at the third shoreline area to be surveyed, which was at Fisherman's Bay located on the southern shore on the eastern portion of Manitou Island. As a result of the survey, MTU recorded 20KE57, which includes the remnants of three structures. One cabin was nearly standing in its entirety with a stove, barrel pieces, and cans located adjacent to it with bricks dating to 1895. A second structure contained several barrel hoops and machine-made bottles inside the foundation. The third structure did not have artifacts in close association, but appeared to date to the 1890s and included an iron winch and winch path on its south side that runs down to the shore of the bay. Several large artifact scatters were found in the surrounding area. MTU also recorded Site 20KE58 in the surrounding area, which consisted of a large artifact scatter that was located farther away from 20KE57. The scatter contained ironstone plate fragments and hole-in-top cans with one of the plate fragments possessing a maker's mark that dates between 1890 and 1907 (Deegan et al. 2007).

Lastly, the MTU survey included a fourth area of Manitou Island not associated with any of the three bays. The location of North Point on the northernmost shore point of the island was visited by MTU to search for evidence of a copper mine that was reportedly located in this area by a few historical accounts, namely, an Ulffers 1878 map and an account by Fadner during the 1960s, both of which indicated that a mine shaft was located in this area. MTU was unable to locate the mine shaft, but did find a copper vein and a large pile of stone debris ("poor rock") resulting from mining activities (Deegan et al. 2007). Based upon the survey results, MTU recommended as all five sites eligible for the NRHP under Criteria A and D.

## 4.2 Gull Rock Light Station

Constructed in 1867, Gull Rock Light Station is listed on the NRHP (listing number 84001751). Gull Rock currently contains two structures, including a 1.5-story, square wood frame and brick keeper's dwelling with a basement and brick privy. Former structures include an oil house built in 1906 and a boat house. The oil house and boat house structures have since been demolished. In 1901, a 40-foot long retaining wall was constructed around the northeast corner of the keeper’s dwelling/light tower to prevent wave damage. The light, which is a part of the keeper’s dwelling, was automated in 1913 and maintained by the keepers of the light station on Manitou Island, a larger island located to the east of Gull Rock. No light keepers or other personnel continued to live or work on Gull rock after 1913 (Woodward Clyde 1997).

Today, the unmanned lighthouse remains an active aid to navigation and a key landmark marking the bend in the shipping lane that connects Duluth, MN to Sault Saint Marie, MI. During fierce storms from the northwest, Gull Rock also marks the gateway to safe passage on the leeward side of the Keweenaw Peninsula, a well-known safe harbor. Because the Gull Rock Lighthouse lies in the open waters of Lake Superior, it is exposed to the lake’s severe winds, high waves, large winter ice-jams, and the hazardous current off the tip of the Keweenaw Peninsula. Storm waves occasionally wash completely over the island’s surface, briefly engulfing enclosing the base of the lighthouse in water (GRL 2015).

The following description of the structures is based on AECOM’s exterior views of the structures during survey as well as previous environmental reports prepared by others. The following paragraphs describe the Gull Rock Light Station.

The existing Gull Rock light tower is a 46-foot high square, brick structure that creates a focal plane 50 feet (15.24 meters) above the mean low water level of Lake Superior. It is constructed of 12-inch (30 centimeters) thick outer brick walls with a 4-inch (10 centimeters) thick brick interior walls that supports the staircase. The lantern is cast iron and is 10-sided with vertical bars. Originally, the light was a Fourth Order Fresnal lens, which was replaced later by a 250 millimeter (9.8 inch) acrylic lens. Fresnal lens were developed by a French physicist (Augustin Fresnal) in 1822, and were in widespread use by 1841. The Fresnal lens concentrates the light source via the use of prisms. Initially, as with other early light sources, the Fresnal lens used animal (typically whale) oil, until the scarcity of whales forced the use of lard (mid 1860s) and later kerosene (1870s) as fuel. The Gull Rock Light fuel source was converted to solar energy with batteries as a power source and continues to be used remotely as a navigational aid (Woodward Clyde 1997).

The 1.5-story, approximately 2,400 square-foot keeper’s dwelling is attached to the light and is also of brick construction with a gabled roof. One additional remaining structure on Gull Rock is the square brick privy, which is in relatively good condition but has no floor. The only remains of the former boathouse are iron features located to the west of the structure in a linear row down to the lake shore. Although an oil house was supposedly located on Gull Rock, there is currently no evidence of it remaining. Reportedly, there is record of a boat that delivered materials and a work crew to construct the oil storage building in 1896 (Pepper 2012).

In 1873 an appropriation was requested for the construction of a fog signal at Gull Rock, but the station was never constructed. Concrete walkways were replaced in 1883 and a 29-foot-long boat landing was constructed on the south side of the rock in 1890 (Pepper 2012). In 1906, this landing was reconstructed and a boathouse was built.

According to Lighthouse Digest and other popular lighthouse publications, construction began on the Light Station in 1867, but was delayed by the drowning death of the construction foreman, William Tunbridge. Once a new foreman was selected, work resumed until the Light Station was ready for operation in November 1867. Thomas Jackson was the first keeper with Henry Letchen as his assistant in 1867, but for unknown reasons they were removed by 1868. Stephen Cocking became the next keeper and would remain for nine years. His assistants reportedly kept resigning and ultimately his wife Mary became his assistant. They remained until 1877, when he was appointed keeper at Eagle Harbor. James Corgan took over as keeper and his wife was appointed assistant keeper. They remained until 1883 when he was also transferred. Another keeper was John Nolan, who was assistant to Norman Guilbault in 1887 (who died that same year). John then became keeper. He had John Smith as his assistant for three years. John Nolan's wife Alice became his assistant and remained there with him until 1903 when he was transferred to Eagle Harbor as keeper. Gull Rock Light would see 20 keepers and assistants over its 60 years as a manned station. The last keeper was Herbert Crittenden, who served from 1910 until its closing as a manned light (Nelson 2002).

Currently, the Gull Light Station is owned by the Michigan Lighthouse Conservancy and is managed by the Gull Rock Lightkeepers (GRL), a nonprofit group founded in 2004 to restore the lighthouse for preservation purposes. GRL is a Michigan-based 501(c)3 nonprofit whose sole mission is to preserve and restore the Gull Rock Light Station. Reportedly, major structural repairs were completed in the summer of 2012.

# 5. Methodology

Methods utilized by AECOM involved desktop analysis as well as field work, which are described in the following sections.

## 5.1 Background Research

To commence the Phase I archaeological study, AECOM completed background research and records review at the MSHDA in Lansing, Michigan on June 8, 2015. The research was completed by Ms. Amanda Jenkins under the supervision of the Project's Principal Investigator, Ms. Lynn M. Gierek, RPA, of AECOM. As previously stated, the Gull Rock Light Station is listed on the NRHP (listing number 8400175); however, based on review of the site file background research, AECOM determined that no previous archaeological surveys had been conducted within the Project Area and no archaeological sites have been recorded.

NRHP and NHLPA information was reviewed for the historic light station. Research consisted of queries for previously recorded archaeological sites in the vicinity as well. Inventory forms of known archaeological sites and the previously-conducted archaeological investigation on nearby Manitou Island were photocopied and reviewed (Deegan et al. 2007). AECOM additionally reviewed USGS 7.5-Minute Topographical Quadrangle Maps (1985, 1994, and 2009), Government Land Office (GLO) maps, and historical plat maps for Grant Township in Keweenaw County (Walling 1873; Houghton 1845; W. W. Hixson & Company 1917, 1930).

## 5.2 Field Methods

AECOM's archaeological field work covered the entirety of Gull Rock, including areas immediately surrounding the lighthouse structure. Field work was completed on June 9, 2015 by Ms. Gierek. During the time of AECOM's archaeological fieldwork, AECOM's environmental team conducted environmental soil and lake sediment sampling in the Project Area as well. The field methodology included pedestrian survey on 2 to 5 meter (2 to 5 yards) transect intervals. No archaeological materials were found as a result of the survey. Additionally, the prominent conglomerate rocks on Gull Rock were visually surveyed for any evidence of rock art.

All observations were recorded in the Field Supervisor's daily journal, and the Project Area was photo-documented with a digital single-lens reflex (SLR) camera. The survey boundary was recorded with a Trimble GeoXH™ handheld Global Positioning System (GPS) capable of sub-meter accuracy. GPS data were downloaded into the Project's Geographic Information System (GIS) after the completion of the field survey.

# 6. Results

## 6.1 Background Research

By reviewing the output of the background research, AECOM determined that no previous archaeological surveys had been conducted within the Project Area and no previously-recorded archaeological sites are within or in the immediate vicinity of the Project Area.

One previous survey was conducted in 2006 on Manitou Island to the east, which resulted in the identification of five historic period archaeological sites, including three ephemeral fishing villages (20KE55, 20KE56, and 20KE57); one historic trash midden site (320KE58); and a small copper mining site (20KE59) (Refer to Section 4.1).

One historic architectural site is located within the Project Area. The Gull Rock Light Station is listed on the NRHP (listing number 84001773) (refer to Section 4.2). Historical archival research revealed no additional structures or properties located within the Project Area.

## 6.2 Field Survey

AECOM's archaeological field work covered the entirety of Gull Rock, including areas immediately surrounding the lighthouse structure **(Figure 2 in Appendix A)**. As a result of AECOM's archaeological survey, no archaeological materials were found as a result of the survey. Photographs of the survey area are located in **Appendix B.**

# 7. Recommendations

No further work is warranted in the Project Area and AECOM recommends that a finding of “No Historic Properties Affected” for archaeological resources for the Project as presently designed. AECOM assumes that there will be no disturbance to the structures themselves from the Project as planned and that remediation work will be temporary in nature. Therefore, AECOM recommends that a finding of “No Adverse Effect” for the NRHP-listed Gull Rock Light Station (listing number 84001751).

In the event that artifact concentrations, archaeological features, or human remains or burials are discovered as a result of Project activities, the Project must issue a stop-work in the immediate area and the USCG and MSHDA must be contacted for consultations prior to resuming any activities.

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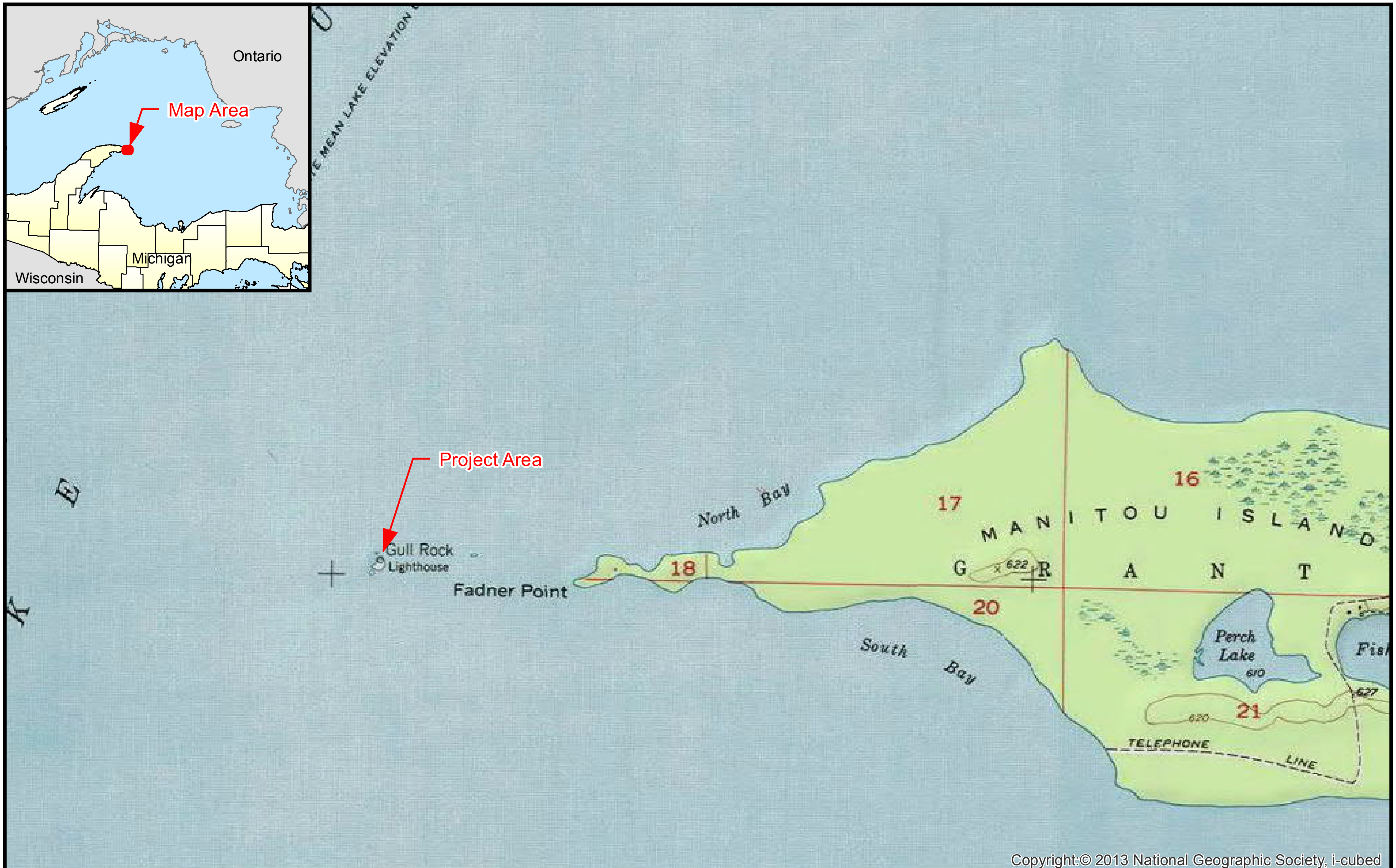
# Appendix A - Figures





AECOM

SITE LOCATION MAP
ARCHAEOLOGICAL SURVEY
GULL ROCK
KEWEENAW COUNTY, MICHIGAN

N

0 500 1,000 2,000
Feet

| | | |
|---|---|---|
| Drawn: | JW | 9/2/2015 |
| Approved: | LG | 9/2/2015 |
| Scale: | AS SHOWN | |
| PROJECT NUMBER | 60289135 | |
| FIGURE NUMBER | 1 | |

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SURVEY AREA
ARCHAEOLOGICAL SURVEY
GULL ROCK
KEWEENAW COUNTY, MICHIGAN

| | | |
|---|---|---|
| Drawn: | JW | 9/2/2015 |
| Approved: | LG | 9/2/2015 |
| Scale: | AS SHOWN | |
| PROJECT NUMBER | 60289135 | |
| FIGURE NUMBER | 2 | |

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# Appendix B - Photolog

| AECOM | PHOTOGRAPH LOG | |
|---|---|---|
| **Client Name:** USCG | **Project:** Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | **Project No.** 60289135.1.3 |

| **Photo No.** 1 | **Date:** 6/9/15 | |
|---|---|---|
| **Direction Photo Taken:**<br><br>North | |  |
| **Description:**<br><br>View of the Gull Rock Light Station from Lake Superior. | | |

| **Photo No.** 2 | **Date:** 6/9/15 | |
|---|---|---|
| **Direction Photo Taken:**<br><br>Northwest | |  |
| **Description:**<br><br>Close-up view of the Gull Rock light. | | |

# PHOTOGRAPH LOG

| **Client Name:** USCG | **Project:** Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | **Project No.** 60289135.1.3 |
|---|---|---|

| **Photo No.** 3 | **Date:** 6/9/15 |
|---|---|
| **Direction Photo Taken:** North | |
| **Description:** Close-up view of the south side of the Gull Rock light and the keeper's dwelling. | |

| **Photo No.** 4 | **Date:** 6/9/15 |
|---|---|
| **Direction Photo Taken:** East-Northeast | |
| **Description:** Close-up view of the west side of the Gull Rock light and the keeper's dwelling | |

| **AECOM** | | **PHOTOGRAPH LOG** |
|---|---|---|
| **Client Name:** USCG | **Project:** Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | **Project No.** 60289135.1.3 |

| **Photo No.** 5 | **Date:** 6/9/15 |
|---|---|
| **Direction Photo Taken:** Northeast | |
| **Description:** View of the west side of the Gull Rock light and the keeper's dwelling | |

| **Photo No.** 6 | **Date:** 6/9/15 |
|---|---|
| **Direction Photo Taken:** East | |
| **Description:** Close-up view of the concrete walkways on the west side of the light and keeper's dwelling. | |

AECOM

# PHOTOGRAPH LOG

| Client Name: USCG | Project: Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | Project No. 60289135.1.3 |
|---|---|---|

**Photo No. 7** | **Date:** 6/9/15

**Direction Photo Taken:**

East

**Description:**

Close-up view of the seawall located to the northwest of the light and keeper's dwelling.

**Photo No. 8** | **Date:** 6/9/15

**Direction Photo Taken:**

Northeast

**Description:**

View of the seawall and shore located to the northwest of the light and keeper's dwelling.

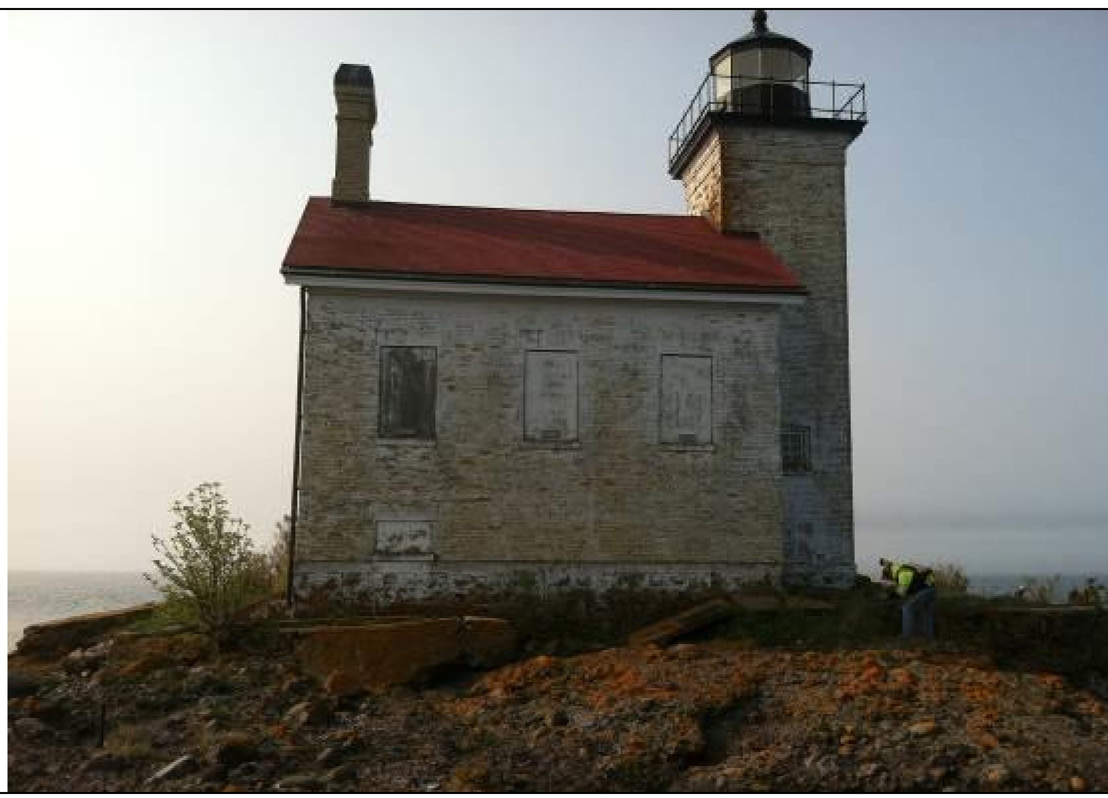
AECOM

# PHOTOGRAPH LOG

| **Client Name:** USCG | **Project:** Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | **Project No.** 60289135.1.3 |
|---|---|---|

| **Photo No.** 9 | **Date:** 6/9/15 |
|---|---|
| **Direction Photo Taken:** Northeast | |
| **Description:** View of the north side of the keeper's dwelling showing privy in the background. | |

| **Photo No.** 10 | **Date:** 6/9/15 |
|---|---|
| **Direction Photo Taken:** Southeast | |
| **Description:** View of the north side of the light and keeper's dwelling. | |



PHOTOGRAPH LOG

| | | |
|---|---|---|
| **Client Name:** USCG | **Project:** Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | **Project No.** 60289135.1.3 |

| | | |
|---|---|---|
| **Photo No.** **11** | **Date:** 6/9/15 |  |
| **Direction Photo Taken:** Southeast | | |
| **Description:** View of the east side of the keeper's dwelling (far right) and the eastern shore of Gull Rock. | | |

| | | |
|---|---|---|
| **Photo No.** **12** | **Date:** 6/9/15 |  |
| **Direction Photo Taken:** East | | |
| **Description:** Close-up view of the privy. | | |

| **AECOM** | | **PHOTOGRAPH LOG** |
|---|---|---|
| **Client Name:** USCG | **Project:** Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | **Project No.** 60289135.1.3 |

**Photo No.** 13 | **Date:** 6/9/15

**Direction Photo Taken:**

North-Northwest

**Description:**

View of the privy and the eastern shore of Gull Rock with the seawall and keeper's dwelling shown at far left.

**Photo No.** 14 | **Date:** 6/9/15

**Direction Photo Taken:**

North

**Description:**

View of the west side of Gull Rock showing location of former boathouse and boat landing.

**AECOM** **PHOTOGRAPH LOG**

| **Client Name:** USCG | **Project:** Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | **Project No.** 60289135.1.3 |
| --- | --- | --- |

| **Photo No.** 15 | **Date:** 6/9/15 |
| --- | --- |
| **Direction Photo Taken:** West | |
| **Description:** View of the west side of Gull Rock west of the former boat landing. | |

| **Photo No.** 16 | **Date:** 6/9/15 |
| --- | --- |
| **Direction Photo Taken:** South | |
| **Description:** View of the iron features remaining from the boat landing located on the southwestern portion of Gull Rock. | |

AECOM

# PHOTOGRAPH LOG

| | | |
|---|---|---|
| **Client Name:** USCG | **Project:** Gull Rock Light Station CERCLA Project, Gull Rock, Keweenaw County, Michigan | **Project No.** 60289135.1.3 |

**Photo No.** 17

**Date:** 6/9/15

**Direction Photo Taken:**

West

**Description:**

Close-up view the iron features remaining from the boat landing located on the southwestern portion of Gull Rock.

**Photo No.** 18

**Date:** 6/9/15

**Direction Photo Taken:**

South

**Description:**

Close-up view the iron features remaining from the boat landing located on the southwestern portion of Gull Rock.