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Final
Remedial Investigation
Work Plan

Bangor Range/Bangor, Maine

Munitions Response Site MEHQ-002-R-01
Maine Army National Guard

Army National Guard

Contract No. W9133L-14-D-0001
Deliver Order No. 0006

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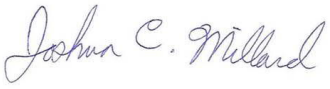
Licensed Certified Geologist:	 Signature **Joshua Millard, C.G.** **ME License #GE565**

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Acronyms and Abbreviations

ARNG	Army National Guard
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CSM	conceptual site model
DU	decision unit
ISM	incremental sampling methodology
MC	munitions constituents
MEC	munitions and explosives of concern
MRS	munitions response site
MEARNG	Maine Army National Guard
MEDEP	Maine Department of Environmental Protection
mya	million years ago
NDNODS	Non-Department of Defense Owned Non- Operational Defense Site
NFA	No further action
NOAA	National Oceanic and Atmospheric Association
PA	Preliminary Assessment
RI	Remedial Investigation
SI	Site Inspection
SSHP	Site Safety and Health Plan
UFP-QAPP	Unified Federal Policy - Quality Assurance Project Plan
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
XRF	X-ray fluorescence

1 Work Plan

This Work Plan has been developed to support the long-term management of the Non-Department of Defense, Non-Operational Defense Site (NDNODS) Bangor Range Munitions Response Site (MRS). The Bangor Range (Army Environmental Database Restoration No. MEHQ-002-R-01) is located in Bangor, Maine. This is not a stand-alone document, but a supplement to the Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP) for Bangor Range (**Appendix A**), and is meant to aid in the execution of Remedial Investigation (RI) field work. For a full description of work to be performed for this RI, please refer to the Bangor Range UFP-QAPP, which is referenced throughout this Work Plan.

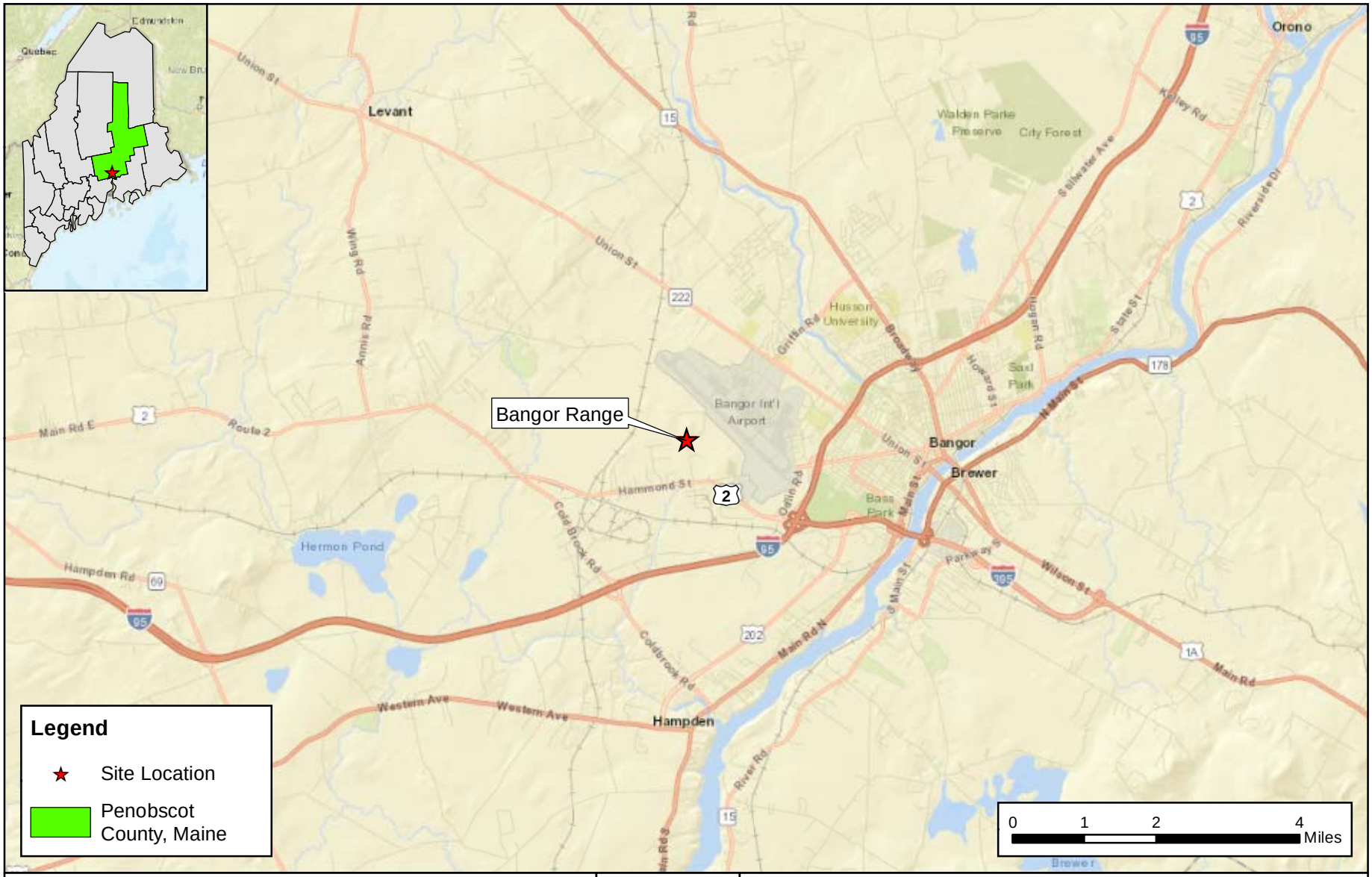
Environmental work is being conducted at the MRS by the Army National Guard (ARNG) Directorate and the Maine ARNG (MEARNG). This project is being executed by AECOM Technical Services, Inc. under ARNG Contract Number W9133L-14-D-0001, Delivery Order 0006, issued 20 September 2016 and modified 27 June 2017.

The RI of Bangor Range is being conducted to determine whether there is an unacceptable risk to human and/or ecological receptors from potential munitions constituents (MC) remaining at the MRS from historical training use. This Work Plan includes methods and procedures that the investigative team will employ at Bangor Range. Additional field safety information can be found in the Site Safety and Health Plan (SSHP; **Appendix B**), which will be reviewed by field personnel prior to mobilization and adhered to during all field tasks.

1.1 Site Description

The Bangor Range MRS is located on the west side of Hildreth Street North north of its intersection with Hammond Street and approximately 0.9 miles west of Bangor National Airport in Bangor, Maine (**Figure 1**). The area surrounding the MRS is predominantly forested; the properties surrounding the MRS include the MEARNG Regional Training Institute to the north, storage units and commercial buildings to the south, and the Bangor International Airport to the east. No residences exist in the vicinity of the former range. The MRS is a 6.7-acre area that includes a historical concrete target foundation structure and two historical berm impact areas referred to as the Concrete Structure, Earthen Berm 1 and Earthen Berm 2, respectively (discussed in greater detail below; **Figure 2**). The concrete structure and berms, which were used during small arms training, are surrounded by a mixed hardwood and coniferous tree community. Soils at the MRS are classified as silt loams with significant organic content. Access to the site is unrestricted and includes developed access to berms along Hildreth St N and the Regional Training Institute driveway. Currently, the majority of the MRS is owned by the City of Bangor; small portions of the MRS are owned by Hardy Associates, Inc. and Dunbar & Brawn Construction, Inc.

The MRS boundary presented in the 2009 Preliminary Assessment (Malcolm Pirnie, 2009) was based on the MRS' use as a1,000 yard known distance range, and included approximately 79.8 acres. During the 2011 Historical Records Review (HRR; Parsons Infrastructure and Technology Group [Parsons]



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PROJECT	RI through DD for Bangor Range, ME MRS			
REVISION NO	0	GIS BY	MS	2/16/2018
SCALE	1:126,720	CHK BY	JW	2/16/2018
SOURCE	ARNG; State of Maine, ESRI & Partners	PM	LS	2/16/2018

Bangor Range Site Location

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Figure 1

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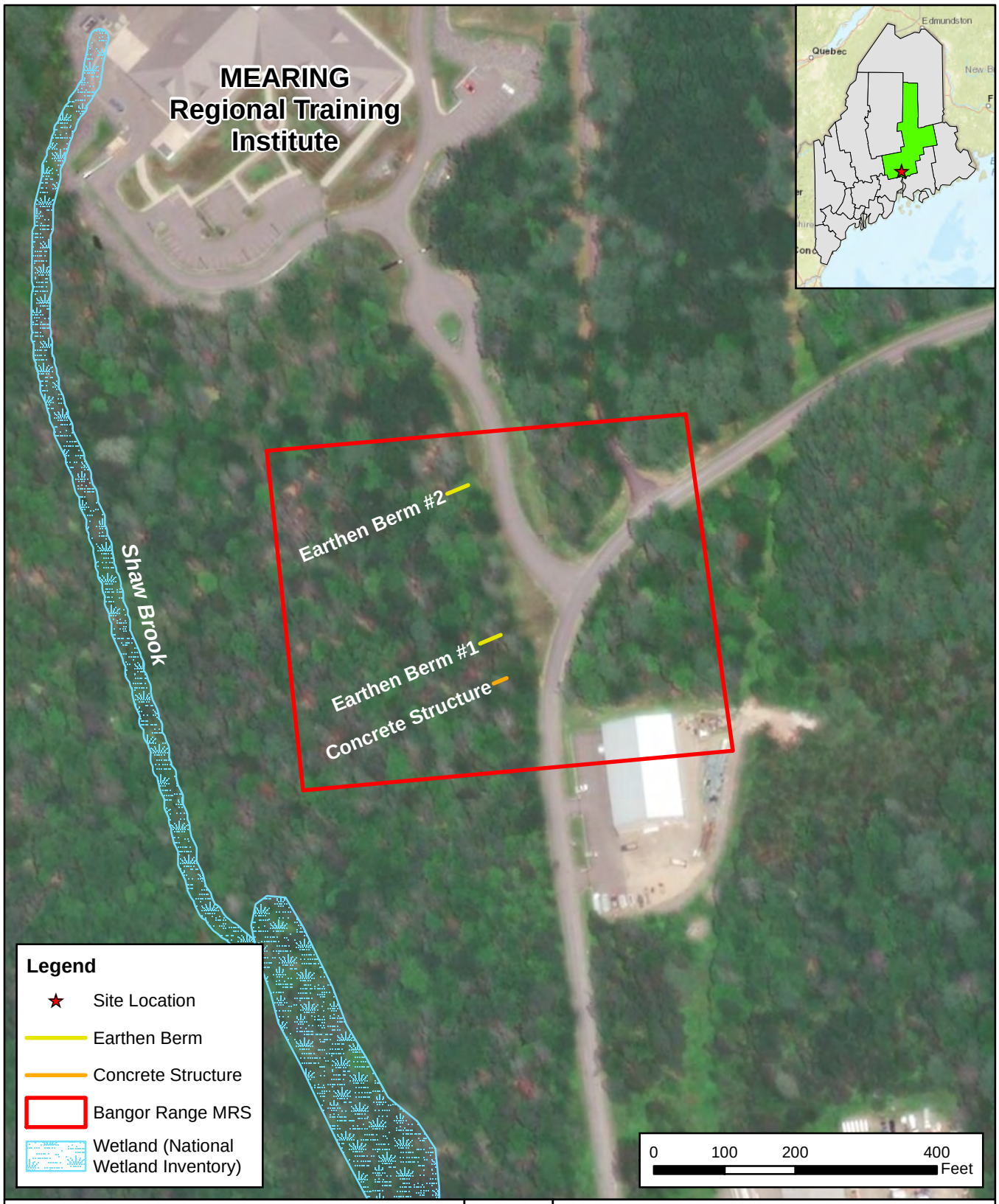

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SOURCE	ARNG; State of Maine, ESRI & Partners	PM	LS	10/29/2018

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Bangor Range Site Layout

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Figure 2

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2011), the MRS boundary was reviewed and modifications were made based on application of standard Safety Danger Zones (SDZs) tempered by topographic conditions that limit bullet trajectory. The HRR revised the MRS acreage to include 266.6 acres. The MRS boundary was subsequently divided into two MRSs to distinguish between the former ranger area (firing point, target area, and range floor; MEHQ-002-R-01) and the remainder of the MRS (including the SDZ; MEHQ-002-R-02). Based on the results of the 2012 Site Inspection (SI; Parsons, 2012), the Bangor Range MRS boundary was refined to 6.7 acres and includes the area where MC contamination was found to have exceeded the selected screening criteria. The Bangor Range SDZ MRS (MEHQ-002-R-02; 259.9 acres) was recommended for No Further Action.

According to the visual survey conducted during the 2012 SI, Berm 1 is an earthen berm downrange from the historical firing point, and measures approximately 30 feet long by 6 feet wide. This historical firing point is no longer included in this MRS. The location of the firing point has been developed into storage units and a commercial building in the vicinity of the intersection of Hammond Street and Hildreth Street N. The same survey recorded Berm 2 as an earthen berm 1,000 yards downrange from the historical firing point, and measuring approximately 30 feet long by 6 feet wide. The concrete structure measures approximately 12 feet deep with one wall collapsed inward. No munitions and explosives of concern (MEC) or munitions debris were observed during the visual survey.

A feature of potential interest is Shaw Brook, a surface water body located west of the MRS. Vegetation is very dense at the MRS and Shaw Brook is approximately 400 feet west of the MRS target features. Migration of solid (particulate) MC from the berms and concrete structure is unlikely to reach the brook due to the retardation of transport from vegetation and adhesion to soil. However, this potential pathway will be investigated during field activities as described in Section 1.4 and in UFP-QAPP Worksheet #17.

1.2 History

The HRR (Parsons, 2011 [Appendix I]) states that Bangor Range was operational between 1920 and 1925 and was used by MEARNG as a 1,000 yard known distance rifle range. Firing at the range occurred in a northerly direction towards ten targets; two targets each at 200, 400, 600, 800, and 1,000 yards. The range complex included barracks, a mess house, storehouses, a magazine, and quarters for the range keeper. The historical firing point was located in the vicinity of the intersection of Hammond Street (Route 2) and Hildreth Street N in an area that is currently developed with commercial structures. A 1987 Trustee's Deed and 1988 Warranty Deed confirm the termination of site use as a rifle range in 1925. Personnel interviews conducted during the HRR suggest that the concrete structure onsite was used to hold targets. The 2012 SI (Parsons, 2012) identified potential munitions used at the site as .22 caliber, .30 caliber, .38 caliber, and .45 caliber small arms ammunition.

1.3 Previous Investigations

Three environmental assessments have been completed at the Bangor Range since 2009. These include:

- Final State/Territory Inventory Report, National Guard Bureau, NDNODS Inventory for Maine, 2009 (Preliminary Assessment; Malcolm Pirnie Inc., 2009)
- Final Historical Records Review/Work Plan, Maine, 2011 (Parsons, 2011)

- Final Maine Site Inspection Report, ARNG MMRP, 2012 (Parsons, 2012)

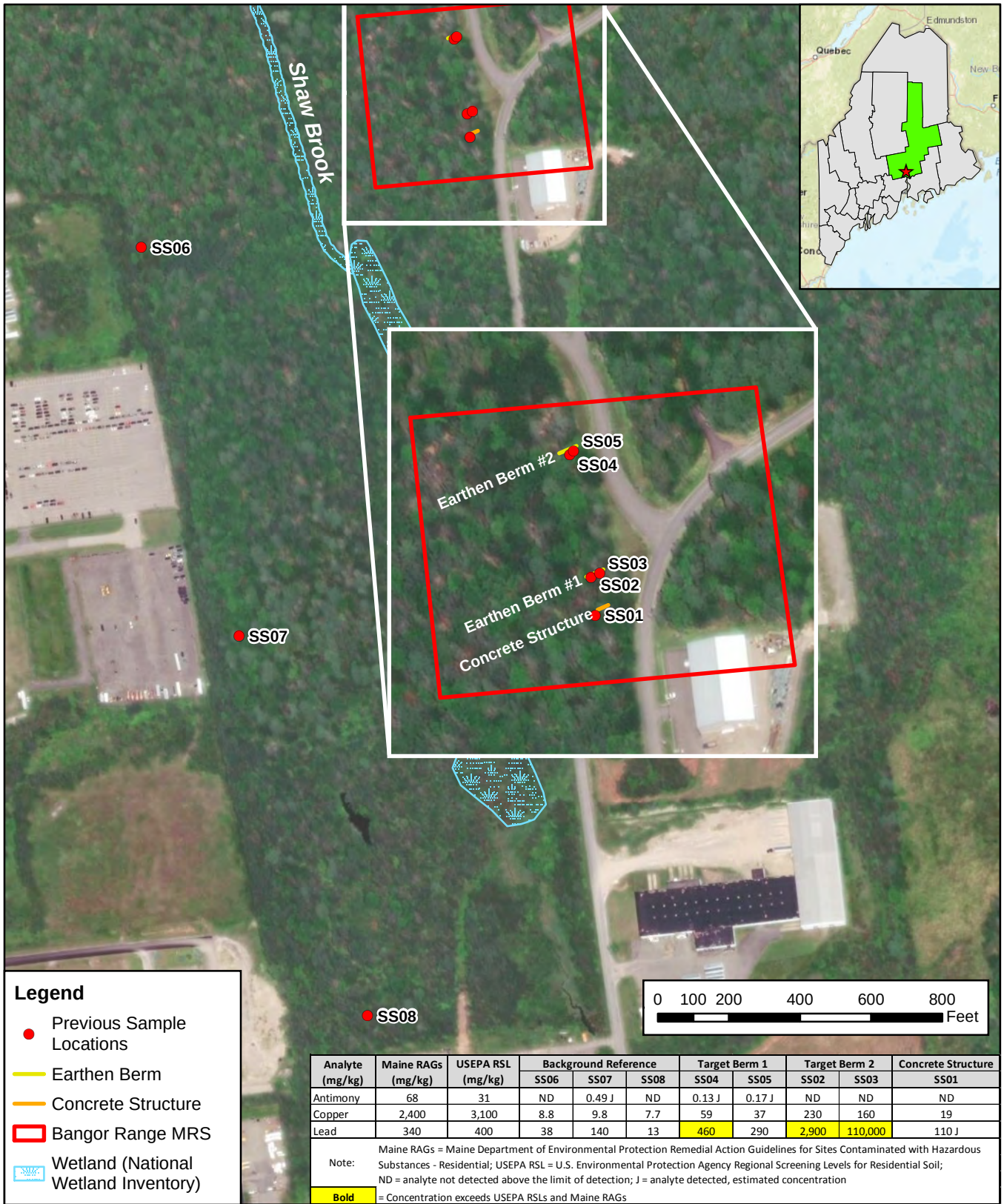
In 2009, the ARNG completed its NDNODS Inventory, resulting in the identification of more than 500 sites where Guardsmen trained and discharged munitions. NDNODS Inventory Reports are considered to have met the requirements of a Preliminary Assessment (PA) under the Comprehensive Environmental Response, Compensation and Liability Act. In 2009, the NDNODS Inventory for Maine was completed; it identified the Bangor Range MRS as one of seven eligible MRSs in Maine with potential munitions risk and was recommended for further investigation.

The MRS boundary presented in the 2009 PA (Malcolm Pirnie, 2009) was based on the MRS' use as a 1,000 yard known distance range, and included approximately 79.8 acres. During the 2012 HRR (Parsons, 2012), the MRS boundary was reviewed and modifications were made based on application of standard Safety Danger Zones (SDZs) tempered by topographic conditions that limit bullet trajectory. The HRR revised the MRS acreage to include 266.6 acres. The MRS boundary was subsequently divided into two MRSs to distinguish between the former range area (firing point, target area and range floor; MEHQ-002-R-01) and the remainder of the MRS (including the SDZ; MEHQ-002-R-02). Based on the 2012 SI (Parsons, 2012), the Bangor Range MRS boundary (MEHQ-002-R-01) was refined to 6.7 acres and includes the area where munitions constituents (MC) contamination was found to have exceeded the selected screening criteria. The remaining area was designated as the Bangor Range SDZ MRS (MEHQ-002-R-02; 259.9 acres) and was recommended for No Further Action.
The SI approach included both visual survey and targeted surface soil sampling for MC to evaluate the potential presence of MEC and MC. Parsons performed 1.92-miles of magnetometer-assisted visual survey that focused on the portions of the MRS most likely to have evidence of historical range activities. No evidence of MEC was observed within the MRS during SI activities.

In total, five composite surface soil samples were collected from target berms and the concrete structure area using a spoke and hub compositing method. An additional three background surface soil samples (called ambient samples in the SI) were collected near, but outside the MRS for comparison. Soil samples at the MRS were screened using X-ray fluorescence (XRF). All soil samples were analyzed for small arms indicator metals antimony, copper, and lead. **Figure 3** presents the SI findings and current United States Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) for Residential Soil (USEPA, 2017) and Maine Department of Environmental Protection (MEDEP) Remedial Action Guidelines (RAGS) for Residential Soil for Sites Contaminated with Hazardous Substances (MEDEP, 2018).

Samples collected from Earthen Berms 1 and 2 exceeded background reference concentrations and human health screening criteria (RSLs and RAGs) for lead. Antimony did not exceed background concentrations in any samples.

The results of the HRR and SI resulted in additional revisions to the size and shape of the MRS. The original MRS acreage identified in the 2009 PA was divided into two MRSs. The revised NDNODS Bangor Range MRS (MEHQ-002-R-01) boundary was drawn to incorporate the target berms and exclude areas not suspected of MC contamination. The SI revised Bangor Range MRS acreage is 6.7 acres. The portion of land that was the range fan and portions of the former range floor (259.9 acres)



Analyte (mg/kg)	Maine RAGs (mg/kg)	USEPA RSL (mg/kg)	Background Reference			Target Berm 1		Target Berm 2		Concrete Structure
			SS06	SS07	SS08	SS04	SS05	SS02	SS03	SS01
Antimony	68	31	ND	0.49 J	ND	0.13 J	0.17 J	ND	ND	ND
Copper	2,400	3,100	8.8	9.8	7.7	59	37	230	160	19
Lead	340	400	38	140	13	460	290	2,900	110,000	110 J

Note: Maine RAGs = Maine Department of Environmental Protection Remedial Action Guidelines for Sites Contaminated with Hazardous Substances - Residential; USEPA RSL = U.S. Environmental Protection Agency Regional Screening Levels for Residential Soil; ND = analyte not detected above the limit of detection; J = analyte detected, estimated concentration

Bold = Concentration exceeds USEPA RSLs and Maine RAGs

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SCALE	1:4,800	CHK BY	JW	10/29/2018
SOURCE	ARNG; State of Maine, ESRI & Partners	PM	LS	10/29/2018

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Bangor Range SI Results

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Figure 3

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was renamed "NDNODS Bangor Range SDZ MRS" (MEHQ-002-R-02). Based on former range use, this area is not expected to be contaminated with MEC or MC and no range-related features are expected to be found within the downrange portion of the SDZ. The SI investigation recommended NFA for the NDNODS Bangor Range SDZ MRS (MEHQ-002-R-02).

Physical and ecological characteristics of the Bangor Range area (e.g., geology) were detailed within the 2012 SI's conceptual site model (CSM). **Table 1** presents the information taken from the SI (Parsons, 2012), updated with recent data. This information was incorporated into the development of the Bangor Range CSM (see UFP-QAPP Worksheet #10) that informed the RI approach summarized below.

Table 1. Bangor Range Physical and Ecological Characteristics (Parsons, 2012)

Physical Characteristics	
Climate	The climate at Bangor Range is classified as humid and continental characterized by warm summers and cold winters with high precipitation. Temperature in the area varies from the 60s in summer to the 10s in winter. The average maximum temperature is 80° F in July, and the average minimum temperature is 10° F in February. The long-term average annual temperature is 45 degrees Fahrenheit (°F) for the Bangor, ME area. Summer time (June through August) temperatures range from an average low of 56°F in the evenings to an average high of 77°F during the daytime. (National Oceanic and Atmospheric Association [NOAA], 2017). The total annual average rainfall is 46 inches. Snowfall also significantly contributes to annual precipitation. The snowiest month of the year is February. Rainfall is fairly evenly distributed throughout the year with the wettest month being July with an average rainfall of 4.7 inches and the driest month being March with an average of 2.3 inches. Winter snowstorms can occur from November through April with the harshest conditions occurring December through March (NOAA, 2018). The percent relative humidity for the region averages 75 percent, although it frequently reaches into the 90th percentile. (NOAA, 2017). The annual wind speed is approximately 7.3 miles per hour, blowing on average in a westerly direction (NOAA, 2017).

Physical Characteristics	
Geology	The entire State of Maine is situated within the New England Physiographic Province, which is further divided into three subsections: The Seaboard Lowland (low lying land found along the coast), New England Upland (intermediate altitudes found mostly along the central and far north portions of the state) and the White Mountain (higher altitudes found along the western portion of the state) sections. Geologic processes including igneous activity, metamorphism, erosion, deposition, periods of subsidence and uplift and tectonic activity help to form the bedrock and shape the present day landforms in the state. Deposition of limestone and other marine sediments started in the late Pre-Cambrian and continued until the Devonian Period. During this same timeframe, some limited volcanic activity occurred in the region. The tectonic activity that began in the Cambrian Period lead to the formation of the Taconic, Acadian and later the Appalachian Mountains and more periods of volcanism. The following Carboniferous Period, which consists of the Mississippian and Pennsylvanian geologic periods, saw the intrusion of the Sebago Pluton. During this time and continuing through the Mesozoic Era, approximately 65 to 245 million years ago (mya), regional metamorphism, rock deformation and faulting occurred along the southern coast of Maine. Uplift of the North American continent continued into the Tertiary Period, approximately 1.6 to 65 mya. Several periods of continental glaciation occurred across the North American continent during the Pleistocene and caused crustal down warping, as much as 425 feet along the coast of Maine, erosion of the surficial rocks, and the deposition of glacial sediment. As the glaciers receded, marine transgression occurred through the southern parts of the state with a gradual rise in sea levels continuing to present time (Maine Geological Survey, 2005). Surficial geology along the NDNODS Bangor Range consists of Ordovician to Silurian aged clastic and carbonate rocks, with the Vassalboro Formation best represented in the area. The Vassalboro Formation is typically described as massive, bluish gray sandstone; calcareous beds are commonly found. Locally, it has undergone metamorphism and is a quartzite with shaley layers being altered to pyritiferous mica schist. Glacial outwash lies over the bedrock in the Penobscot River Valley where most of the range is located (U.S. Geological Survey [USGS], 2011).
Topography	The Bangor Range MRS lies along moderately south and westward sloping land. The area along the historical firing point is nearly level with an elevation of approximately 155 feet above mean sea level. Along the northern border of the MRS, the land gradually slopes upward, an elliptically shaped hill occurs immediately north of the MRS. The apex of the hill represents the highest point of land in the area with an elevation of over 220 feet mean sea level (USGS, 1996; Google Earth, 2011).
Soil	Almost the entire Bangor Range MRS soil is classified as silt loam derived from glaciolacustrine and glaciomarine deposits. The soil ranges from poorly drained to moderately well drained with the capacity of the most limiting layer to transmit water being very low (0.00 to 0.20 inches/hour) in most onsite soil types (National Resources Conservation Service, 2009).
Hydrogeology	Groundwater in Maine occurs in glacial deposits, unconsolidated Coastal Plain sediments and in bedrock. A regional surficial aquifer system consists of glacial deposits of sand and gravel laid down during several episodes of glaciation that advanced and retreated from the northwest. The most recent episode, the Wisconsinian, retreated about 12,000 years ago. During the retreat, ice and melt water from the glaciers laid down characteristic deposits. Till consisting of unstratified material ranging in size from clay to boulders was deposited directly from ice. Meltwater laid down outwash, which consists of stratified deposits of sand and gravel. Ice-contact deposits, consisting mainly of poorly stratified sand and gravel, and glacial lake deposits, made up of clay, silt and fine sand, were also deposited (USGS, 1995).. Retreat of the glaciers resulted in sand and gravel deposits while melt water transported clastic material from the ice to valleys that were often formed by the advance of a glacier.

Physical Characteristics	
	Typically, coarser sediment such as sand and gravel were deposited first with finer sand, silt and clay carried and deposited much farther from the glacier. These deposits were well sorted and stratified. Following the retreat of the glaciers, the land rebounded, and streams began to erode the glacial deposits. Deposition of reworked glacial material occurred as alluvium in the streams. These deposits from the valley fill glacial aquifers of the surficial aquifer system. The areas where sand and gravel were deposited at the face of a glacier often provide very high-yield well production from wells typically ranging from 10 to 1,000 gallons per minute (gpm) and in some cases as much as 3,000 gpm. Wells set in outwash deposits commonly range from 10 to 400 gpm with extreme high yields of 2,000 gpm in a few wells. In some valleys where streams drained toward the glacier or where stream flow was dammed, large lakes commonly formed. Sediments deposited in these lakes were primarily clay, silt, and very fine sand that accumulated in thickness up to several hundred feet. Valleys containing these sediments typically display poor hydraulic properties and therefore yield little groundwater (USGS, 1995). Below the surficial glacial aquifer lies the bedrock aquifer. The complexity and diversity of the geology in the state is seen in the composition of the bedrock aquifer, which is made up of carbonate and crystalline rock hydrogeologic units. Carbonate rocks of Silurian age form an aquifer in northeastern Maine where they supply about four million gallons per day, primarily for industrial and domestic use. Crystalline rock aquifers composed of igneous and metamorphic rocks are generally the least productive of the regional aquifer. Due to the impermeable nature of these rocks, groundwater in crystalline rocks is essentially limited to fracture planes or joints. These openings are typically heterogeneous in spacing, orientation, size, and degree of interconnection. Generally, openings in these rocks are more prevalent near land surface and decrease in the number and size with depth. Several monitoring wells used for the purposes investigating a nearby Dow Air Force Base Fire Training Area exist approximately 0.2 miles east of the MRS. Static water levels in these wells ranged from 3.4 to 6.45 feet below ground surface (bgs) during a sampling event in 2008 (MEDEP, 2018a). Shallow groundwater near the MRS is influenced by topography and therefore anticipated to flow to the west and discharge to Shaw Brook. Regionally, shallow groundwater is influenced by the presence of stream valleys with a general eastward flow from the area around Bangor toward the Penobscot River. Residents near the Bangor Range MRS area live in the Bangor Water District. The source of drinking water for the City of Bangor Maine is Floods Pond in Otis, which is over 18 miles from the Bangor Range. The watershed for Floods Pond is estimated at 8.7 square miles (Bangor Water District, 2010). Shaw Brook runs along the base of the west side of the hill found north of the MRS and flows southward approximately 40 feet west of the MRS boundary. All storm water runoff from the Bangor Range MRS flows toward the brook; however, a direct pathway from the target area to the brook is not present. The brook flows in a southerly direction for approximately 2.5 miles where it discharges into the Souadabscook Stream. The Souadabscook Stream, in turn, flows to the southeast and discharges into the Penobscot River (USGS, 1996; U.S. Fish and Wildlife Service [USFWS] National Wetland Inventory, 2017a).

Physical Characteristics	
Vegetation	The NDNODS Bangor Range MRS is within the Acadian Plains and Hills Ecoregion. The Acadian Plains and Hills Ecoregion is mostly forested with dense concentrations of continental glacial lakes. Vegetation consists of mostly spruce and fir on lowlands with maple, beech, and birch on the hills. Near the coastal areas fine and coarse-loamy, frigid inceptisols and spodosols are typical. The boreal features of this ecoregion include rocky woodlands of patchy black spruce *(Picea mariana)* as well as some boreal plant species that are otherwise restricted to alpine and subalpine areas of Maine, such as black crowberry (*Empetrum nigrum*), baked appleberry (*Rubus chamaemorus)*, and roseroot (*Rhodiola rosea*). Coastal raised peat bogs occur are also present in this ecoregion. There are also some areas of jack pine (*Pinus banksiana*) woodland, near the southern range limit of this ecoregion (Griffith, et al., 2009).
Cultural, Archaeological and Historical Resources	According to the National Heritage Areas Program and the National Historic Landmarks Program, no cultural or archaeological resources are listed in Penobscot county (National Park Service, 2018a, 2015). According to the National Register of Historic Places, cultural and archaeological resources are present in Penobscot county, but no cultural or archaeological resources are listed within the MRS boundary (National Park Service, 2018b).
Wetlands	According to the National Wetland Inventory (USFWS, 2017a), there are no wetland areas that occur within the MRS. Nearby Shaw brook flows southerly approximately 40 feet to the west of the MRS boundary.
Demographics	The estimated population of the city of Bangor was 31,985 in 2016; the population density (using square mileage from 2010) is 964 inhabitants per square mile (US Census Bureau, 2017). The estimated population of Penobscot County was 151,806 in 2016 (US Census Bureau, 2017). There are no residents on the MRS.
Ecological Characteristics	
Habitat Type	The watershed surrounding the MRS is federally designated critical habitat for the Atlantic Salmon (*Salmo salar*); however, no water bodies exist within the MRS. No other federally designated critical habitat is located within the MRS (USFWS, 2017b). The MRS does not contain Maine Natural Resources Protection Act habitat (MEDEP, 2018b). The nearest Maine Natural Resources Protection Act Habitat area is a vernal pool 2224 located 0.3 miles southeast of the MRS.
Ecological Receptors	The project area is host to three federally listed threatened and endangered species: the Atlantic salmon (*Salmo salar*), Canada Lynx (*Lynx Canadensis*) and Northern Long-eared Bat (*Myotis septentrionalis*). The Northern Long-eared Bat is federally listed as endangered wherever found, but has no designated critical habitat. Bangor, Maine lies within a watershed that is designated as critical habitat for Atlantic Salmon; however, no water bodies exist within the MRS. The MRS does not contain any designated critical habitat for the Canada Lynx (USFWS, 2017b). Undeveloped forest does exist within the MRS and provides habitat for a variety of terrestrial species.
Degree of Disturbance	There are numerous industrial and commercial buildings near the MRS; therefore, there is high amount of disturbance to the land.

1.4 Investigation Approach

The sampling approach of the RI is designed to characterize the nature and extent of MC contamination in the soil berms, the concrete structure area, and groundwater to surface water interface. To accomplish this, a phased approach will be used that includes assessing the lateral extent of MC contamination in

the field using XRF analysis followed by laboratory analysis of soil samples collected using incremental sampling methodology (ISM). Five percent of XRF screening grab samples will be sent to the laboratory for analysis.

Based on the findings of the SI (Parsons, 2012), potential MC are limited to small arms metals: antimony, copper, lead, and zinc. All samples collected for laboratory analysis will be sent to Katahdin Analytical Services, Inc., in Scarborough, Maine, for analysis of these four metals. Waste characterization parameters will also be collected and analyzed if necessary. The results of waste characterization will be used to inform the Feasibility Study.

Three areas have been identified within the MRS as decision units (DUs) for MC soil sampling: the Earthen Berm 1 (357 square feet), Earthen Berm 2 (357 square feet), and the Concrete Structure (240 square feet) (**Figure 4**). The soil from the Earthen Berms and Concrete Structure DUs will be screened for lead in the field using XRF. The results of this analysis will characterize the lateral extent of contamination in surface soil (0-6 inches bgs), refine the boundaries of DUs that will be sampled using ISM, and identify high concentration (worst case) areas to collect subsurface samples from 12 to 18 inches bgs to determine the vertical extent of MC in soil. Surface soil samples will be collected from the A soil horizon after detritus, humus, and surface debris have been removed from the sample location.

Locations where XRF values exceed the human health screening criterion for lead will refine the boundary of the MRS DUs. Should samples taken along the boundary of the initial DUs exceed the screening criterion, step-out samples will be taken until exceedances are no longer encountered. Step-out samples with screening exceedances may increase the size of their respective DUs. Once all DU boundaries are confirmed, an approximate 30- to 50-part incremental sample will be collected in triplicate from surface soil at each DU and analyzed for metals MC (antimony, copper, lead, and zinc). If XRF data indicates that migration of soil with elevated MC concentrations has occurred from the DUs toward Shaw Brook, then eight discrete surface water and sediment samples will be collected from Shaw Brook. Laboratory-provided bottle ware and necessary equipment will be present during fieldwork activities for surface water and sediment sampling, if necessary.

A discrete soil sample (0-6 inches) will be collected from the location with the highest XRF lead result at each DU for waste characterization analysis (e.g., toxicity characteristic leaching procedure). If the lead concentration for ISM samples exceeds the *MEDEP Residential Soil RAGS* (140 ppm), the TCLP sample for the corresponding DU(s) will be analyzed for TCLP lead and pH only. These data may be used in alternative evaluation during the Feasibility Study.

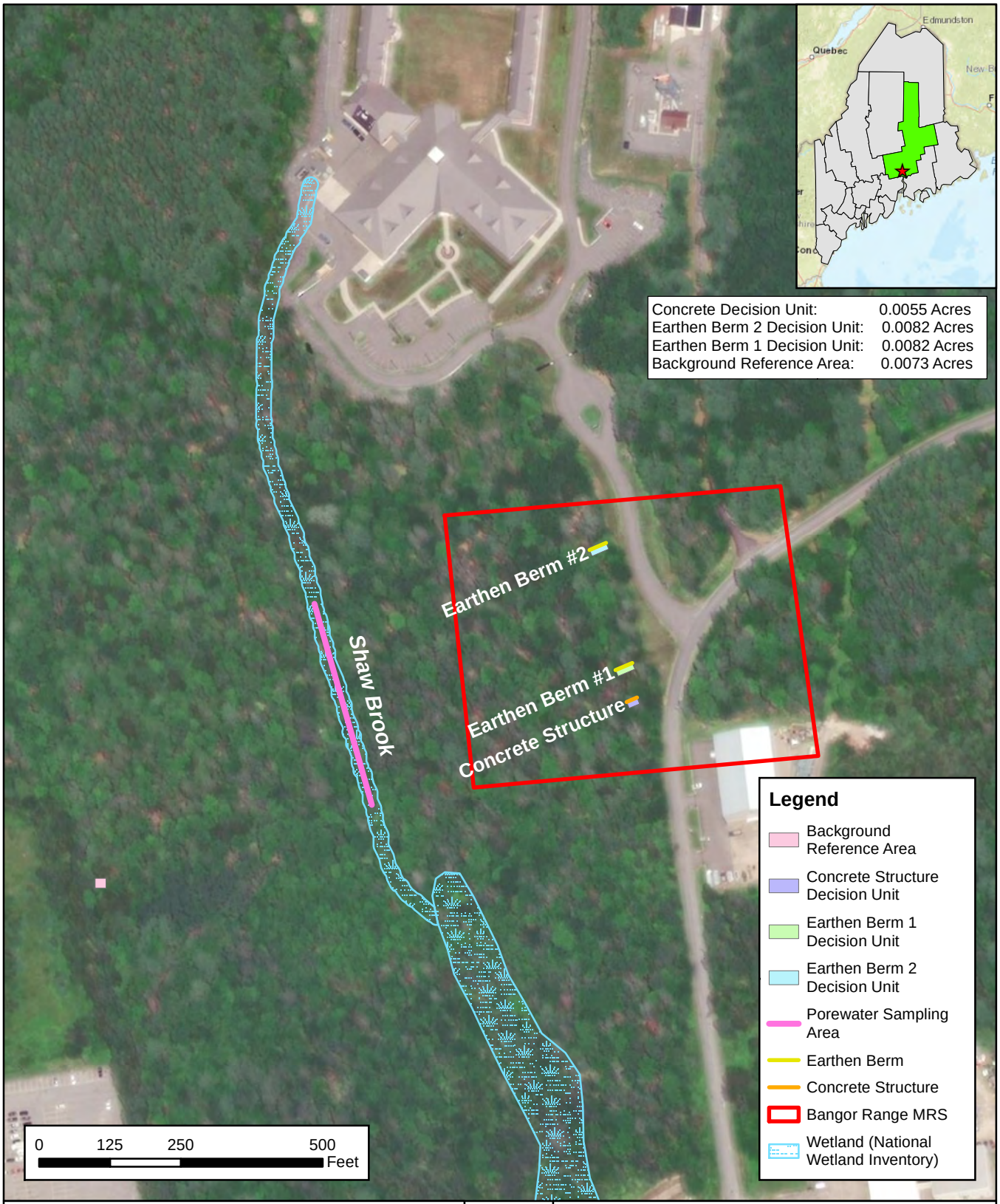
The vertical extent of MC will be characterized by collecting discrete subsurface soil samples from 12 to 18 inches bgs by hand auger where select surface soil XRF readings exceed the human health screening criterion for lead. Subsurface samples will be analyzed by both XRF (where applicable) and laboratory analytical methods for metals MC. The results of the subsurface XRF analysis will be used to determine whether deeper samples are needed from 24 to 30 inches bgs to delineate the vertical extent of contamination. If soil is too moist for XRF use at any DU, two random locations will be selected within that DU for subsurface sampling. At each location, a 12 to 18 inches bgs and 24 to 30 inches bgs sample will be collected. Laboratory analysis of samples collected from 24 to 30 inches bgs will be

contingent on the results from the above sample. In anticipation of the end use of data (i.e., soil removal volume estimates) it is unlikely that resolution finer than 12 inches vertically within the soil profile is needed as most soil removal equipment will excavate soil in 1-foot lifts. If RI results indicate unacceptable risk exists, remedial alternatives evaluated will assume concentrations in the 6-12 inch horizon are the same as those measured at the surface (0-6 inch horizon). This assumption is considered conservative based on multiple factors, including the typical penetration depths of small arms into soil berms and the predominant deposition of pulverized/fragmented bullets in the upper 6 inches, as well as the relatively low mobility of MC metals. Such alternatives would necessarily include collection of confirmatory samples to ensure underlying soil left in place does not exceed cleanup levels.

In addition, a background reference surface soil sample will be collected in triplicate using ISM from an area not affected by historical training activities. The area will be representative of undisturbed media and of an appropriate size to adequately characterize background concentrations and be comparable to investigative samples. The proposed location for background reference sample collection is shown on **Figure 4**. The results of all ISM samples will be used in the risk assessment in the RI report.

Since shallow groundwater discharges to Shaw Brook and there are no potential receptors until the water reaches the stream, MC concentrations in groundwater will be analyzed using pore water sampling in the streambed of Shaw Brook. Eight discrete samples will be collected from an area of the stream that is adjacent to the DUs in the MRS. A background reference porewater sample will be collected upstream from an area unaffected by shallow groundwater coming from the MRS. For all porewater samples, the sampler will be inserted into the streambed deep enough to ensure the sample collected will contain only groundwater and no surface water. If laboratory analysis determines that groundwater with elevated concentrations of MC is entering Shaw Brook, field staff will remobilize to the site to collect eight discrete surface water and sediment samples in Shaw Brook.

Details regarding the investigative approach, including the site specific conceptual site model (Worksheet #10), Data Quality Objectives (Worksheet #11), and detailed sampling design and rational (Worksheet #17), are provided in **Appendix A**. Field work for the remedial investigation of the Bangor Range MRS is anticipated to take place on two parcels of land, County parcels R08-001 and R08-012. These parcels are owned by Hardy Associates, Inc. and the City of Bangor, respectively. Rights of entry for relevant parcel has been received (**Appendix C**).



CLIENT	Army National Guard			
PROJECT	RI through DD for Bangor Range, ME MRS			
REVISION NO	0	GIS BY	MS	10/29/2018
SCALE	1:3,000	CHK BY	JW	10/29/2018
SOURCE	ARNG; State of Maine, ESRI & Partners	PM	LS	10/29/2018

N

Bangor Range RI Approach

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 4

Q:\Projects\ENV\GEARS\GEO\NGB IDIQ\NDNODS 6 SARs\900-Work\GIS\Other_Sites\ME_Bangor\MXD\Work_Plan_Figures\Fig_4_Bangor_RI_Approach.mxd

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Appendix A

Uniform Federal Policy – Quality Assurance Project Plan

AECOM

Final
Uniform Federal Policy – Quality Assurance Project Plan Military Munitions Response Program
Bangor Range, Maine

Munitions Response Site MEHQ-002-R-01

Maine Army National Guard

Army National Guard

Contract No. W9133L-14-D-0001

Delivery Order No. 0006

FEBRUARY 2019

Prepared for:
Army National Guard
NGB-AQ-W9133L
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

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Table of Contents

List of Figures

List of Attachments

Acronyms and Abbreviations

AECOM	AECOM Technical Services, Inc.
ARNG	Army National Guard
ARNG-IED	Army National Guard – Cleanup & Restoration Branch
bgs	below ground surface
CD	Compact Disc
CERCLA	Comprehensive Environmental Response, Compensation & Liability Act
CSM	Conceptual Site Model
CCV	Continuing Calibration Verification
DD	Decision Document
DO	Delivery Order
DoD	Department of Defense
DQI	Data Quality Indicators
DQO	Data Quality Objective
DU	decision unit
DUA	Data Usability Assessment
EPA	Environmental Protection Agency
EQB	equipment blank
FS	Feasibility Study
HHRA	Human Health Risk Assessment
HRR	Historical Records Review
ICAL	Initial Calibration
ICB/CCB	Initial and Continuing Calibration Blank
ICS	Interference Check Solutions
ICV	Initial Calibration Verification
IDW	investigative derived waste
ITRC	Interstate Technology Regulatory Council
IS	Internal Standards
ISM	incremental sampling methodology
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicates
LDR	Linear Dynamic Range
LOD	level of detection
LOQ	level of quantitation
MB	Method Blank
MC	munitions constituents
MEARNG	Maine Army National Guard
MEC	Munitions and Explosives of Concern
MEDEP	Maine Department of Environmental Protection
mm	millimeter
MMRP	Military Munitions Response Program
MRS	Munitions Response Site
MS	Matrix Spike
MSD	Matrix Spike Duplicate

NDNODS	Non-Department of Defense-owned, Non-Operational Defense Sites
NFA	No Further Action
OSHA	Occupational Safety and Health Administration
Katahdin	Katahdin Analytical Services
PALs	Project Action Limits
PDF	Portable Document File
PDS	Post-Digestion Spike
PM	Project Manager
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QL	Quantitation Limit
RI	Remedial Investigation
RSD	relative standard deviation
SDG	sample delivery group
SI	Site Inspection
SOP	standard operating procedure
TCLP	toxicity characteristic leaching procedure
TPP	Technical Project Planning
TSA	Technical Systems Audit
UCL	upper confidence limit
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
USEPA	U.S. Environmental Protection Agency
XRF	X-ray fluorescence

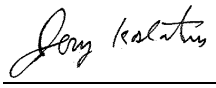
QAPP Worksheets #1 & #2 - Title and Approval Page

(UFP-QAPP Manual Section 2.1; EPA 2106-G-05 Section 2.2.1)

Project Name:	Remedial Investigation through Decision Document for Six Army National Guard Munitions Response Sites, Bangor Range MRS
Site Location:	Penobscot County, ME
Contract/Delivery Order:	Contract No. W9133L-14-D-0001 Delivery Order No. 0006
Preparation Date (Month/Year):	February 2019

27 February 2019

Investigative Organization's Project Manager: Signature Date
Printed Name / Organization: **Rosa Gwinn / AECOM**



27 February 2019

Investigative Organization's Project QC Manager: Signature Date
Printed Name / Organization: **Jerry Kashatus / AECOM**

Lead Organization's Project Manager: Signature Date
Printed Name / Organization: **MAJ Julie Hatcher / ARNG-IED**

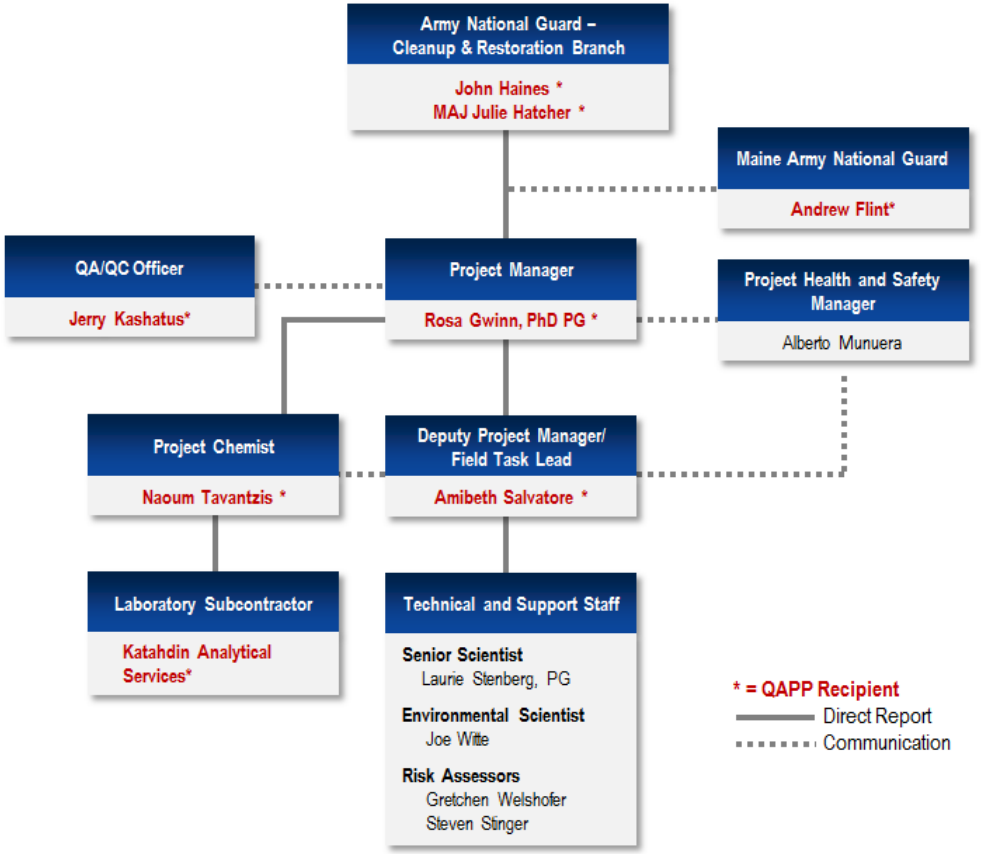
Regulatory Agency Project Manager: Signature Date
Printed Name / Organization: **Iver McLeod / MEDEP**

QAPP Worksheets #3 & #5 – Project Organization and QAPP Distribution

(UFP-QAPP Manual Sections 2.3 and 2.4; EPA 2106-G-05 Sections 2.2.3 and 2.2.4)

The project team organization for this project is presented in the chart below. Recipients of controlled copies of the Quality Assurance Project Plan (QAPP) are identified with an asterisk in the chart below. The draft QAPP, final QAPP, and any changes/revisions will be provided to the QAPP recipients, who are responsible for document control within their organization.

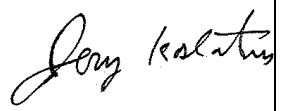
Project Organizational Chart

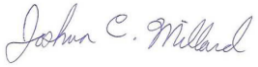
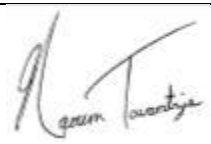
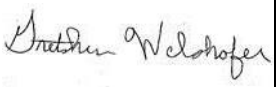
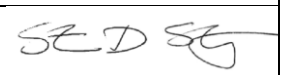


QAPP Worksheets #4, #7, & #8 – Personnel Qualifications and Sign-off Sheet

(UFP-QAPP Manual Sections 2.3.2 – 2.3.4; EPA 2106-G-05 Sections 2.2.1 and 2.2.7)

Organization: AECOM Technical Services, Inc. (AECOM)

Name	Project Title/Role	Education/Experience	Specialized Training/ Certifications	Signature/Date
Rosa Gwinn	Project Manager (PM)	Education: PhD, Geological Sciences; MS, Geological Sciences; BA, Geological Sciences Experience: 26+ years of experience performing and managing environmental investigations and remediation projects; 10+ years at military ranges; installation team leader on multiple Army National Guard (ARNG) ORA Phase II sites.	Professional Geologist (WA, UT)	 27 February 2019
Amibeth Salvatore	Deputy PM/ Field Task Leader	Education: Master of Environmental Science & Management Experience: 5+ years of experience working on munitions constituent (MC) investigations under MMRP and ORA for ARNG and USMC. Direct experience developing QAPPs and other planning documents and serving as field and technical leader for MC investigation at multiple sites.	40hr HAZWOPER, 8hr OSHA Supervisor, First Aid/CPR	 27 February 2019
Laurie Stenberg	Project Senior Scientist (Independent Technical Reviews)	Education: BA, Geology Experience: 27 years of experience. ARNG Operational Range Assessment (ORA) Phase II Installation Team Leader at 8 Installations. Directed QAPP development for ORA Phase IIs at ARNG Installations. Experience executing Military Munitions Response Program (MMRP) projects at ARNG installations.	Professional Geologist (PA) AECOM Certified PM	 27 February 2019
Jerry Kashatus	Project QA/QC Officer	Education: MS, Geological Sciences; BS, Earth Sciences Experience: 30+ years of experience performing and managing environmental investigations for federal clients. Has served in QA/QC capacity on projects for 25+ years; completed training for performing quality audits per AECOM's internal requirements. Works with staff to ensure compliance with the corporate Quality Management System.	Professional Geologist (Pennsylvania)	 27 February 2019

Name	Project Title/Role	Education/Experience	Specialized Training/ Certifications	Signature/Date
Joshua Millard	Project Geologist	Education: MS, Environmental GeoScience; BS, Environmental Geology Experience: 21 years of experience designing and performing environmental investigations for federal and private sector clients. Senior geologist on multiple SASE and RI for NAVY and USACE projects, including RCRA, MMRP, and petroleum sites.	Certified Geologist (Maine)	 27 February 2019
Naoum Tavantzis	Project Chemist	Education: BA, Environmental Science, MBA Experience: 9+ years of experience, 2 years of experience as an analyst in an environmental laboratory; 6+ experience in developing UFP-QAPPs for field investigations at military ranges, as well as working with analytical laboratories to ensure project objectives are achieved; Senior Chemist on multiple ORA and MMRP investigations and military restoration projects.		 27 February 2019
Gretchen Welshofer	Human Health Risk Assessor	Education: BA, Communication; MS, Environmental Science Experience: 25 years of experience performing human health risk assessments (HHRAs); expertise in evaluating potential risks and hazards to human health posed by MC emanating from small arms and large caliber ranges; expertise in evaluating contaminant fate and transport for validity of exposure pathways.		 27 February 2019
Steven Stinger	Ecological Risk Assessor	Education: MS, Environmental Science and Engineering; BS, Environmental Resource Management Experience: 30+ years of experience in the management and remediation of hazardous waste sites, including preparation of human health and ecological risk assessments and development of risk-based cleanup levels.		 27 February 2019
Joe Witte	Environmental Scientist	Education: BS, Environmental Science and Policy; Experience: 4+ years of experience in developing planning documents and serving as field leader for environmental investigations.	40hr HAZWOPER, First Aid/CPR	 27 February 2019

Name	Project Title/Role	Education/Experience	Specialized Training/ Certifications	Signature/Date
Alberto Munuera	Regional Health & Safety Manager	Education: MS, Occupational Health and Safety; BS, Geological Sciences Experience: 10+ years as a Health and Safety Manger responsible for managing large scale safety programs that include risk assessments and implementation of control measures, ergonomics, industrial hygiene, social psychology and environment protection.		Signature included in Appendix B (Site Safety and Health Plan) of the Work Plan

ORGANIZATION: Katahdin Analytical Services, Inc. (Katahdin)

Name	Project Title/Role	Education/Experience	Specialized Training /Certifications	Signature/Date
Leslie Dimond	Laboratory QA Manager	BA, Chemistry Over 17 years environmental laboratory experience Knowledgeable in a wide variety of USEPA methodologies including SW846 methods, USEPA 500 and 600 series and CLP Protocols.		01.15.18 Leslie Dimond
Heather Manz	Laboratory Project Manager	BS, Earth Sciences Over 8 years environmental laboratory experience including data management and Project Management. Currently, she is the POC for all Department of Defense (DoD) projects performed by the laboratory.		Heather Manz 1-15-18

*Signatures indicate personnel have read and agree to implement this QAPP as written

QAPP Worksheet #6 – Communication Pathways

(UFP-QAPP Manual Section 2.4.2; EPA 2106-G-05 Section 2.2.4)

Communication Driver	Responsible Entity	Name	Contact Information	Procedure (timing, pathway, documentation, etc.)
Small Arms Ranges Program Manager and/or Contract Officer Representative decisions and modification	ARNG Cleanup & Restoration Branch (ARNG-IED) Project Manager	MAJ Julie Hatcher	703-607-9166 julie.a.hatcher4.mil@mail.mil	Communicate award of work and options as directed by National Guard Bureau Contracting Officer. Track project progress through monthly reporting and daily field reporting. Stop work for quality or performance concerns.
NDNODS Program Manager: decisions and modification	ARNG-IED Program Manager	John Haines	703-607-7986 john.b.haines.ctr@mail.mil	Track Non-Department of Defense-owned, Non-Operational Defense Sites (NDNODS) project progress through monthly reporting and daily field reporting.
Maine MRS-specific decisions and modifications	ARNG-IED Maine PM	John Haines	703-607-7986 john.b.haines.ctr@mail.mil	Communicate Maine-specific decisions and status updates to AECOM PM.
Regulatory agency interface	Maine ARNG (MEARNG)	Andrew Flint	207-430-5901 andrew.c.flint2.nfg@mail.mil	Communicate technical approaches and decisions directly to regulatory agency representative(s).
Coordination of work at Bangor Range MRS	MEARNG	Andrew Flint	207-430-5901 andrew.c.flint2.nfg@mail.mil	Communicate with AECOM Field Task Leader to schedule field tasks and timing.
Monthly status & field progress reports	AECOM PM	Rosa Gwinn	301-820-3131 rosa.gwinn@aecom.com	Provide progress reports to the ARNG-IED Project Manager.
Stop work due to safety issues	AECOM All	Alberto Munuera	757-408-4276 (mobile) alberto.munuera@aecom.com	Work may be stopped at any time for any safety concern. Refer to the Site Safety and Health Plan for specifics related to health and safety. Persons other than the responsible entity may also stop work for safety concerns.
QAPP changes prior to field work	AECOM PM	Rosa Gwinn	301-820-3131 rosa.gwinn@aecom.com	Notify ARNG-IED Project Manager of QAPP revisions and request for concurrence.
QAPP changes during project execution	AECOM PM	Rosa Gwinn	301-820-3131 rosa.gwinn@aecom.com	Approval will be obtained for modifications to the QAPP as necessary from ARNG-IED. All approved modifications will be included in Nonconformance Report(s) and resolution / corrective action will be determined.

Communication Driver	Responsible Entity	Name	Contact Information	Procedure (timing, pathway, documentation, etc.)
Field corrective actions	AECOM PM	Rosa Gwinn	301-820-3131 rosa.gwinn@aecom.com	Approval will be obtained for modifications to the QAPP as necessary from ARNG-IED. All approved modifications will be included in Nonconformance Report(s) and resolution / corrective action will be determined.
Sample receipt variances	Katahdin	Heather Manz	207-874-2400 x17 hmanz@katahdinlab.com	Report all project nonconformances and problems to the AECOM Project Chemist.
Laboratory quality control (QC) variances	Katahdin	Heather Manz	207-874-2400 x17 hmanz@katahdinlab.com	Report all project nonconformances and problems to the AECOM Project Chemist.
Analytical corrective actions	Katahdin	Heather Manz	207-874-2400 x17 hmanz@katahdinlab.com	Report all project nonconformances and problems to the AECOM Project Chemist.
Eurofins laboratory modifications and performance problems	Katahdin	Heather Manz	207-874-2400 x17 hmanz@katahdinlab.com	Report all project nonconformances and problems to the Katahdin PM. Katahdin PM will report to AECOM Project Chemist.
Reporting laboratory data quality issues	Katahdin	Heather Manz	207-874-2400 x17 hmanz@katahdinlab.com	All QA/QC issues with project field samples will be reported to AECOM as soon as possible, and no longer than within 2 business days.
Data validation issues, e.g., non-compliance with procedures	AECOM Project Chemist	Naoum A. Tavantzis	301-267-8761 naoum.tavantzis@aecom.com	Project Chemist Naoum A. Tavantzis will contact Laboratory Project Manager by phone or email if a non-compliance, etc. is identified, and resolution / corrective action will be determined.
Data review corrective actions	AECOM Project Chemist	Naoum A. Tavantzis	301-267-8761 naoum.tavantzis@aecom.com	Project Chemist Naoum A. Tavantzis will contact Laboratory Project Manager by phone or email if a non-compliance, etc. is identified, and resolution / corrective action will be determined.

QAPP Worksheet #9 – Project Planning Session Summary

(UFP-QAPP Manual Section 2.5.1; EPA 2106-G-05 Section 2.2.5)

Technical Project Planning (TPP) Meeting 1 and Site Visit – Meeting Minutes
Army National Guard (ARNG) Remedial Investigation through Decision Document for Six ARNG Munitions Response Sites (MRSs)
Contract No. W9133L-14-D-0001, DO 0006
Monday, 25 September 2017
0930 to 1100 hrs

Participants:

Name	Title/Role	Affiliation	Phone #	E-mail Address
John Haines*	Program & Bangor Range Project Manager	ARNG, Cleanup Division (ARNG IED)	703-607-7986	john.b.haines.ctr@mail.mil
Andrew Flint	Environmental Program Manager	Maine ARNG (MEARNG)	207-430-5901	andrew.c.flint2.nfg@mail.mil
Iver McLeod*	Project Manager	Maine Department of Environmental Protection (MEDEP)	207-592-2981	iver.j.mcleod@maine.gov
Tom Palmer	Landowner	City of Bangor	207-592-4218	tom.palmer@bangor.maine.gov
Curt Davis	Stakeholder	Bangor International Airport	207-992-4608	cdavis@flybangor.com
Rosa Gwinn	Project Manager	AECOM	301-820-3131	rosa.gwinn@aecom.com
Amibeth Salvatore*	Deputy Project Manager	AECOM	301-820-3628	amibeth.salvatore@aecom.com
Joe Witte*	Project Coordinator	AECOM	301-820-3267	joe.witte@aecom.com

*attended via telephone

A briefing package (Attachment 1) was provided in advance of the meeting. Key points that augment the package are provided below. The meeting was held at the Regional Training Institute on N. Hildreth Street, Bangor, Maine.

The meeting began at 0930 hours EST.

I. Introductions and Agenda (Slides 1-6)

Rosa Gwinn (AECOM) welcomed everyone and began the meeting by circulating a sign-in sheet (Attachment 2). Attendees were either in person or via teleconference, as indicated in the participant list above.

Rosa presented a health & safety moment on the importance of maintaining a Safe Work Plan for all site work. Rosa also emphasized the importance of knowing how to retreat from any site in the event of an

emergency, especially at sites as vegetated as the Bangor Range.

Introductions began with John Haines welcoming everyone. Rosa presented the meeting agenda and goals according to the briefing package. It was noted that a site visit would be conducted after the TPP1 meeting.

II. TPP Process (Slide 7)

The TPP process was introduced in the context of how it will apply to the current project. The main concepts of the planning phases are to determine what questions need to be answered, what data are needed to answer those questions, and how those data will be obtained. Future TPP meeting format is flexible and may include teleconferences. Additional in-person meetings may be held during Proposed Plan and Decision Document phases of the project.

III. Program Drivers and Overview (Slides 8-13)

Slides 8-13 were presented briefly because project participants are familiar with the subject. The Bangor Range MRS was solely used for small arms training, and munitions and explosives of concern (MEC) is not anticipated at the site. The current project includes all phases of the Comprehensive Environmental Response, Compensation & Liability Act (CERCLA) process from Remedial Investigation (RI) through Decision Document (DD). The overall goals of these phases are to characterize the nature and extent of potential contamination, assess the risks to human health and the environment associated with MC exposure, and evaluate potential remedial options to mitigate those risks.

Slide 13 presented the activities that will be conducted to address the objectives of an RI through DD. The first step is to complete a site-specific Work Plan that includes a Uniform Federal Policy (UFP)-Quality Assurance Project Plan (QAPP). A Community Relations Plan (CRP) will also be prepared. The CRP will include discussion of assessing community interest from interested parties such as the City of Bangor.

IV. Bangor Range MRS Information/SI Findings (Slides 14-20)

Rosa reviewed the location and site history of the Bangor Range munitions response site (MRS). The MRS is a 6.7-acre area formerly used as a known distance rifle range that is currently located west of the Bangor International Airport and immediately south of the entrance to the Regional Training Institute. It includes three earthen berms and a concrete target foundation. The former firing position is currently developed land with commercial structures and is not included in the MRS. The terrain is generally level and heavily wooded. No historical evidence of MEC has been documented or found at the site.

The 2012 SI methods and results were summarized. Iver McLeod (MEDEP) informed the group that the MEDEP Remedial Action Guidelines (RAGs) for lead concentrations referenced during the SI should be reviewed as part of RI planning. AECOM will propose a screening level for use in the RI Work Plan / UFP-QAPP that accounts for current and potential future land use, and our stakeholders will review on these comparison criteria, including conformance to MEDEP RAGS.

The general conceptual site model (CSM) for the MRS is shallow surface deposition of bullets that may contribute lead and other metals to shallow soil. Rosa Gwinn discussed the very thick brush at the MRS, and noted that lead at the site will be particularly immobile in the highly organic soil, meaning transport

to surface water or groundwater is unlikely. Rosa added that stream sampling of the nearby Shaw Brook will not be necessary given the distance to the water body from the MRS berms. She emphasized that the concrete infrastructure onsite is not considered part of an environmental assessment. The project team noted the potential to encounter porcupines at the site.

Tom Palmer (City of Bangor) added that some landowners would like to use the remaining MRS structures as attractions of a potential future park, to which Andrew Flint reminded the group that the park user scenario, which is more conservative than a trespasser scenario but less conservative than residential, is a scenario in MEDEP RAGS.

AECOM will coordinate the timing of field work with all parties who may want to observe the sampling and will provide at least 2 weeks' notice. The field schedule will target optimal sampling conditions (dry and no snow, April/May is best).

V. RI Objectives, Approach, and Stakeholder Involvement (Slides 21-23)

The overall RI objectives and sampling approach were reviewed (Slides 21-22). The RI will address the potential for MC contamination in both surface soil and subsurface soil. Rosa Gwinn described incremental sampling methodology (ISM) and advocated its use at the MRS as an estimate of exposure point concentrations. Most stakeholders are familiar with ISM and approve of its use. Surface soil will be characterized using an ISM approached refined by X-ray fluorescence (XRF) analysis. Andrew Flint (MEARNG) added that XRF analysis has been used at other nearby environmental sites, and that XRF should be suitable for the Bangor Range MRS. Iver stated that a 10 percent laboratory confirmation of XRF samples is a standard for MEDEP projects; this will be stated in the planning documents and as part of the results. Discrete samples will be collected to characterize subsurface soil. Select soil samples will also be analyzed for Toxicity Characteristic Leachate Procedures (TCLP) for potential soil disposal purposes.

John Haines (ARNG) contributed that a community relations and questionnaire sections may also identify stakeholder issues that will need to be incorporated into the RI Work Plan. Both Tom and Curt Davis (Bangor Airport) would help identify people to interview for CRP activities.

VI. Schedule and Open Discussion (Slides 24-25)

The preliminary schedule on slide 24 was reviewed. MEDEP was asked for their general review time requirements, Iver McLeod stated this usually takes approximately 30 calendar days but can be done sooner if the need arises.

Document distribution of project submittals was discussed. AECOM will transmit documents directly to stakeholders. The following distribution was determined:

- MEARNG: Submittals will be made electronically as source files and portable document file (PDF) versions, and delivered in hard copy accompanied by a PDF on compact disc (CD).
- MEDEP: All documents submitted in hard copy accompanied by PDF on CD. Two hard copies accompanied by PDF on CD will be provided to MEDEP.

The group also discussed future uses of the MRS. Tom commented that the site is eligible for a re-use

scenario and would likely be converted to a parking lot in that event. Andrew reminded the group that there is an adjacent USACE site delineated with flagging with high TCE concentrations. Andrew also added that there is a potable well at the MRS that is monitored for perfluorinated alkyl substances.

TPP1 Presentation concluded at 1100 hours EST.

VII. Site Visit (Monday, 25 September 2017)

Andrew Flint (MEARNG), Tom Palmer (City of Bangor), Curt Davis (Bangor International Airport), and Rosa Gwinn (AECOM) proceeded to Bangor Range MRS after the TPP1 meeting at 1110 hours.

Immediately to the south of the gate to the Regional Training Institute is a small traffic roundabout. A 10-ft wide strip of grass is maintained on the west side of the road. The last berm of the former known distance range (i.e., the 1000-yd berm) emerges from the woods perpendicular to the roadway (Photograph 1) into the grassy strip. The berm extends about 40 feet into the woods. The berm is no more than 10 feet higher than the ground surface in front of the berm to the south, and is covered with deadfall, dense leaf litter, low brush, and hardwood trees (Photograph 2).

Photograph 1: The 100-yd berm extends from the woods into the mowed strip, visible at the right side of the image.

Photograph 2: The 1000-yd berm extends from the foreground to the background on the right side of the photograph. The berm is vegetated with brush and trees, and the ground is littered with deadfall and thick leaf litter.

Another berm (800-yd target) is 600 feet to the south; it is not immediately apparent from the road, and ends where woods end at the grassy strip. Similar to the 100-yd berm, it is about 40-feet long, and covered with forest, deadfall, and dense leaf litter (Photograph 3).

Photograph 3: The 800-yd berm as viewed from the south forms a mound no more than 8 feet high and about 40 feet long. There is a mix of hardwood and evergreen trees, and the ground has dense leaf litter and low brush.

About 25 feet to the south of the 800-yd berm is a concrete box that is over 10 feet deep. Based on range use standards, this was occupied by personnel to protect them as they raised targets during training. The front edge of the box has broken vertically and collapsed onto the back half (Photograph 4).

Photograph 4: The front edge of the concrete structure that accommodated targets has collapsed onto the back edge.

During the site walk, Andrew Flint noted that AECOM can coordinate with him well in advance of field sampling to request MEARNG personnel training support in clearing brush and deadfall from the sampling berms prior to sampling. As long as care is taken to avoid ground disturbance, the effort would greatly improve the ability to screen and sample soil.

The group discussed some likely remedial alternatives, given current knowledge of the site. If RI sampling results are similar to SI results, then some options would include covering contaminated soil with a cap that could be used for parking. Another alternative might include removal of the fronts of the berms. There was a discussion that the full program described in the TPP meeting would take several years, and the City of Bangor would welcome an earlier possibility of beneficial use. As stated in the presentation, removal actions (time-critical or non-time-critical) may take place at any stage of CERCLA programs.

The site visit concluded at approximately 1200 hrs EST. The group visited adjacent property unrelated to this project.

Action Items:

-Submit meeting minutes (AECOM)

-Discuss removal actions with ARNG (AECOM)

QAPP Worksheet #10 – Conceptual Site Model

(UFP-QAPP Manual Section 2.5.2; EPA 2106-G-05 Section 2.2.5)

The CSM for Bangor Range MRS is presented within this worksheet as a combination of diagrams/figures and narratives. This profile was generated based on the information and findings presented in the 2012 Site Inspection (SI; Parsons, 2012) as well as the information gathered during the 2011 Historical Records Review (HRR: Parsons, 2011). The CSM describes the potential physical, chemical, and biological processes that may transport contaminants from sources to receptors and provides the basis for evaluating potential risks to human health and the environment. The Work Plan presents the site-specific history of the Bangor Range MRS, a brief site description, and the physical and ecological characteristics of the area.

Sources

Based on a review of the available historical records, former munitions-related training was limited to small arms (rifles and potentially pistols) at the Bangor Range MRS. The MRS was used by the MEARNG for live-fire, small-arms weapon training from 1920 to 1925. Historically, the Bangor Range was used as a 1,000-yard known distance rifle range. Based on the 2012 SI (Parsons, 2012), the Bangor Range MRS boundary was refined to 6.7 acres and includes the area where MC contamination was found to have exceeded the SI screening criteria (MEDEP 2010 Remedial Action Guidelines [RAGs] for Soil Contaminated with Hazardous Substances, and USEPA Ecological Soil Screening Levels). The MRS includes a historical 800 yard and 1,000 yard earthen target berm (referred to hereafter as Earthen Berms 1 and 2, respectively), as well as a concrete target structure located (referred to hereafter as the Concrete Structure) south of the 800 yard target berm. Other historical range features, including the firing point and 200, 400, and 600 yard target berms, occupied an area outside of the current MRS that has since been industrially developed, and no longer exist. These areas were recommended for no further action (NFA) as part of the MEHQ-002-R-02 MRS. Firing at the former range occurred in a northerly direction toward the target berms.

The 2012 SI reported that .22 caliber, .30 caliber, .38 caliber, and .45 caliber rounds were historically used at the MRS based on visual survey observations, the range type, timeframe of use, and its location (Parsons, 2012). Potential MC present within berm soil as a result of small arms projectiles are primarily lead and secondarily antimony, copper, and zinc. MC contamination (lead) was confirmed in surface soil at the 800 yard and 1,000 yard earthen berms at concentrations above human health screening criteria during the 2012 SI.

Pathways

MC deposited in surface soil as a result of firing activities at the MRS has limited potential to migrate from source areas (i.e., earthen berms, soil in front of the concrete structure). Given the MRS topography, range orientation, and heavy vegetation, stormwater runoff from significant rain events is unlikely to transport suspended MC off site or to wetlands west of the MRS. This was visually confirmed with a during the September 2017 site visit with stakeholders (**Worksheet #9**). Stormwater runoff from the MRS flows west, but MC from the Earthen Berms and Concrete Structure is encumbered due to the retardation of transport from thick vegetation and adhesion to soil. While current migration is highly unlikely, historical migration could have occurred. **Figure 10-1** presents a pictorial diagram of the site. **Figure 10-2** presents a conceptual diagram of transport from MC in soil to receptors. Transport pathways from DUs to surface water bodies are potentially complete.

Metals MC have a strong affinity to sorb to soil particles, particularly soils that are rich in organic matter, and usually only migrate via physical transport pathways. Because of these chemical properties, they typically do not leach to groundwater except where shallow groundwater exists less than 5 feet below

ground surface (bgs). According to 2008 monitoring well data provided by MEDEP, depth to groundwater at wells less than ¼ mile from the MRS is less than 7 feet bgs and in one well is less than 5 feet bgs (Cross Section A-A' of **Figure 10-1**). Shallow groundwater flows to the west and discharges to Shaw Brook, approximately 200 feet from the western MRS boundary. Groundwater pathways are potentially complete for the Bangor Range MRS.

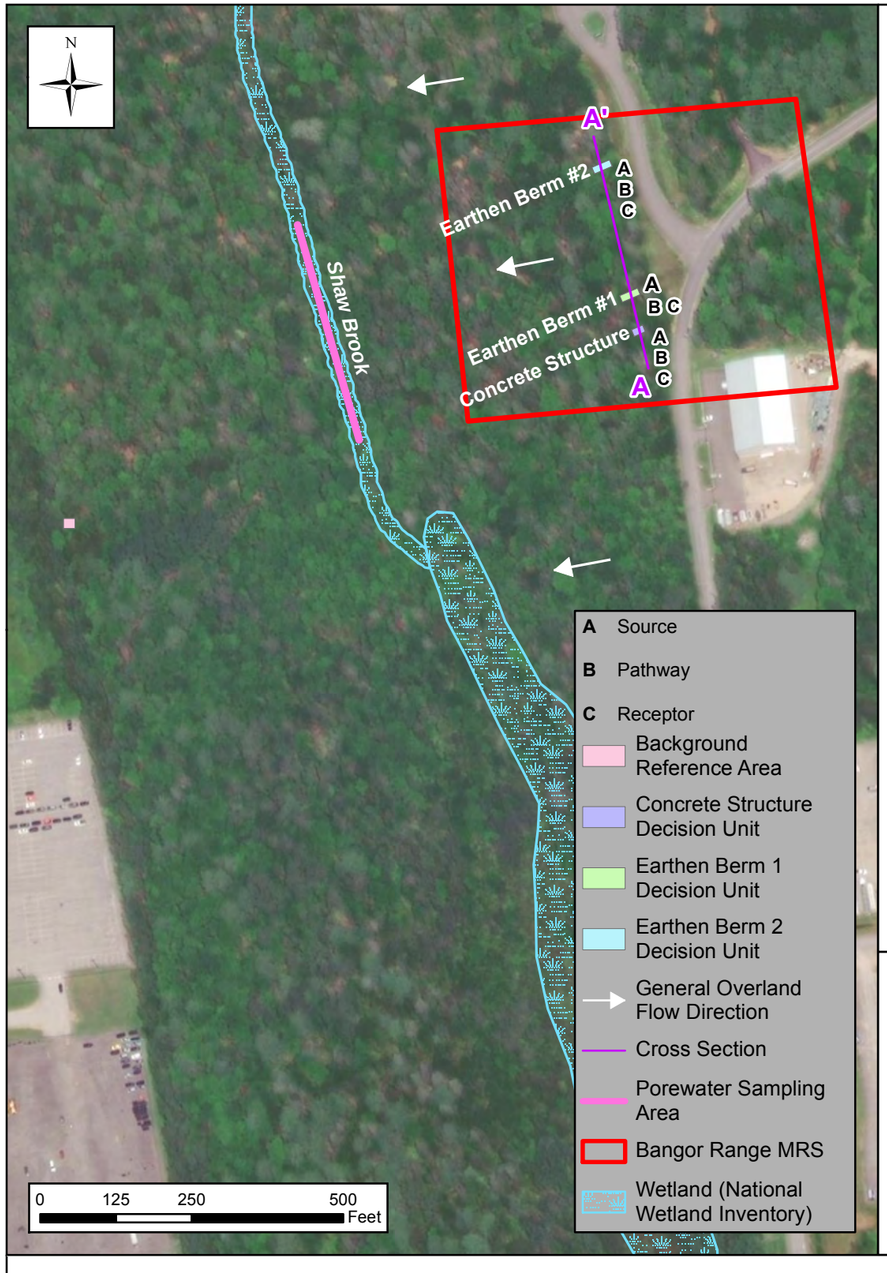
MC within soil at the MRS is anticipated to remain in soil at both earthen berms and the concrete structure, and not be transported off site. The primary exposure pathways between MC and receptors is expected to be limited to direct exposure to potentially contaminated soil at source areas, the earthen berms and soil in front of the concrete structure. However, RI field activities will examine if soil with elevated concentrations of MC has migrated from the MRS, and if groundwater with elevated concentrations of MC is entering Shaw Brook.

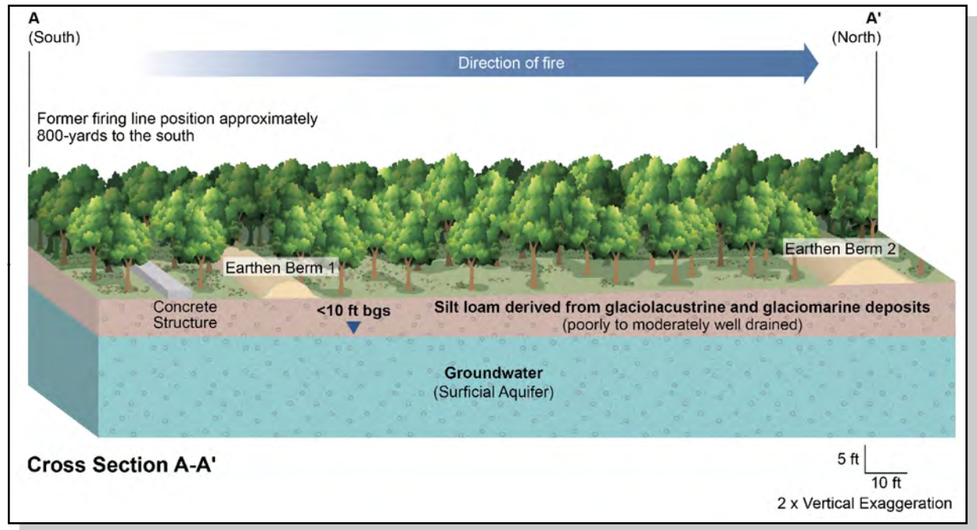
Receptors

The area surrounding the MRS is predominantly forested; the properties surrounding the MRS include the MEARNG Regional Training Institute to the north, storage units and commercial buildings to the south, and the Bangor International Airport to the east. No residences exist in the vicinity of the former range (see Figure 2-1 of the Work Plan). Access to the MRS is unrestricted. Potential human receptors include visitors or workers (e.g., construction, commercial/industrial), and potential hikers. The MRS area is zoned for airport development and urban industry with few restrictions on the land use. As such, there is potential that the site could be used for residential and/or recreational purposes in the future. There is no evidence that people use Shaw Brook for swimming, fishing, or any recreational purposes. There are no human receptors for groundwater.

Maine lists several state endangered species that have known ranges or locations within the vicinity of the MRS: Sedge Wren (*Cistothorus platensis*), Cobblestone Tiger Beetle (*Cicindela marginipennis*), Little Brown Bat (*Myotis lucifigus*), New England Cottontail (*Sylvilagus transitionalis*), and Northern Long-eared Bat (*Myotis septentrionalis*). Maine state listed threatened species that have known ranges or locations within the vicinity of the MRS include the Short-eared Owl (*Asio flammeus*), Upland Sandpiper (*Bartramia longicauda*), and Spotted Turtle (*Clemmys guttata*) (Maine Department of Inland Fisheries and Wildlife, 2015).

The project area is host to three federally listed threatened and endangered species: the Atlantic salmon (*Salmo salar*), Canada Lynx (*Lynx Canadensis*), and Northern Long-eared Bat (*Myotis septentrionalis*). The Northern Long-eared Bat, a federally listed threatened species, does not have any critical habitat listed but is listed as threatened wherever found. The watershed surrounding the MRS is federally designated critical habitat for the Atlantic Salmon (*Salmo salar*). No water bodies exist within the MRS (U.S. Fish and Wildlife Service [USFWS], 2017); however, shallow groundwater from the MRS flows to the west and discharges to Shaw Brook. There are no critical habitat areas for the Canada Lynx located within the MRS (USFWS, 2017), and the industrial developed nature of the surrounding areas are unsuitable habitat for Canada Lynx. The small size of the MRS limits the amount of time species are expected to remain in the area, and minimizes their potential exposure to MC within the MRS. Therefore, land animals are not a concern as the MC exposure pathways are incomplete.





A – Sources
Metals, particularly lead, in soil on the earthen berms and in front of the concrete target structure as a result of historical small arms training.

B – Pathways
Metals MC have limited potential to migrate from soil at the earthen berms or concrete structure (Source areas: "A" on map to left) beyond MRS boundaries. MC from the berms and concrete target structure is unlikely to travel offsite due to the retardation of transport from vegetation and adhesion to soil. RI activities will confirm this assumption. Groundwater at the at wells less than ¼ mile from the MRS is less than 7 feet below ground surface (Cross section A-A'). Given the depth to groundwater in the area, the groundwater pathway is potentially complete. Shallow groundwater discharges to Shaw Brook.

C - Receptors
The MRS is located within a fragmented forest that is surrounded by light industrial development. No residences are in the immediate vicinity of the MRS but there is a potential for future residents. Human receptors may recreationally visit the MRS for sightseeing, hiking/exercise (recreational users). Future maintenance workers may also visit the earthen berms or concrete structure area to conduct maintenance activities. There is no evidence that Shaw Brook is used by people for swimming, fishing, or any recreational purpose.

Maine has several state listed threatened and endangered species with known ranges or locations within the vicinity of the MRS, but no critical habitat designated within the MRS. Three federally-listed threatened and endangered species are listed for Penobscot county. Bangor, Maine lies within a watershed that is federally designated as critical habitat for the endangered Atlantic salmon (Salmo salar); however, no water features exist within the MRS. The federally threatened Canada lynx (Lynx Canadensis) has not been identified in the MRS and does not hold any designated critical habitat within the MRS. The threatened Northern Long-eared Bat (Myotis septentrionalis) is listed as threatened wherever found and has been listed in Penobscot county, but is expected to be minimally exposed to MC within the MRS if present. Shaw brook, west of the MRS, could provide habitat for aquatic species, and shallow groundwater from the MRS flows to the west and discharges to Shaw Brook. The small size of the MRS limits the amount of time species are expected to remain in the area and minimizes the potential exposure to MC within the MRS.

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 10-1
Conceptual Site Model
Bangor, Maine

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Date.....January 2018
Prepared by.....AECOM

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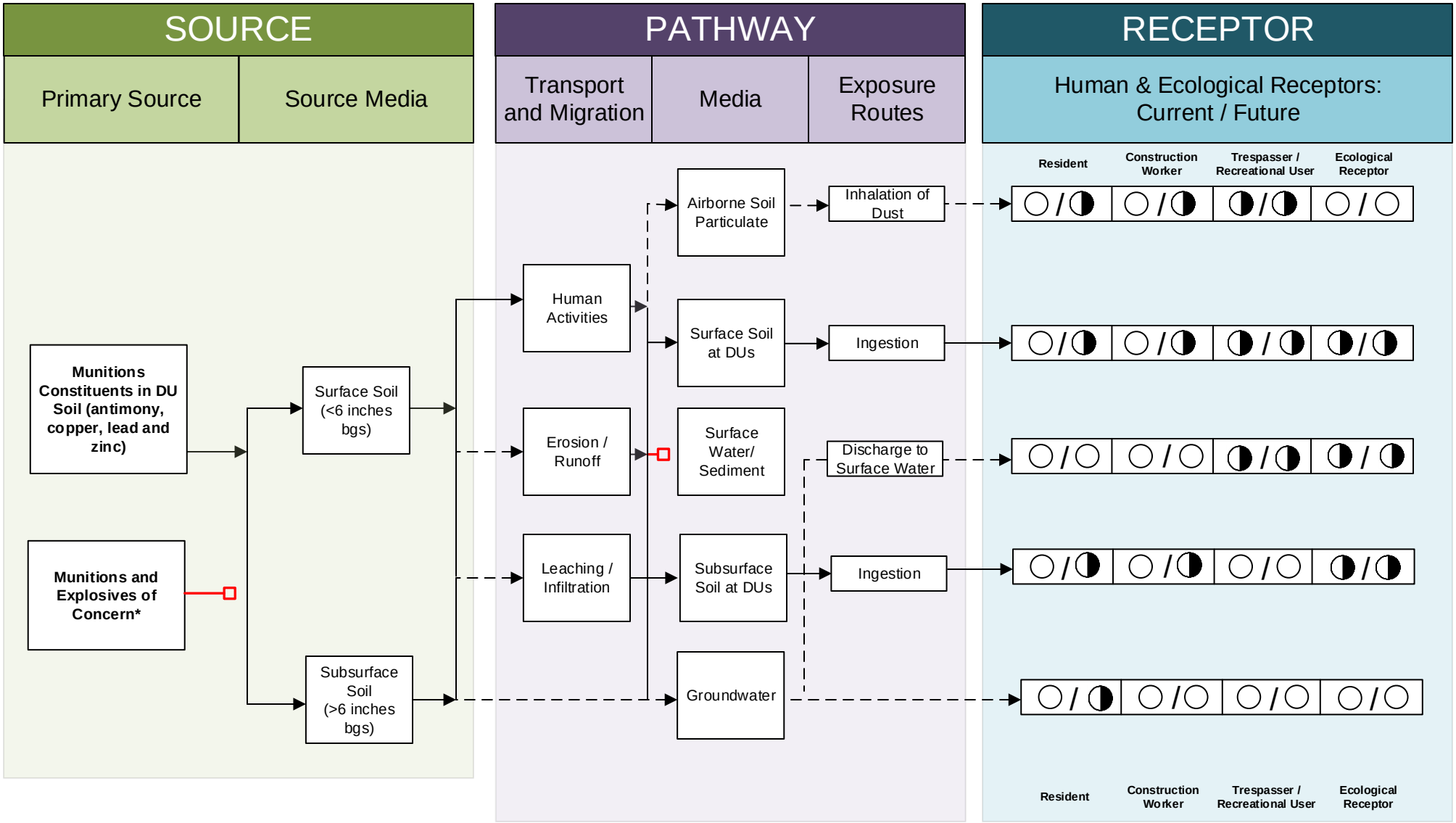


LEGEND

- Flow-Chart Stops
- Flow-Chart Continues
- Partial / Possible Flow
- Incomplete Pathway
- Potentially Complete Pathway
- Complete Pathway

*Munitions and explosives of concern are not present at the MRS

Figure 10-2
Conceptual Site Model Diagram
Bangor Range MRS, Maine

QAPP Worksheet #11 – Project/Data Quality Objectives

(UFP-QAPP Manual Section 2.6.1; EPA 2106-G-05 Section 2.2.6)

Data Quality Objectives (DQOs) are used to help decision-makers collect data of the right type, quality, and quantity to support the decision-making process. The approach to developing DQOs is an iterative process geared toward generating data that will be appropriate to making the decisions needed to reach the project goals. The DQO process consists of seven steps as presented in the USEPA *Guidance on Systematic Planning Using the Data Quality Objectives Process* (USEPA QA/G-4, 2006). Each step is presented below.

Step 1: State the Problem

Historical small-arms firing is known to have occurred at the Bangor Range MRS from 1920 to 1925 during the site's use by the MEARNG. Soil at former Earthen Berm 1 and Earthen Berm 2 as well as the Concrete Structure area may have been affected by MC from bullets used during small arms training. SI data collected in 2012 indicated there is likely metals MC contamination at the Earthen Berms and Concrete Structure area: MC, lead in particular, is present in soil above background concentrations and screening levels. Land at other historical range features (i.e., firing points and other target berms), located outside of the subject MRS, has been since been developed, and are not considered sources of MC contamination. Based on the 2012 SI (Parsons, 2012), the Bangor Range MRS boundary (MEHQ-002-R-01) was refined to 6.7 acres and includes the area where MC contamination was found to have exceeded the selected screening criteria. The remaining area was designated as the Bangor Range SDZ MRS (MEHQ-002-R-02; 259.9 acres) and was recommended for NFA.

The lateral and vertical distribution of MC in soil at the earthen berms and soil in front of the concrete structure is unknown and additional data are needed to confirm whether there is an effect on soil at these locations.

Stormwater runoff from the MRS flows west. MC in soil from the Earthen Berms and Concrete Structure is likely encumbered due to the retardation of transport from thick vegetation and adhesion to soil. However, it is possible that soil with elevated concentrations of MC has migrated from these areas toward Shaw Brook to the west.

Groundwater is shallow in this area (less than 10 feet bgs); therefore, it is possible that MC leached from the soil into the groundwater. Shallow groundwater flows to the west and discharges to Shaw Brook, approximately 200 feet from the western MRS boundary. There are no receptors for groundwater directly but there are potential ecological receptors in Shaw Brook. Background (also called reference) data for metals MC in all media, collected using the same methods used for this Remedial Investigation (RI), are needed so that data sets are comparable.

As described in **Worksheet #9**, the general plan for investigating the nature and extent of MC in soil at the Earthen Berms and in front of the Concrete Structure was presented to stakeholders at the project kickoff meeting. Site maps showing detailed sampling locations appear on **Figures 17-2**, **17-3**, and **17-4** of **Worksheet #17**.

Step 2: Identify the Goals of the Study

Soil sampling at the earthen berms and concrete structure area and porewater sampling at Shaw Brook will provide answers to the following questions:

- *If present, do MC concentrations in soil/porewater exceed Project Action Limits (PALs) and background?*

- *What is the lateral and vertical distribution of MC in soil exceeding screening PALs and background?*
- *If MC is present in concentrations above the PALs and background, do these concentrations pose an unacceptable risk to human health and the environment?*
- *If MC concentrations in soil and porewater are below the PALs, can a NFA decision be supported?*
- *If MC is present at concentrations that pose an unacceptable risk to human health and/or the environment, is/are they sufficiently defined to support an informed risk management decision of potential remedial actions?*

XRF data will be used to determine if soil with elevated MC concentrations has migrated from the MRS toward Shaw Brook. If migration is determined, surface water and sediment in Shaw Brook will be included. If collected, surface water and sediment sampling will provide answers to the questions listed above.

Step 3: Identify Information Inputs

Inputs needed to answer the questions identified in Step 2 are detailed below:

- Historical information and previous SI data were reviewed to design the sampling and analysis approach. Details regarding the sampling design are presented in **Worksheet #17**.
- Soil data are needed from discrete locations to understand the lateral and vertical extent of MC. This includes XRF data to determine if migration of soil with elevated MC has migrated toward Shaw Brook. For risk assessment, defensible exposure concentrations within a decision unit (DU) are needed and will be accomplished by either a sufficient quantity of discrete samples or the incremental ISM described in **Worksheet #17** and detailed in standard operating procedure (SOP) MC-4.
- If MC-laden soil migration is determined, surface water and sediment samples will be collected from Shaw Brook. For risk assessment purposes, defensible exposure concentrations will be accomplished by collecting a sufficient quantity of samples (8 samples) in each medium.
- To determine MC concentrations in groundwater that may impact ecological receptors in Shaw Brook, porewater samples will be collected from the streambed of Shaw Brook. For risk assessment purposes, defensible exposure concentrations will be accomplished by collecting a sufficient quantity of samples (8 samples) in each medium.
- Naturally occurring background metals MC concentrations will be determined in a nearby area that is unaffected by historical site activities, see **Worksheet #17, Figure 17-1**.
- During the RI, ISM and potential sediment results will be compared to the PALs established by following screening criteria detailed on **Worksheet #15** (and area-specific background concentrations):
    - U.S. Environmental Protection Agency (USEPA) Regional Screening Levels protective of a residential scenario using a target hazard quotient of 0.1 and a target cancer risk of $1x10^{-6}$ (USEPA, 2017).
    - MEDEP RAGs for Sites Contaminated with Hazardous Substances (MEDEP, 2018)
    - USEPA Region 4 Ecological Risk Assessment Supplemental Guidance (USEPA, 2015)
- Porewater and potential surface water samples will be compared to PALs detailed on **Worksheet #15**, which are based on Region 3 Biological Technical Assistance Group (BTAG) Ecological Screening Values (July 2006).

- Based on these screening criteria and the sampling design, soil data will be obtained using two methods: on-site XRF and off-site laboratory analysis by analytical methods. USEPA SW-846 Method 6020A (metals) was selected to achieve the required levels of detection (LODs) and levels of quantitation (LOQs).

Step 4: Define Boundaries of the Study

The physical boundaries of the MRS and DUs are shown in **Figure 17-1** of **Worksheet #17**. The investigation/DU boundaries may be refined based on results of the MC investigation during which step-out samples may be collected to define the edge of MC concentrations above the MEDEP Remedial Action Guidelines for Residential Soil for Sites Contaminated with Hazardous Substances (MEDEP, 2016) for lead, as applicable. Field work for the remedial investigation of the Bangor Range MRS is anticipated to take place on two parcels of land, County parcels R08-001 and R08-012. These parcels are owned by Hardy Associates, Inc. and the City of Bangor, respectively. Rights of entry (ROEs) have been requested for these two parcels.

Step 5: Develop the Analytic Approach

The purpose of this step is to integrate the outputs from the previous steps into a statement that defines the conditions that would cause the decision-maker to choose among alternative actions. For this RI, the risk-based assessment will use results from incremental samples collected from each DU. Data from these samples represent the potential exposure risk to receptors across the entire DU. The primary concern is human receptors who have access to the site. Ecological receptors may be present; however, there is little or no sensitive habitat at the MRS. Discrete sample data will be used for delineation of MC extent. Both human and ecological PALs are listed in **Worksheet #15**. The selection process for location of DUs and collection of incremental samples for MC analysis is outlined in **Worksheet #17**.

The decision rules for this RI are:

- *Earthen Berms1 and 2 and Concrete Structure: If XRF results of the 0- to 6-inch historic surface soil samples along the DU boundary exceed the 2016 MEDEP Residential Soil RAGS for lead(**Worksheet #15**), then: step-out samples will be collected and analyzed with XRF until exceedances are no longer observed; the DU boundary will be revised; and ISM samples will be collected from the revised DU.*
- *Earthen Berms 1 and 2 and Concrete Structure: If XRF results of the 0- to 6-inch historic surface soil samples along the DU boundary do not exceed the 2018 MEDEP Residential Soil RAGS for lead (**Worksheet #15**), then: ISM samples will be collected from the initial DU.*
- *Earthen Berms 1 and 2 and Concrete Structure Area: If the ISM MC concentrations are less than the PALs (**Worksheet #15**), then there is no unacceptable risk of MC exposure to receptors, the assessment will be considered complete, and this portion of the MRS will be recommended for NFA.*
- *Earthen Berms 1 and 2and Concrete Structure Area: If the ISM MC concentrations exceed the PALs (**Worksheet #15**), then MC concentrations pose a potential risk to receptors, a HHRA and/or (as applicable) Screening Level Ecological Risk Assessment will be conducted, and the DU will be retained for evaluation in the Feasibility Study (FS) if unacceptable risks are identified.*
- *Earthen Berms 1 and 2 and Concrete Structure Area: If laboratory analysis of any discrete 12- to 18-inch soil sample shows MC above PALs, then the laboratory will analyze the corresponding 24- to 30-inch contingency sample for vertical delineation of MC. If laboratory analysis of a discrete 24- to 30-inch soil sample shows MC above PALs, then a second mobilization will be required to determine depth of MC. (Note: discrete samples collected below the surface interval are for MC delineation purposes.)*

- *Groundwater: If the porewater MC concentrations are less than the ecological screening criteria (**Worksheet #15**), then there is no unacceptable risk of MC exposure to ecological receptors, the assessment will be considered complete.*
- *Surface water: If the porewater MC concentrations are less than the screening criteria (**Worksheet #15**) and XRF results do not indicate migration of MC-laden soil toward Shaw Brook, then there is no unacceptable risk of MC exposure to receptors. The assessment will be considered complete and surface water will be recommended for NFA.*
- *Surface water: If the porewater MC concentrations exceed the screening criteria (**Worksheet #15**), then MC concentrations pose a potential risk to surface water receptors and surface water/sediment samples will be collected and analyzed.*
- *Surface water: If XRF results indicate migration of MC-laden soil toward Shaw Brook, then MC concentrations pose a potential risk to surface water receptors and surface water/sediment samples will be collected and analyzed.*
- *Surface water/sediment: If surface water and sediment samples are collected and analyzed and MC concentrations exceed the PALs (**Worksheet #15**), then MC concentrations pose a potential risk to receptors, a HHRA and/or (as applicable) Screening Level Ecological Risk Assessment will be conducted, and the area will be retained for evaluation in the Feasibility Study (FS) if unacceptable risks are identified.*

Step 6: Specify Performance or Acceptance Criteria

This step is to specify the decision-makers acceptable limits on decision errors, which are used to establish appropriate performance goals for limiting uncertainty in the environmental data. These acceptable limits on decision errors allow decision-makers to generate resource-effective sampling designs while limiting uncertainties in the collected data. Decision errors are associated with both field sampling and laboratory analyses.

The baseline condition (i.e., null hypothesis) for MC sampling is that MC is present. The false negative decision error would be deciding that MC is not present when it actually is or deciding that the extent of a MC has been defined when it actually has not. This type of decision error is controlled by having a high degree of confidence that the sample locations selected will identify an MC if present, and that the analysis selected is sufficient to detect selected analytes in the sampled media, the detection limits are adequate to ensure an accurate quantification of the MC, and there is a high degree of confidence that the dataset is of sufficient quality and completeness.

The following mechanisms are incorporated into the sampling design to address the above criteria. MC samples will be collected in areas most likely to have an MC release. Procedures are in place for minimizing field sampling decision errors. These procedures include adhering to the planning documents and SOPs and using proper sampling techniques (**Worksheet #17**). If the total percent relative standard deviation (RSD; total error) between three field replicates from the same DU meets the measurement performance criteria listed in **Worksheet #12-1**, then the sampling design and execution are adequate, and the distribution of replicate results can be assumed to be approximately normal. **Worksheets #12** and **#28** specify analytical performance and acceptance criteria.

There are several types of decision errors that may stem from laboratory analysis. The data can be biased high (false positive), biased low (false negative), or completely invalid (rejected). The level of error associated with the laboratory data will be minimized by adherence to analytical methods that produce precise, high-quality data and will be verified through the data validation process. As part of the data validation process, the project chemist will assess data usability (**Worksheet #37**).

Step 7: Develop the Design

This step is used to produce the most resource-efficient sampling design that will meet the DQOs. The sampling design for the DUs at the Bangor Range MRS includes a combination of statistical and judgmental sampling and is described in the steps below. Details on sample design are presented in **Worksheet #17**.

- Collect discrete samples and perform real-time analysis by XRF for evaluating extent of MC at both earthen berm DUs and the concrete structure area DU. Step-out samples may be needed to delineate the extent of MC.
- Collect incremental samples in triplicate from the Earthen Berm 1, Earthen Berm 2, and Concrete Structure DUs as well as a background location.
- Collect discrete, subsurface samples at select Earthen Berm 1, Earthen Berm 2, and Concrete Structure Area locations where XRF results exceed human health criterion for lead.
- Collect porewater samples from streambed of Shaw Brook including background sample.
- If necessary, collect surface water and sediment samples from Shaw Brook including background samples for each.
- Submit all samples to the laboratory for analysis using USEPA SW-846 Method 6020A.

QAPP Worksheet #12-1 – Measurement Performance Criteria – Aqueous and Solid – 6020A

(UFP-QAPP Manual Section 2.6.2; EPA 2106-G-05 Section 2.2.6)

Matrix: Discrete/Incremental Soil +Sediment/Surface Water/Pore Water
Analytical Group or Method: Metals 6020A – Katahdin
Concentration Level: Low

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision (overall)	Field Duplicates [Discrete]	Relative Percent Difference (RPD) <30% when detects are at least 5x LOQ, or within ±4x the LOQ for results <5x LOQ
Precision (overall)	Field Triplicates [Incremental]	Relative Standard Deviation (RSD) <30% when detects are at least 5x LOQ, or average deviation within ±4x the LOQ for results <5x LOQ
Accuracy/Bias (overall)	Field Blanks (aqueous only; e.g., equipment and rinsate blanks)	No results greater than LOD
Precision and Accuracy-overall	Method Blank (MB)	No analytes detected > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes >LOQ.
Analytical Accuracy/Bias (laboratory)	Laboratory Control Spike (LCS)	Analyte-specific as per DoD QSM.
Analytical Precision	Laboratory Control Sample Duplicates (LCSD)	RPD ≤20%
Analytical Accuracy/Bias (matrix interference)	Matrix Spike Duplicate (MSD)	Analyte-specific as per DoD QSM.
Analytical Accuracy/Bias (laboratory)	Serial Dilution Test	Five-fold dilution must agree within ± 10% of the original measurement. Only applicable for samples with concentrations > 50 X LOQ (prior to dilution).
Analytical Accuracy/Bias (laboratory)	Post Digestion Spike	% Recovery = 80%-120%
Analytical Accuracy (laboratory)	Internal Standards (IS)	Response within 30%-120% of intensity in calibration blank

QAPP Worksheet #12-2 – Measurement Performance Criteria – Aqueous and Solid – TCLP Metals

(UFP-QAPP Manual Section 2.6.2; EPA 2106-G-05 Section 2.2.6)

Matrix: Toxicity Characteristic Leaching Procedure (TCLP) Waste
Analytical Group or Method: Metals, Mercury/6010C/7470A/7471B – Katahdin
Concentration Level: Low

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision (overall)	Field Duplicates	RPD <30% when detects are at least 5x LOQ, or within ±4x the LOQ for results <5x LOQ
Accuracy/Bias (overall)	Field Blanks (aqueous only; e.g., equipment and rinsate blanks)	No results greater than LOD
Precision and Accuracy-overall	MB	No analytes detected > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes >LOQ.
Analytical Accuracy/Bias (laboratory)	LCS	Analyte-specific as per DoD QSM.
Analytical Precision	LCSD	RPD ≤20%
Analytical Accuracy/Bias (matrix interference)	Matrix Spike Duplicate (MSD)	Analyte-specific as per DoD QSM.
Analytical Accuracy/Bias (laboratory)	Serial Dilution Test	Five-fold dilution must agree within ± 10% of the original measurement. Only applicable for samples with concentrations > 50 X LOQ (prior to dilution).
Analytical Accuracy/Bias (laboratory)	Post Digestion Spike	% Recovery = 80%-120%

QAPP Worksheet #13 – Secondary Data Uses and Limitations

(UFP-QAPP Manual Section 2.7; EPA 2106-G-05 Chapter 3)

Data Type	Data Source	Data Uses Relative to the Current Project	Factors Affecting the Reliability of Data and Limitations on Data Use
Previous Analytical Data	Site Inspection (SI) Report for Bangor Range (Parsons, 2012)	Soil data has been used to inform the sampling approach and design.	Data collection was limited in scope and was not collected using the same methods planned for the RI. SI data will not be used to supplement risk evaluations.
Historical Site Use	Historical Records Review (HRR), 2011 (Parsons, 2011)	Location of MRS features. Types of munitions used. Timeframe for active firing use.	No known limitation.

QAPP Worksheets #14 & #16 – Project Tasks and Schedule

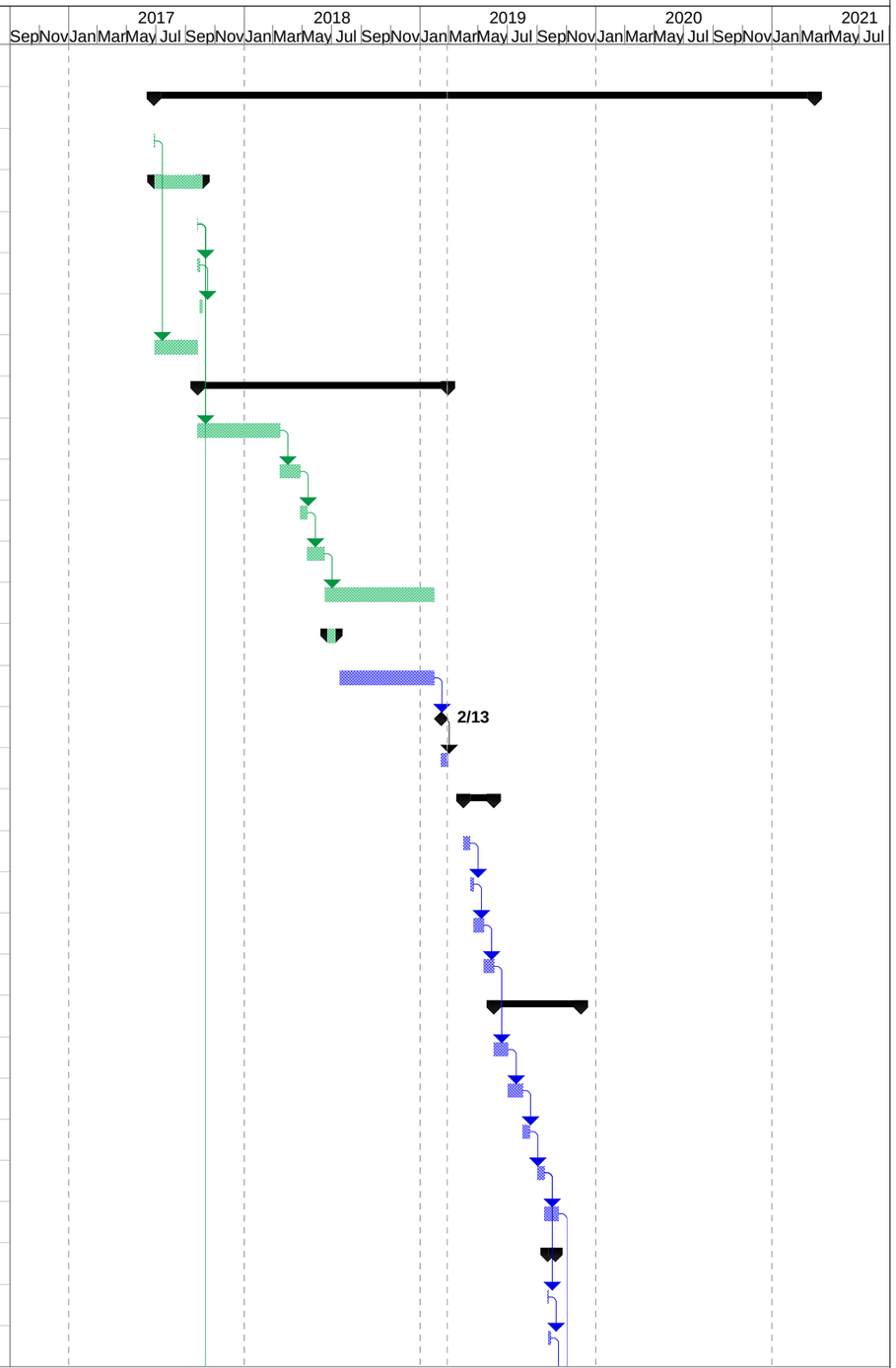
(UFP-QAPP Manual Section 2.8.2; EPA 2106-G-05 Section 2.2.4)

Activity	Responsible Party	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date
Mobilization/ Demobilization	Field Team Leader	April 2019	April 2019	Field documentation	N/A
Soil sampling	Field Team Leader	April 2019	April 2019	Field notes, trip report	N/A
Analysis	Katahdin	April 2019	May 2019	Report of Analyses/Data Package	28 days after samples arrive at laboratory
Validation	Project Chemist	May 2019	June 2019	Validation Summary Report	28 days after Analysis/Data Packages received
Summarize Data	Project Manager	June 2019	July 2019	Draft RI Report	TBD

The Schedule provided below is a detailed schedule broken down by each subtask that will occur for the activities associated with the RI through DD for the Bangor Range MRS. The timeframes for post- RI documents are somewhat speculative.

Detailed Project Schedule & Milestones

ID	Task Name	Duration	Start	Finish	Predecessors
1	**Notice to Proceed**	1 day	Tue 9/20/16	Tue 9/20/16	
2	**Task 4: Remedial Investigation, Feasibility Study, Proposed Plan, and Record of Decision Document for Bangor Range MEHQ-002-R-01**	**1373 days**	**Tue 6/27/17**	**Tue 3/30/21**	
3	Notice to Proceed	1 day	Tue 6/27/17	Tue 6/27/17	
4	**TPP1/Kick-off Meeting/Site Visit**	**100 days**	**Wed 6/28/17**	**Thu 10/5/17**	
5	Kickoff Meeting	1 day	Mon 9/25/17	Mon 9/25/17	
6	Prepare and Submit Draft Meeting Notes	4 days	Tue 9/26/17	Fri 9/29/17	5
7	Prepare and Submit Final Meeting Notes	6 days	Sat 9/30/17	Thu 10/5/17	6
8	Notify COR that Rights of Entry (ROE) are required and obtain ROEs	90 days	Wed 6/28/17	Mon 9/25/17	3
9	**Work Plan/UFP-QAPP/SSHP for Bangor Range**	**520 days**	**Tue 9/26/17**	**Wed 2/27/19**	
10	Prepare and Submit Draft Work Plan for Bangor Range	171 days	Tue 9/26/17	Thu 3/15/18	5
11	Army Review	30 days	Fri 3/16/18	Thu 4/26/18	10
12	Prepare and Submit Responses to Comments on the Draft Work Plan for Bangor Range	15 days	Fri 4/27/18	Fri 5/11/18	11
13	Prepare and Submit Draft Final Work Plan for Bangor Range	35 days	Sat 5/12/18	Fri 6/15/18	12
14	Regulatory Agency Review (multiple rounds of comments)	162 days	Mon 6/18/18	Tue 1/29/19	13
15	**TPP2 Meeting (Not Needed)**	**16 days**	**Sat 6/23/18**	**Sun 7/8/18**	
19	Prepare and Submit Responses to Comments for Bangor Range (multiple rounds comments)	195 days	Thu 7/19/18	Tue 1/29/19	
20	Prepare and Submit Final Work Plan for Bangor Range	0 days	Wed 2/13/19	Wed 2/13/19	19FS+15 days
21	Regulatory Agency Approval/Concurrence of Final Work Plan for Bangor Range	14 days	Thu 2/14/19	Wed 2/27/19	20
22	**Field Investigation**	**63 days**	**Mon 4/1/19**	**Sun 6/2/19**	
23	Coordination/Preparation for Field Work	14 days	Mon 4/1/19	Sun 4/14/19	
24	Field Work (XRF with discrete and incremental sampling)	7 days	Mon 4/15/19	Sun 4/21/19	23
25	Laboratory Analysis	21 days	Mon 4/22/19	Sun 5/12/19	24
26	Data Validation	21 days	Mon 5/13/19	Sun 6/2/19	25
27	**Remedial Investigation (RI) including MRSPP Update for Bangor Range**	**181 days**	**Mon 6/3/19**	**Sat 11/30/19**	
28	Prepare and Submit Draft RI for Bangor Range	30 days	Mon 6/3/19	Tue 7/2/19	26
29	Army Review	30 days	Wed 7/3/19	Thu 8/1/19	28
30	Prepare and Submit Responses to Comments for Bangor Range	15 days	Fri 8/2/19	Fri 8/16/19	29
31	Prepare and Submit Draft Final RI for Bangor Range	15 days	Sun 9/1/19	Sun 9/15/19	30FS+15 days
32	Regulatory Agency Review	30 days	Mon 9/16/19	Tue 10/15/19	31
33	**TPP3 Meeting**	**16 days**	**Mon 9/23/19**	**Tue 10/8/19**	
34	TPP3 Meeting	1 day	Mon 9/23/19	Mon 9/23/19	31FS+7 days
35	Prepare and Submit Draft Meeting Notes	5 days	Tue 9/24/19	Sat 9/28/19	34

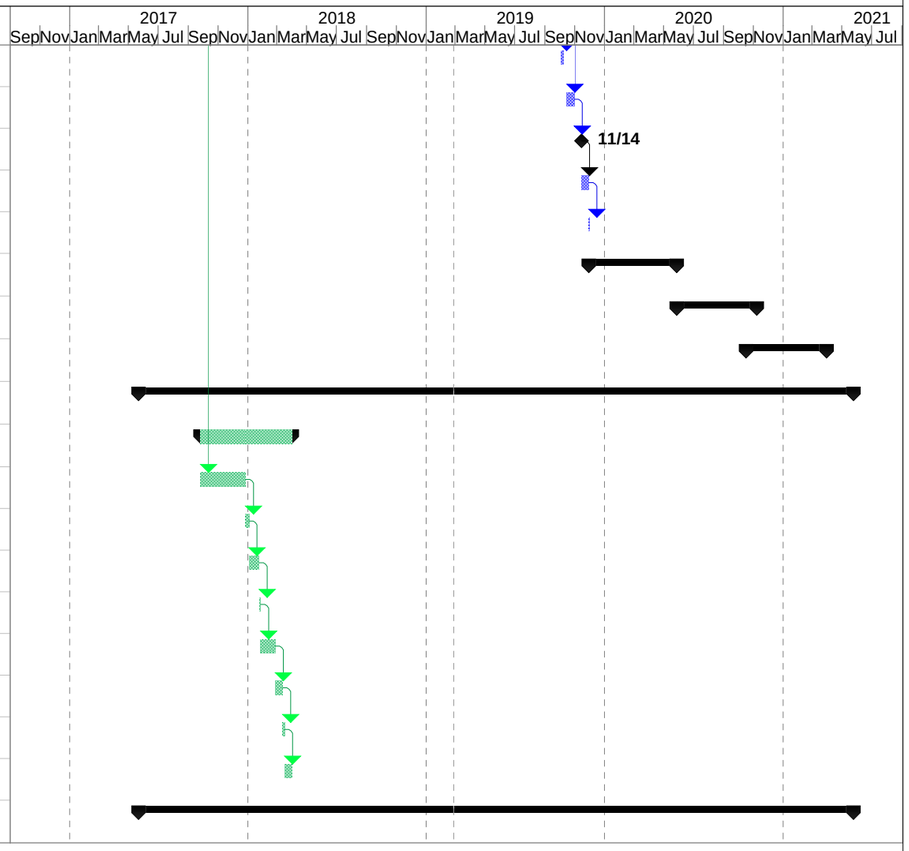


Project: RI-DD Six ARNG NDNODS MMRP Sites

Task Milestone Summary Completed Task

Detailed Project Schedule & Milestones

ID	Task Name	Duration	Start	Finish	Predecessors
36	Prepare and Submit Final Meeting Notes	5 days	Fri 10/4/19	Tue 10/8/19	35FS+5 days
37	Prepare and Submit Responses to Comments on Draft Final for Bangor Range	15 days	Wed 10/16/19	Wed 10/30/19	32
38	Prepare and Submit Final RI for Bangor Range	0 days	Thu 11/14/19	Thu 11/14/19	37FS+15 days
39	Regulatory Agency Approval/Concurrence of Final RI for Bangor Range	15 days	Fri 11/15/19	Fri 11/29/19	38
40	ERIS and SDSFIE Submittals	1 day	Sat 11/30/19	Sat 11/30/19	39
41	**Feasibility Study (FS) including MRSPP Update (if applicable) for Bangor Range**	**180 days**	**Sat 11/30/19**	**Wed 5/27/20**	
54	**Proposed Plan including MRSPP Update (if applicable) for Bangor Range**	**164 days**	**Thu 5/28/20**	**Sat 11/7/20**	
65	**Record of Decision including MRSPP Update (if applicable) for Bangor Range**	**165 days**	**Sat 10/17/20**	**Tue 3/30/21**	
74	**Task 10: Community Relations Plans (CRP)**	**1464 days**	**Mon 5/22/17**	**Mon 5/24/21**	
75	**Bangor Range, ME**	**187 days**	**Tue 9/26/17**	**Sat 3/31/18**	
76	Prepare and submit Draft CRP	92 days	Tue 9/26/17	Tue 12/26/17	5
77	Army Review	5 days	Wed 12/27/17	Tue 1/2/18	76
78	Prepare and Submit Responses to Comments on Draft CRP	21 days	Wed 1/3/18	Tue 1/23/18	77
79	Prepare and Submit Draft Final CRP	3 days	Wed 1/24/18	Fri 1/26/18	78
80	Regulatory Agency Review	30 days	Sat 1/27/18	Sun 2/25/18	79
81	Prepare and Submit Responses to Comments on Draft Final CRP	15 days	Mon 2/26/18	Mon 3/12/18	80
82	Prepare and Submit Final CRP	4 days	Tue 3/13/18	Fri 3/16/18	81
83	Approval/Concurrence of Final CRP	15 days	Sat 3/17/18	Sat 3/31/18	82
84	**Restoration Advisory Board (RAB) - GENERAL EXAMPLE, Apply to MRS as needed**	**1464 days**	**Mon 5/22/17**	**Mon 5/24/21**	



QAPP Worksheet #15 – Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

(UFP-QAPP Manual Section 2.6.2.3; EPA 2106-G-05 Section 2.2.6)

Matrix: Discrete/Incremental Soil/Sediment
Analytical Method: Metals (Total) by USEPA SW-846 Method 6020A
Concentration Level: Low

Analyte	CAS #	USEPA Residential Soil RSL (mg/kg)(1)	USEPA Industrial Soil RSL (mg/kg)(2)	MEDEP Residential Soil RAGs (mg/kg)(3)	MEDEP Park User Soil RAGs (mg/kg)(4)	Ecological Soil Screening Value (mg/kg)(5)	PAL (mg/kg)	PQL Goal (mg/kg)	Laboratory-specific DL (mg/Kg)	Laboratory-specific LOD (mg/Kg)	Laboratory-specific LOQ (mg/Kg)
Antimony	7440-36-0	31	470	43	120	0.27	0.27	0.027	0.020	0.050[a]	0.10
Copper	7440-50-8	3,100	47,000	4,300	12,000	28	28	2.8	0.071	0.20	0.30
Lead	7439-92-1	400	800	140	290	11	11	1.1	0.0070	0.050	0.10
Zinc	7440-66-6	23,000	350,000	32,000	91,000	46	46	4.6	0.13	0.80	1.0

PAL= Project Action Level; LOD = Limit of Detection; LOQ = Limit of Quantitation; PQL = Project Quantitation Limit
PQL goals are ideally (1/10) regulatory standard listed
[a] Laboratory LOD is greater than the PQL goal. The PAL is greater than the laboratory LOD. The PQL will be raised to the laboratory LOD.
Screening Level References:
(1) USEPA Residential Soil RSL Value (June 2017), protective of a target hazard quotient of 0.1 and a target cancer risk of $1x10^{-6}$
(2) USEPA Industrial Soil RSL Value (June 2017), protective of a target hazard quotient of 0.1 and a target cancer risk of $1x10^{-6}$
(3) MEDEP Residential Soil Remedial Action Guidelines for Sites Contaminated with Hazardous Substances (October 2018)
(4) MEDEP Park User Soil Remedial Action Guidelines for Sites Contaminated with Hazardous Substances (October 2018)
(5) USEPA Region 4 Ecological Risk Assessment Supplemental Guidance Soil Screening Values for Hazardous Waste Sites (August 2015)

The 2018 MEDEP Residential Soil RAGs will be used as the human health screening criteria for RI purposes. The 2015 USEPA Region 4 Soil Screening Values will be used for ecological soil screening criteria for RI purposes.

Matrix: Porewater/Surface Water
Analytical Method: Metals (Total) by USEPA SW-846 Method 6020A
Concentration Level: Low

Analyte	CAS #	BTAG Ecological Screening Value (µg/L)[1]	PAL (µg/L)	PQL Goal (µg/L)	Laboratory-specific DL (µg/L)	Laboratory-specific LOD (µg/L)	Laboratory-specific LOQ (µg/L)
Antimony	7440-36-0	30	30	3.0	0.054	0.50	1.0
Copper	7440-50-8	9.0	9.0	0.90	0.18	2.0	3.0
Lead	7439-92-1	2.5	2.5	0.25	0.074	0.50	1.0
Zinc	7440-66-6	120	120	12	3.9	8.0	10

PAL= Project Action Level; LOD = Limit of Detection; LOQ = Limit of Quantitation; PQL = Project Quantitation Limit
PQL goals are ideally (1/10) regulatory standard listed
[a] Laboratory LOD is greater than the PQL goal. The PAL is greater than the laboratory LOD. The PQL will be raised to the laboratory LOD.
Screening Level References:
[1] Region 3 Biological Technical Assistance Group (BTAG) Screening Values, Hardness value = 100 (July 2006)

Matrix: TCLP Soil
Analytical Method: TCLP Metals (Lead) by USEPA SW-846 Method 1311/6020A
Concentration Level: Low

Analyte	CAS #	PAL (mg/L)[a]	PQL Goal (mg/L)	LCS Lower Control Limit (%)	LCS Upper Control Limit (%)	Laboratory-specific DL (ug/L)	Laboratory-specific LOD (ug/L)	Laboratory-specific LOQ (ug/L)
Lead	7439-92-1	5.0	5.0	80	120	0.00025	0.0010	0.50

PAL= Project Action Level; LCS = Laboratory Control Spike; LOD = Limit of Detection; LOQ = Limit of Quantitation; PQL = Project Quantitation Limit
[a] 40 CRF 261.24 Toxicity Characteristic Table 7-1

QAPP Worksheet #17 – Sampling Design and Rationale

(UFP-QAPP Manual Section 3.1.1; EPA 2106-G-05 Section 2.3.1)

The sampling approach of the RI is designed to characterize the nature and extent of MC contamination in soil at both earthen berms the concrete structure area, and groundwater that is associated with historical training activities conducted at Bangor Range MRS. The DQOs for the MC sampling approach are presented in **Worksheet #11**. The sampling design rationale for the MRS is based on historical use, range layout, previous sampling results, and the CSM discussed in **Worksheet #10**. A phased approach that includes assessing the extent of MC contamination in the field using X-ray fluorescence (XRF) analysis, when feasible, followed by laboratory analysis of soil samples collected using ISM will be used to accomplish project goals. Five percent of XRF screening grab samples will also be analyzed by the laboratory.

Based on the findings of the SI and HRR, potential MC are limited to small-arms metals (antimony, copper, lead, and zinc). All samples collected for laboratory analysis will be sent to Katahdin Analytical Services in Scarborough, ME for analysis of target small-arms metals, and/or waste characterization parameters. At the time of collection, the general characteristics of soil samples (XRF, ISM, and discrete subsurface) will be described: grain size, organic content, color, presence of bullets or bullet fragments, and moisture.

Three distinct soil DUs have been identified as associated with the former firing range (**Figure 17-1**). The Earthen Berm 1 DU is approximately 0.008 acres; the Earthen Berm 2 DU is approximately 0.008 acres; and the Concrete Structure DU is approximately 0.005 acres. **Figure 17-2** presents the initial DU and the sampling plan for the Earthen Berm 1 DU, **Figure 17-3** shows the initial DU and the sampling plan for the Earthen Berm 2 DU, and **Figure 17-4** depicts the initial DU and the sampling plan for the Concrete Structure DU. The entire MRS covers a 6.7-acre area.

Field staff will follow the safety procedures and guidance outlined in the SSHP (Attachment B of the Work Plan). Because the MRS is a former small arms range with no evidence of MEC, unexploded ordnance support will not be necessary. However, AECOM field sampling personnel are experienced in military munitions work and know the "3Rs" for MEC safety: Recognize, Retreat, and Report. Should any material be discovered that may pose an explosive hazard, field staff will follow the guidelines in Section 11.9 of the SSHP (Attachment B of the Work Plan).

Step 1 – X-ray Fluorescence Screening:

The initial DUs for the earthen berms and concrete structure will be screened for lead in the field using XRF. A grid will be laid out across the DUs and discrete samples will be taken from 0 to 6 inches bgs at each grid node. The initial, or 0-inch, sample collection depth will begin in the soil A horizon after organic matter including detritus, humus, and surface debris has been cleared of the sample location. An approximate 4 - by 4-foot grid will be sampled at the Earthen Berm 1 DU (approximately 36 samples; **Figure 17-2**). Similarly, an approximate 4- by 4-foot grid will be sampled at the Earthen Berm 2 DU (approximately 36 samples; **Figure 17-3**). An approximate 3- by 4-foot grid will be sampled at the Concrete Structure DU (approximately 30 samples; **Figure 17-3**).

Each discrete sample will be collected using a new disposable sampling implement, placed in a clear plastic zip-top bag, and disaggregated/homogenized in the field by mechanical methods prior to analysis (SOP MC-9, **SOP MC-6,** and **Section 5.4** of **SOP MC-5 [Attachment A]**). Samples will be analyzed for lead by XRF following the general guidance of U.S. Environmental Protection Agency (USEPA) Method 6200 and standard operation procedure (**SOP) MC-5**. Lead concentrations will be recorded as the

concentration measured and the error of the reading as given by the XRF analyzer. Field notes will document sample handling and preparation following **Section 3.5.1 of SOP MC-3 (Attachment A)**.

Soil moisture can potentially interfere with XRF analysis (>20 percent moisture). Sampling will be scheduled during a distinctly dry season. An experienced sampling team will determine the applicability of XRF use in the field with the assistance of a soil moisture probe. If a soil sample has a moisture content of approximately 20% or less, XRF will be used to analyze the sample for lead. If moisture content is greater than 20%, the sample will be dried in the field. Samples to be dried will be placed into disposable aluminum containers and warmed over a low temperature hot plate until moisture is at or below 20%. Dried samples will be placed back into clear plastic zip-top bags and analyzed for lead by XRF.

The results of this analysis will characterize the lateral extent of contamination in surface soil (0 to 6 inches bgs after the removal of surface detritus, humus, and debris). The initial DU boundary will be refined based on the distribution of XRF results for lead that exceed the *2016 MEDEP Residential Soil RAGS* (**Worksheet #15**). Should samples taken along the boundary of the initial DU (± the error of the reading) exceed the *2018 MEDEP Residential Soil RAGS* for lead, step-out samples will be taken along the same grid pattern as the DU until exceedances are no longer encountered. This may result in enlarging the DU boundaries, which will be carried forward to Step 2 – ISM Sampling. If no exceedances are found along the initial DU boundaries, the initial DUs will be used during Step 2.

If the DU is enlarged based on XRF data, field team will make a determination if it seems that soil with elevated concentrations of MC have migrated from the DU areas toward Shaw Brook. If it is determined that migration may have occurred, then eight discrete surface water and sediment samples will be collected and sent to the laboratory for analysis.

Additionally, a discrete soil sample (0-6 inches) will be collected from the location with the highest XRF lead result at each DU for potential waste characterization analysis (e.g., TCLP). If the lead concentration for ISM samples exceeds the *MEDEP Residential Soil RAGS* (140 ppm), the TCLP sample for the corresponding DU(s) will be analyzed for TCLP lead and pH only. This data will be used in alternative evaluation during the FS.

Step 2 – ISM Sampling:

Once a DU boundary is confirmed, a 30- to 50-part incremental sample will be collected in triplicate from surface soil (after removing surface detritus, humus, and debris) using ISM and analyzed for metals MC (antimony, copper, lead and zinc) by the laboratory. The location of increments within a respective DU will be determined using a systematic random approach.

Soil increments will be collected from depths of 0 to 6 inches bgs using a standard stainless steel soil probe. Each increment will be the same volume/mass and contribute to the ISM composite equally. At each DU, incremental samples will be collected in 100 percent triplicate; the number of QC samples will conform to **Worksheet #20**. Sample collection will be in accordance with Interstate Technology Regulatory Council (ITRC) guidance (ITRC, 2012) and **SOP MC-4** (**Attachment A**). All samples collected by ISM will be submitted to the laboratory for analysis as listed in **Worksheet#15**.

Because ISM requires that uniform, cylindrical samples be collected as increments, so as not to bias the IS in any way, the use of single-use disposable sampling scoops is precluded. Other methods of disposable sampling cores for ISM, such as dedicated PVC piping or acetate sleeves, result in an undesirable amount of plastic waste following sample collection and still may require additional decontamination and QC sampling. Per ITRC guidance, sampling instruments are not required to be decontaminated between increments or replicate samples within a decision unit as the media are of the same population; soil probes will be decontaminated between decision units.

During field collection, the general characteristics of soil samples will be described by qualified field personnel using the Unified Soil Classification System to qualitatively document the physical characteristics of soil. This qualitative data will be used in support of potential future remedial alternative evaluation during the FS.

In addition to investigative samples, background reference samples will be collected in 100 percent triplicate using ISM from an area not affected by historical training activities. The sampling area will be representative of undisturbed media and of an appropriate size to adequately characterize background concentrations and be comparable to investigative samples. The proposed location for background reference sample collection is outside of any range-related impacts and shown on **Figure 17-1**. The results of all ISM samples will be used in the risk assessment in the RI report.

Step 3 – Discrete Sampling:

Discrete Subsurface Sampling:

The vertical extent of MC contamination will be characterized by collecting up to 8 discrete subsurface soil samples from 12 to 18 inches bgs where select surface soil XRF readings (± the error of the reading) exceed the *2018MEDEP Residential Soil RAGS for lead*. If no exceedances are found in surface soil, subsurface sampling will not occur. Sampling locations will be determined in the field and selected to provide the best coverage and resolution of potential subsurface MC contamination. Samples will be collected using a hand auger to expose the 12 to 18 inch bgs zone; once exposed, a new disposable sampling implement will be used to collect a sample from 12 to 18 inches bgs by hand and placed into the appropriate laboratory supplied bottleware.

Subsurface samples will be analyzed by both XRF and laboratory analytical methods for metals MC. The results of the subsurface XRF analysis will be used to inform the sampling team if deeper samples are needed from 24 to 30 inches bgs to delineate the extent of contamination. Should XRF results in the 12 to 18 inches bgs sample exceed the *2018MEDEP Residential Soil RAGS* for lead, a contingent sample will be collected from 24 to 30 inches bgs using the same methods. This deeper sample will be held at the laboratory and analyzed only if the laboratory results from the sample above exceed the *2018 MEDEP Residential Soil RAGS* for lead and background concentrations. In anticipation of the end use of data (i.e., soil removal volume estimates) it is unlikely that resolution finer than 12 inches vertically within the soil profile is needed as most soil removal equipment will excavate soil in 1-foot lifts. The results of all discrete subsurface samples will be used to confirm the extent of contamination at the MRS and not used in the assessment of risk.

All soil removed will be returned to the level found and the ground surface returned to level. All non-dedicated sampling tools will be decontaminated between samples using biodegradable detergent and distilled water. The volume of water generated during decontamination procedures will be minimized by the use of spray bottles (< 1 liter per DU is anticipated). This minor volume of decontamination water will be discharged to the ground at the respective sampling location (the DU). Investigative derived waste (IDW) is not anticipated to be generated during sampling activities.

Porewater Sampling:

MC concentrations in groundwater will be analyzed using pore water sampling in the streambed of Shaw Brook. Eight discrete samples will be collected from an area of the stream that is adjacent to the DUs in the MRS. A background reference porewater sample will be collected upstream from an area unaffected by shallow groundwater coming from the MRS. The porewater sampler will be inserted into the streambed deep enough to ensure the sample collected will contain only groundwater and no surface water. Samples will be collected in accordance with the MEDEP SOP titled *Protocol for Groundwater/Surface Water Interface Sampling Using Pore Water Sampler* (**SOP MC**-7, **Attachment A**). All porewater samples will be submitted to the laboratory for analysis as listed in **Worksheet#15**. If

laboratory analysis determines that groundwater with elevated concentrations of MC is entering Shaw Brook, field staff will remobilize to the site to collect eight discrete surface water and sediment samples in Shaw Brook.

Optional Sediment Sampling:

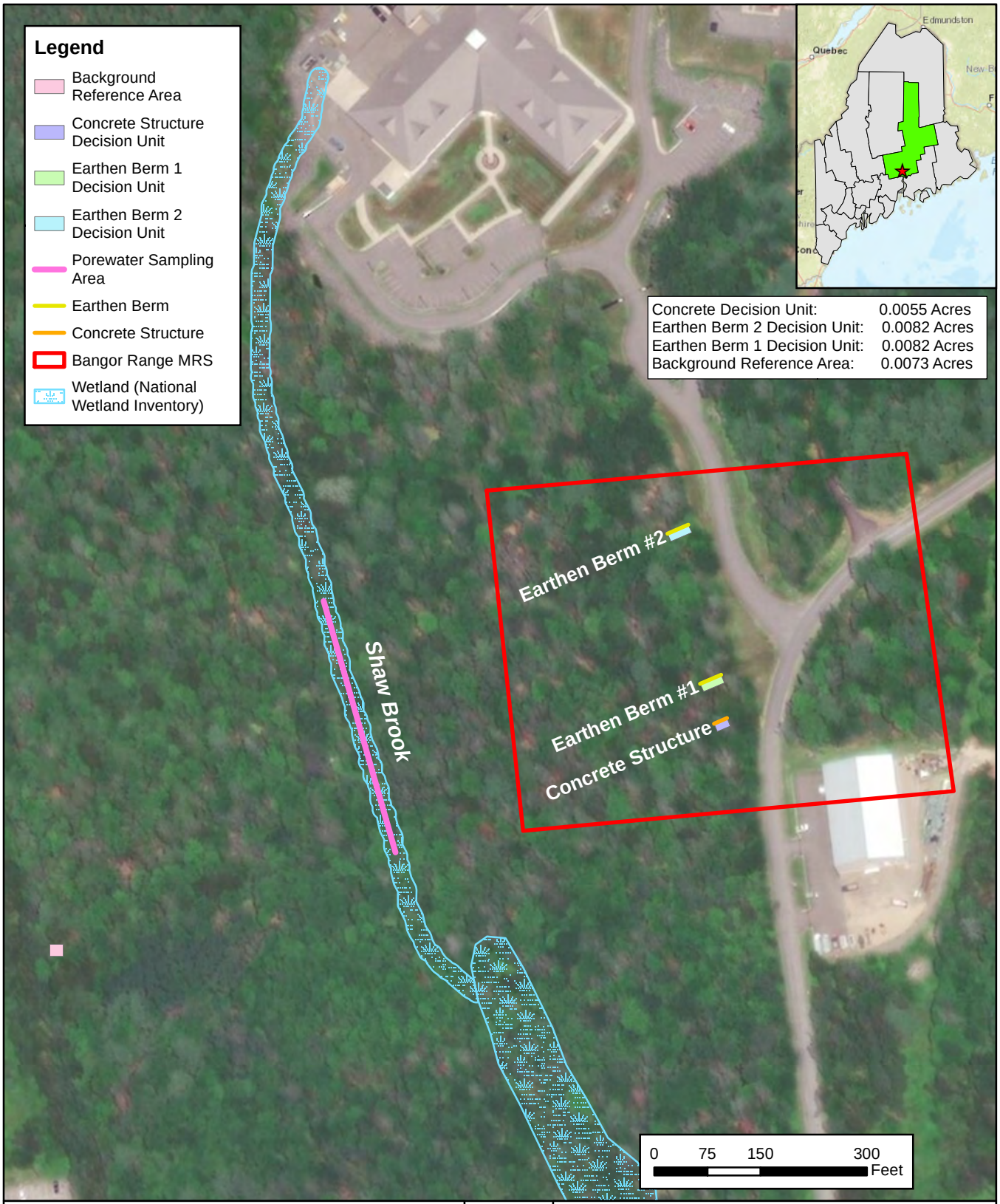
If it is determined to be necessary, eight discrete sediment samples will be collected from Shaw Brook. These samples will be collected from the area of the stream that is determined by field staff to be the likely "worst-case scenario" location for deposition of MC-elevated sediment. A background reference sediment sample will be collected from a location upstream of the MRS. Laboratory-provided bottles and necessary equipment will be present during field activities in case sediment sampling is necessary.

If sediment sampling is necessary, samples will be collected in accordance with **SOP MC-8** (**Attachment A**). The sampling method establishes equipment requirements, procedures for cleaning equipment and containers before sampling, sampling procedures, collecting equipment blank samples, duplicate requirements, and storing samples to ensure that sample contamination does not occur during collection, transport, and analysis. If collected, all sediment samples will be submitted to the laboratory for analysis as listed in **Worksheet#15.** The results will be used for risk assessment purposes.

Optional Surface Water Sampling:

If it is determined to be necessary, eight discrete surface water samples will be collected from Shaw Brook. These samples will be collected from the area of the stream that is determined by field staff to be the likely "worst-case scenario" location for migration of soil with elevated concentrations of MC entering the stream. A background reference surface water sample will be collected from a location upstream of the MRS. Laboratory-provided bottles and necessary equipment will be present during field activities in case surface water sampling is necessary.

If surface water sampling is necessary, samples will be collected in accordance with **SOP MC-9** (**Attachment A**). The sampling method establishes equipment requirements, procedures for cleaning equipment and containers before sampling, sampling procedures, collecting equipment blank samples, duplicate requirements, and storing samples to ensure that sample contamination does not occur during collection, transport, and analysis. If collected, all surface water samples will be submitted to the laboratory for analysis as listed in **Worksheet#15.** The results will be used for risk assessment purposes.



CLIENT	Army National Guard			
PROJECT	RI through DD for Bangor Range, ME MRS			
REVISION NO	0	GIS BY	MS	10/29/2018
SCALE	1:2,400	CHK BY	JW	10/29/2018
SOURCE	ARNG; State of Maine, ESRI & Partners	PM	LS	10/29/2018

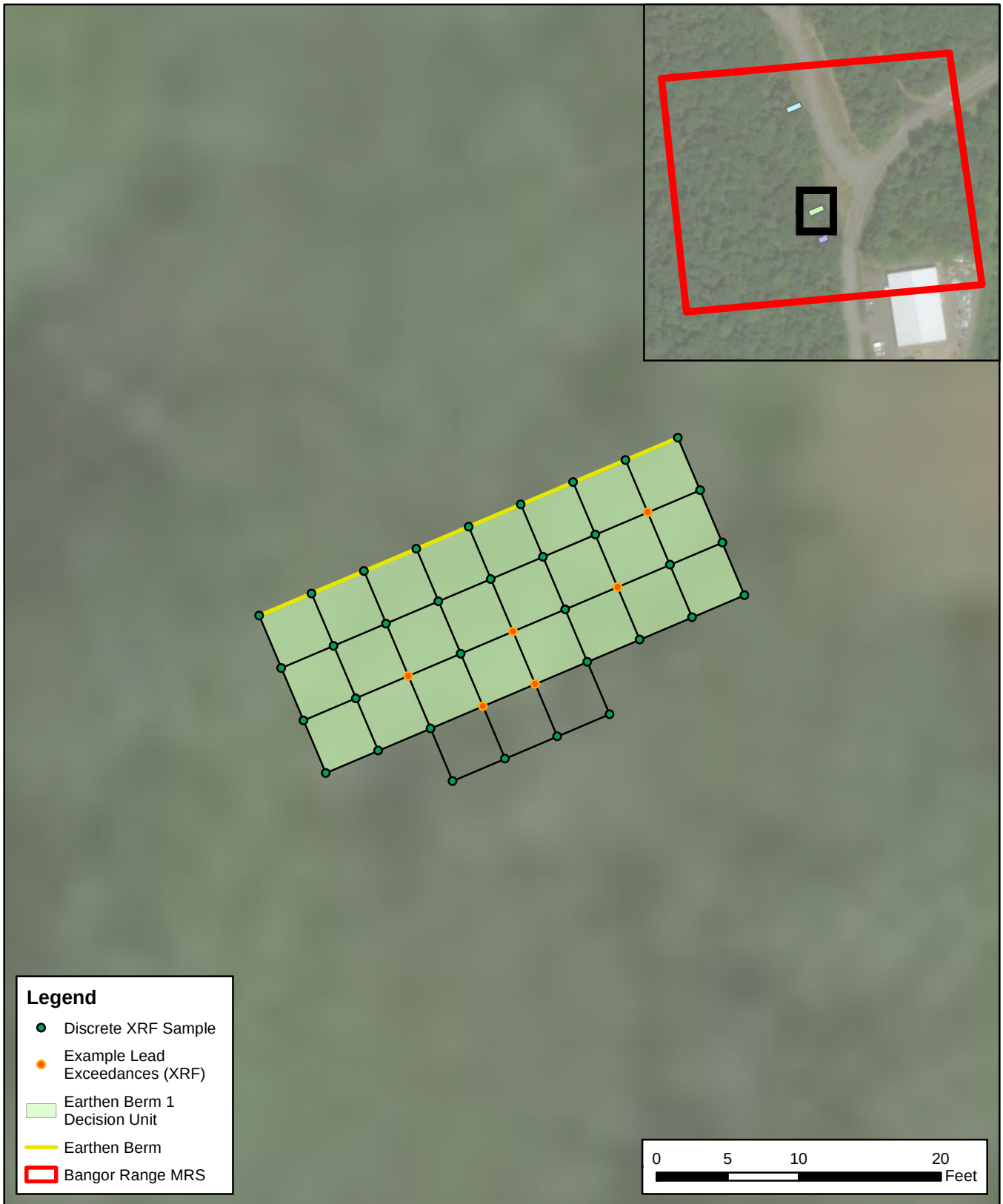
N

Bangor Range RI Approach

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 17-1

Q:\Projects\ENV\GEARS\GEO\NGB IDIQ\NDNODS 6 SARs\900-Work\GIS\Other_Sites\ME_Bangor\MXD\QAAP_Figures\Fig_17-1_Bangor_RI_Approach.mxd



CLIENT	Army National Guard			
PROJECT	RI through DD for Bangor Range, ME MRS			
REVISION NO	0	GIS BY	MS	1/11/2018
SCALE	1:120	CHK BY	JW	1/11/2018
SOURCE	ARNG; State of Maine, ESRI & Partners	PM	LS	1/11/2018

N

Earthen Berm 1 Decision Unit Sampling Plan

AECOM
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Germantown, MD 20876

Figure 17-2

Q:\Projects\ENV\GEARS\GEO\NGB IDIQ\NDNODS 6 SARs\900-Work\GIS\Other_Sites\ME_Bangor\MXD\QAAP_Figures\Fig_17-2_Earthen_Berm_1_DU.mxd

CLIENT	Army National Guard			
PROJECT	RI through DD for Bangor Range, ME MRS			
REVISION NO	0	GIS BY	MS	1/11/2018
SCALE	1:120	CHK BY	JW	1/11/2018
SOURCE	ARNG; State of Maine, ESRI & Partners	PM	LS	1/11/2018

N

Earthen Berm 2 Decision Unit Sampling Plan

AECOM
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Germantown, MD 20876

Figure 17-3

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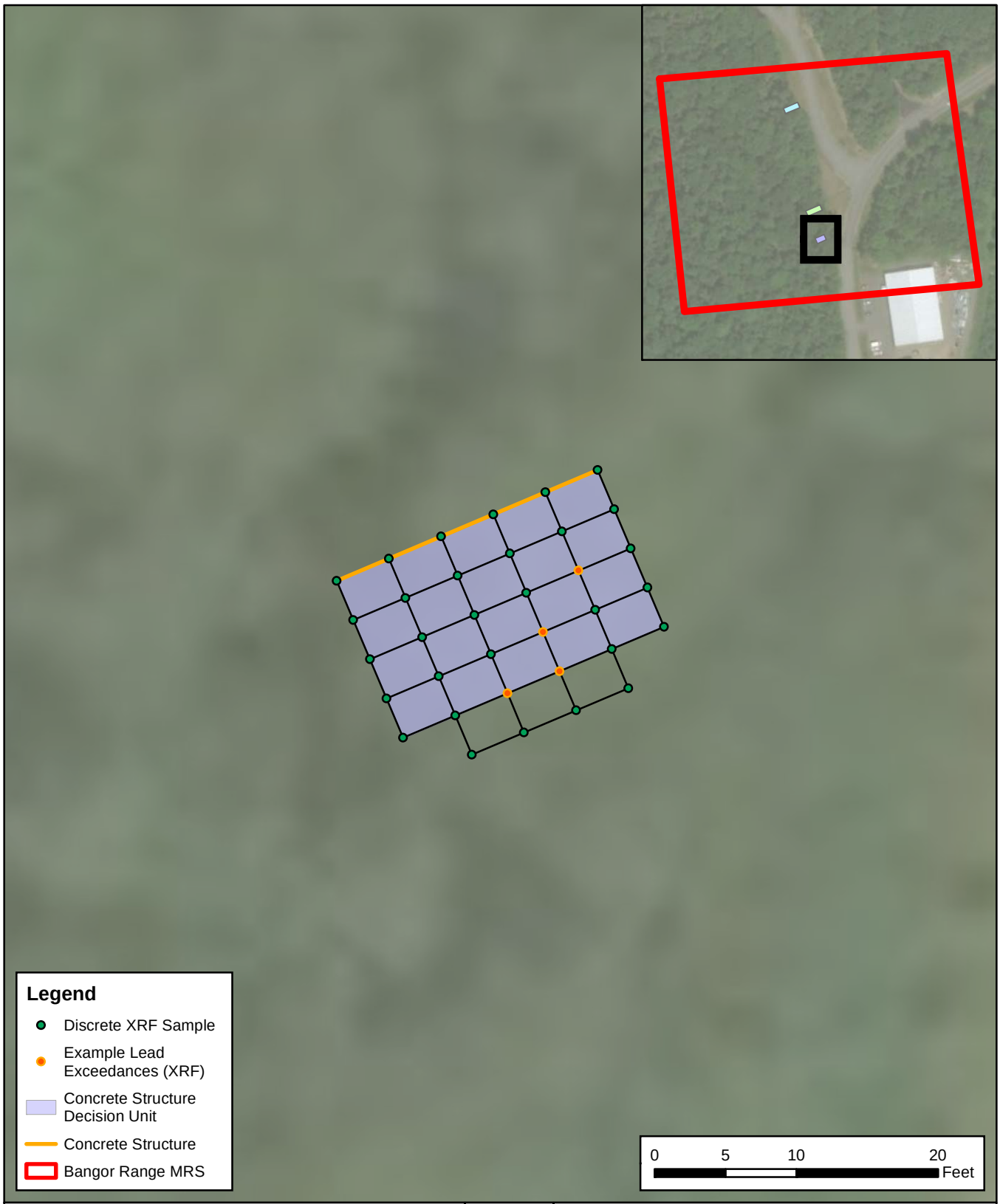

CLIENT	Army National Guard			
PROJECT	RI through DD for Bangor Range, ME MRS			
REVISION NO	0	GIS BY	MS	1/11/2018
SCALE	1:120	CHK BY	JW	1/11/2018
SOURCE	ARNG; State of Maine, ESRI & Partners	PM	LS	1/11/2018

N

Concrete Target Structure Decision Unit Sampling Plan

AECOM
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Germantown, MD 20876

Figure 17-4

Q:\Projects\ENV\GEARS\GEO\NGB IDIQ\NDNODS 6 SARs\900-Work\GIS\Other_Sites\ME_Bangor\MXD\QAAP_Figures\Fig_17-4_Concrete_Target_DU.mxd

QAPP Worksheet #18 – Sampling Locations and Methods

(UFP-QAPP Manual Sections 3.1.1 and 3.1.2; EPA 2106-G-05 Sections 2.3.1 and 2.3.2)

Sample locations will be determined in the field based on XRF results. The type of sample collected will be determined based on the rational presented in **Worksheet #17**. Samples will be analyzed for select target metals (**Worksheet #15**) and waste characterization parameters (TCLP). Sample identification codes are explained below.

Sample ID [1]	Matrix	Depth (inches bgs)	Analytical Group	Number of Samples/ Sample Type	Sampling SOP Reference	Comments
BGR01X01A	Surface soil	0-6 (after detritus, humus, and surface debris have been removed)	Lead by XRF	Discrete Earthen Berm1: approx. 36 Earthen Berm 2: approx. 36 Concrete Structure: approx. 30	Worksheet #21 SOP MC-5	None
			TCLP	Discrete: 1	Worksheet #21 SOP MC-6	
BGR01IS01	Surface soil	0-6 (after detritus, humus, and surface debris have been removed)	Target metals	Incremental in triplicate: 1 incremental sample per DU and background	Worksheet #21 SOP MC-4	None
BGR02DA01A	Subsurface soil	12-18	Target metals	Discrete: up to 8	Worksheet #21 SOP MC-6	None
BGR01DB01A	Subsurface soil	24-30	Target metals	Discrete: up to 8	Worksheet #21 SOP MC-6	Analysis contingent on 12-18 inches bgs sample results
BGR01PW01	Porewater	$\geq$ 8	Target metals	Discrete: 8 and 1 background	Worksheet #21 SOP MC-7	None
BGR01SW01	Surface water	2/3 of the stream depth up from the stream bottom	Target metals	Discrete: 8 and 1 background	Worksheet #21 SOP MC-8	Only collected if XRF or porewater samples indicate potential migration of soil or groundwater with elevated MC concentrations to Shaw Brook
BGR01SD01	Sediment	Upper 3 inches of stream bed sediments	Target metals	Discrete: 8 and 1 background	Worksheet #21 SOP MC-9	

[1] Sample identification codes are explained on the next page.

Sample Identification Codes:

Discrete Samples:

Example sample identification: BGR01X02A

BGR = *Three-character MRS identifier for the Bangor Range MRS.*

01 = *DU location*; The valid location codes are:

- 01 for the Earthen Berm 1 DU
- 02 for the Earthen Berm 2 DU
- 03 for the Concrete Structure DU

X = *One-character sampling method*: The valid sampling method code is:

- X for XRF soil sample

02 = *Sample location*; The valid sample codes are:

- 01 – 50 for each discrete sample location

A = *XRF replicate reading*; The valid XRF reading codes are:

- A – D for each of four replicate sample readings
  E for discrete TCLP sample

Incremental Soil Samples:

Example sample identification: BGR01IS01

BGR = *Three-character MRS identifier for the Bangor Range MRS.*

01 = *DU location*; The valid location codes are:

- 01 for the Earthen Berm 1 DU
- 02 for the Earthen Berm 2 DU
- 03 for the Concrete Structure DU
- 04 for the Background incremental sample

IS = *Two-character sampling method*: The valid sampling method code is:

- IS for incremental surface soil sample

02 = *Sample code*; The valid IS sample codes are:

- 00 = equipment blank
- 01 = primary sample
- 02 = duplicate sample
- 03 = triplicate sample

Discrete Subsurface Samples:

Example sample identification: BGR02DA01A

BGR = *Three-character MRS identifier for the Bangor Range MRS.*

01 = *DU location*; The valid location codes are:

- 01 for the Earthen Berm 1 DU
- 02 for the Earthen Berm 2 DU
- 03 for the Concrete Structure DU

DA = *Two-character sampling depth code*: The valid depth codes are:

- DA = 12-18 inches bgs
- DB = 24-30 inches bgs

02 = *Sample location*; The valid sample location codes are:

- 01 – 08 for each discrete sample location

A = *Discrete QC sample codes*; The valid QC codes are:

- A = primary sample
- B = duplicate sample

Discrete Porewater/Surface Water/Sediment Samples:

Example sample identification: BGR01PW/SW/SD01A

BGR = *Three-character MRS identifier for the Bangor Range MRS.*

01 = *DU location*; The valid location codes are:

- 01-08 for each for each discrete sample location

PW/SW/SD = *Two-character sampling method:*

- PW is for porewater sample
- SW is for surface water sample
- SD is for sediment sample

01 = *Sample code*; The valid IS sample codes are:

- 00 = equipment blank
- 01 = primary sample
- 02 = duplicate sample

For MS/MSD analysis, sample labels and COCs will be marked with "Use also for MS/MSD" because additional soil volume is not needed. If IDW is generated, a sample method code of IDW will be used. No dashes will be used in any sample identification codes.

QAPP Worksheets #19 & #30 – Sample Containers, Preservation, and Hold Times

(UFP-QAPP Manual Section 3.1.2.2; EPA 2106-G-05 Section 2.3.2)

Laboratory: Katahdin Analytical Services
Required Accreditations/ Certifications: ELAP/ DoD
Sample Delivery Method: FedEx

Analyte/ Analyte Group	Matrix	Method/ SOP	ELAP Expiration Date	Container(s) (number, size & type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
Metals	Discrete Soil/Sediment	EPA 6020A/ CA-604 + CA-627	02/01/2019	(1) 4 oz glass jar	≤6ºC	NA	6 months	28 Days
Metals	ISM Soil/Sediment	EPA 6020A/CA-604 + CA-627	02/01/2019	(1) Large Poly Bag	≤6ºC	NA	6 months	28 Days
Metals	Surface Water/Pore Water	EPA 6020A/ CA-604 + CA-627	02/01/2019	250 ml HDPE	HNO3 to pH <2, ≤6ºC	NA	6 months	28 Days
TCLP – Metals Reactivity Flashpoint Corrosivity	Soil	EPA 1311,6010A,7470A/ CA-510,CA-615 EPA 7.3.3.2/7.3.4.2/ CA-733, CA-734 EPA 1010A/CA-736 EPA 9045D/CA-709	02/01/2019	(1) 16 oz glass jar	≤6ºC	Metals-28 days for Hg, others 6 months Reactivity-7 days Ignitability/ Corrosivity - NA	Metals - 28 days for Hg, others 6 months Reactivity-7 days Ignitability-None Specified Corrosivity-ASAP	28 Days

QAPP Worksheet #20 – Field QC Summary

(UFP-QAPP Manual Sections 3.1.1 and 3.1.2; EPA 2106-G-05 Section 2.3.5)

The number of surface soil samples collected will be determined in the field based XRF results. QC samples (duplicates) will be collected at a rate of 10%; equipment blanks at a rate of 5%. Matrix spike and matrix spike duplicate samples will be collected at a rate of 5% or once per mobilization. Incremental samples will be collected in triplicate.

Matrix	Analyte/ Analytical Group	Field Samples	Field Duplicates/ Triplicates	Matrix Spikes	Matrix Spike Duplicates	Equipment Blanks	Total # Analyses [a]
XRF Surface Soil [b]	Lead by XRF	Earthen Berm 1: approx. 36	Each sample analyzed four times	NA	NA	NA	Earthen Berm 1: approx. 144
		Earthen Berm 2: approx. 36	Each sample analyzed four times	NA	NA	NA	Earthen Berm 2: approx. 144
		Concrete Structure: approx. 30	Each sample analyzed four times	NA	NA	NA	Concrete Structure: approx. 120
ISM Surface Soil	Metals	1 incremental sample per DU and background	Incremental: collect 100% in triplicate	5% per mobilization	5% per mobilization	5% per mobilization	≤ 10
Discrete Subsurface Soil	Metals	≤ 8 per DU	Discrete: 10% per mobilization	5% per mobilization	5% per mobilization	NA	≤ 10
Porewater	Metals	8 and 1 background	10% per mobilization	5% per mobilization	5% per mobilization	5% per mobilization	≥10
Surface water	Metals	8 and 1 background	10% per mobilization	5% per mobilization	5% per mobilization	5% per mobilization	≥10

Sediment	Metals	8 and 1 background	10% per mobilization	5% per mobilization	5% per mobilization	5% per mobilization	≥10

[a] Estimated; does not include potential step outs.

[b] XRF used for screening purposes. No additional Field QC planned.

QAPP Worksheet #21 – Field MC Sampling SOPs

(UFP-QAPP Manual Section 3.1.2; EPA 2106-G-05 Section 2.3.2)

The field survey and sampling will be conducted in accordance with AECOM SOPs provided in **Attachment A** of this UFP-QAPP.

SOP	Title, Revision, Date, and URL (if applicable)	Originating Organization	SOP Option or Equipment Type (if SOP provides different options)	Modified for Project? Y/N	Comments
MC-1	Quality Control Process	AECOM	N/A	Y	None
MC-2	Decontamination	AECOM	N/A	N	None
MC-3	Sampling, Handling, Documentation, and Tracking [a]	AECOM	N/A	N	None
MC-4	Incremental Soil Sampling	AECOM	N/A	N	None
MC-5	Field XRF Screening	AECOM	N/A	N	None
MC-6	Surface and Subsurface Sampling	AECOM	N/A	N	None
MC-7	Protocol for Groundwater/Surface Water Interface Sampling using a Pore Water Sampler	MEDEP	N/A	N	None
MC-8	Surface Water Sampling	AECOM	N/A	N	Only necessary if surface water is sampled
MC-9	Sediment Sampling	AECOM	N/A	N	Only necessary if sediment is sampled
MC-10	Protocol for Collecting Data using an Innov-X Field Portable X-Ray Fluorescence Spectrometer for Certain Metals in Solid Media	MEDEP	N/A	N	None

[a] Example Field Forms are provided in **Attachment B** of this UFP-QAPP.

QAPP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection

(UFP-QAPP Manual Section 3.1.2.4; EPA 2106-G-05 Section 2.3.6)

Soil sampling will not use field equipment requiring in-field calibration. XRF analyzers are factory calibrated. Calibration checks will be performed in the field on certified reference material.

Field Equipment	Activity	SOP Reference	Title or Position of Responsible Person	Frequency	Acceptance Criteria	Corrective Action
XRF Analyzer	Soil screening	MC-5	Field Task Leader	Minimum 2x daily	± 10% Expected concentration	Obtain replacement unit if repeated calibration check failure.

QAPP Worksheet #23 – Analytical SOPs

(UFP-QAPP Manual Section 3.2.1; EPA 2106-G-05 Section 2.3.4)

SOP	Title, Revision, Date, and URL (if applicable)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	Modified for Project? Y/N
CA-627	Trace Metals Analysis By ICP-MS Using Method 6020, 09/17, Revision 12	Definitive	Water/Metals	ICP-MS	N
		Definitive	Solid/Metals	ICP-MS	N
CA-608	Trace Metals Analysis By ICP-AES Using EPA Method 6010, 09/17, Revision 18.	Definitive	Waste/TCLP Metals	ICP-MS	N
CA-615	Digestion And Analysis Of Aqueous Samples For Mercury By USEPA Method 7470, 09/17, Revision 09	Definitive	Waste/TCLP Mercury	Mercury Analyzer	N
CA-733	Reactive Cyanide SW-846 Chapter Seven, 7.3.3.2, 07/11, Revision 6.	Definitive	Waste/ Reactive Cyanide & Sulfide	Lachet 8000 Series	N
CA-734	Reactive Sulfide SW-846 Chapter Seven, 7.3.4.2, 05/12, Revision 7.				
CA-736	Test Method for Flash Point by Pensky-Martens Closed-Cup Tester, 08/15, Revision 6. (Reviewed 03/16)	Definitive	Waste/EPA 1010A	Herzog HFP-339 Automated Pensky Marten Closed Cup FP Tester	N
CA-709	pH Concentration Measurements In Soil Matrices – SW 846 Method 9045, 08/16, Revision 11.	Definitive	Waste/EPA 9045D	Orion 720A pH Meter	N

QAPP Worksheet #24 – Analytical Instrument Calibration

(UFP-QAPP Manual Section 3.2.2; EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Range	Frequency	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for Corrective Action	SOP Reference
ICP-MS; Metals	Linear Dynamic Range (LDR) or High-level Check Standard	Every 6 months and with major maintenance	90-110% recovery	Perform maintenance and/or reanalyze at lower concentration	Analyst, Supervisor	CA-627
ICP-MS; Metals	Tuning	Daily	Resolution < 0.9 amu full at 5% peak height, mass calibration cannot drift more than 0.1 amu; RSD ≤ 10% with 5 replicates	Instrument maintenance, do not continue with calibration	Analyst, Supervisor	CA-627
ICP-MS; Metals	Initial Calibration (ICAL)	Daily ICAL prior to sample analysis.	Correlation coefficient ≥ 0.99	Recalibrate and/or perform necessary equipment maintenance	Analyst, Supervisor	CA-627
ICP-MS; Metals	Initial Calibration Verification (ICV)	Once after each ICAL	All reported analytes within ± 10% of the expected value.	Repeat initial calibration (ICAL) and reanalyze all samples analyzed since the last successful calibration verification	Analyst, Supervisor	CA-627
ICP-MS; Metals	Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence.	All reported analytes within ± 10% of the expected value.	Repeat ICAL and reanalyze all samples analyzed since the last successful calibration verification	Analyst, Supervisor	CA-627
ICP-MS; Metals	Low-level Calibration Check Standard (Low Level ICV)	Daily following calibration	80-120% recovery	Recalibrate and/or perform necessary equipment maintenance	Analyst, Supervisor	CA-627

Instrument	Calibration Range	Frequency	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for Corrective Action	SOP Reference
ICP-MS; Metals	IS	Every field sample and standard	IS intensity in the samples within 30-120% of intensity of the IS in the ICAL.	Reanalyze all samples with IS failures. If reanalysis confirms matrix interference, report sample and narrate.	Analyst, Supervisor	CA-627
ICP-MS; Metals	Initial and Continuing Calibration Blank (ICB/CCB)	Once with each ICAL after every 10 samples and at the end of an analytical sequence	Determined concentration ≤ LOD	Determine source of possible contamination, perform maintenance and recalibrate	Analyst, Supervisor	CA-627
Mercury Analyzer	Per EPA 7470A/7471B and Worksheet #28	Prior to analyzing samples per EPA 7470A/7471B	Per calibration criteria per EPA 7470A/7471B and Worksheet #28	Inspect system; correct problem; rerun calibration and affected samples.	Analyst, Supervisor	CA-615
ICP-AES; Metals	Per EPA 6010C and Worksheet #28	Prior to analyzing samples per EPA 6010C	Per calibration criteria per EPA 6010C and Worksheet #28	Inspect system; correct problem; rerun calibration and affected samples.	Analyst, Supervisor	CA-608
ICP-AES; Metals	Initial Calibration (ICAL)	Daily ICAL prior to sample analysis.	Correlation coefficient ≥ 0.99	Recalibrate and/or perform necessary equipment maintenance	Analyst, Supervisor	CA-608
ICP-AES; Metals	ICV	Once after each ICAL	All reported analytes within ± 10% of the expected value.	Repeat ICAL and reanalyze all samples analyzed since the last successful calibration verification	Analyst, Supervisor	CA-608
ICP-AES; Metals	Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence.	All reported analytes within ± 10% of the expected value.	Repeat ICAL and reanalyze all samples analyzed since the last successful calibration verification	Analyst, Supervisor	CA-608

Instrument	Calibration Range	Frequency	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for Corrective Action	SOP Reference
ICP-AES; Metals	Low Level ICV	Daily following calibration	80-120% recovery	Recalibrate and/or perform necessary equipment maintenance	Analyst, Supervisor	CA-608
ICP-AES; Metals	Initial and Continuing Calibration Blank (ICB/CCB)	Once with each ICAL after every 10 samples and at the end of an analytical sequence	Determined concentration ≤ LOD	Determine source of possible contamination, perform maintenance and recalibrate	Analyst, Supervisor	CA-608

QAPP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection

(UFP-QAPP Manual Section 3.2.3; EPA 2106-G-05 Section 2.3.6)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)	Change pump tubing, clean nebulizer, change torch, clean sample cone/skimmer cone	Metals - EPA 6020A	Monitor instrument performance via Continuing Calibration Verification (CCV) and CC Blank	As needed	No maintenance is required as long as instrument QC meets DOD criteria	Change pump tubing, change torch and window, clean filters; recalibrate and reanalyzed affected data	Analyst, Supervisor	CA-627
Mercury Analyzer	Check pump tubing, change sample tubing at least daily. Change reductant, carrier and waste tubing	Mercury – EPA 7470A, 7471B	Monitor instrument performance via CCV and CCB	As needed	No maintenance is required as long as instrument QC meets DOD criteria	Change pump tubing, recalibrate and reanalyze affected data	Analyst, Supervisor	CA-615

QAPP Worksheets #26 & #27 – Sample Handling, Custody, and Disposal

(UFP-QAPP Manual Section 3.3; EPA 2106-G-05 Section 2.3.3)

Sampling Organization: AECOM
Laboratory: Katahdin
Method of Sample Delivery (shipper/carrier): FedEx and/or courier
Number of Days from Reporting until Sample Disposal: 60 days

Activity	Organization and Title or Position of Person Responsible for the Activity	SOP Reference
Sample labeling	AECOM Field Team	MC-3
Chain of Custody (COC) form completion	AECOM Field Team	
Packaging	AECOM Field Team	
Shipping coordination	AECOM Field Team	
Sample receipt, inspection, & log-in	Katahdin Sample Custodians	SD-902, SD-903
Sample custody and storage	Katahdin Sample Custodians	
Sample disposal	Katahdin Sample Custodians	

QAPP Worksheet #28 – Analytical Quality Control and Corrective Action

(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6; EPA 2106-G-05 Section 2.3.5)

Matrix: Discrete/ISM Soil/Sediment & Aqueous
Analytical Group: Metals
Analytical Method: EPA 6020A
SOP Reference: CA-627

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Field Triplicate	1 per sample location	N/A	Use higher value in risk calculations and discuss in uncertainty analysis discussion, if warranted.	J-flag all outside control limits	RSD <30% when detects are ≥5x LOQ, or within ±4x LOQ for results <5x LOQ
Equipment Blank	1 per sampling location or equipment set	N/A	Clean equipment carefully or use disposable sampling equipment where possible.	Per data validation guidelines	No analytes detected > ½ LOQ
Linear Dynamic Range (LDR) or High-level Check Standard	Every 6 months and with major maintenance	90-110% recovery	Perform maintenance and/or reanalyze at lower concentration	Flagging is not appropriate.	Data cannot be reported above the calibration range without an established/passing high-level check standard.
Tuning	Daily	Resolution < 0.9 amu full at 5% peak height, mass calibration cannot drift more than 0.1 amu; RSD ≤ 10% with 5 replicates	Instrument maintenance, do not continue with calibration	Flagging is not appropriate.	No samples shall be analyzed without a valid tune.
Initial Calibration (ICAL)	Daily ICAL prior to sample analysis.	Correlation coefficient ≥ 0.99	Recalibrate and/or perform necessary equipment maintenance	Flagging is not appropriate.	Minimum one high standard and a calibration blank. No samples shall be analyzed until ICAL has passed.
Initial Calibration Verification (ICV)	Once after each ICAL	All reported analytes within ± 10% of the expected value.	Repeat ICAL and reanalyze all samples analyzed since the last successful calibration verification	Flagging is not appropriate.	No samples shall be analyzed until calibration has been verified with a second source.
Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence.	All reported analytes within ± 10% of the expected value.	Repeat ICAL and reanalyze all samples analyzed since the last successful calibration verification	If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Results may not be reported without a valid CCV.

Matrix: Discrete/ISM Soil/Sediment & Aqueous
Analytical Group: Metals
Analytical Method: EPA 6020A
SOP Reference: CA-627

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Low-level Calibration Check Standard (Low Level ICV)	Daily following calibration	80-120% recovery	Recalibrate and/or perform necessary equipment maintenance	Flagging is not appropriate.	No samples shall be analyzed without a valid low-level calibration check standard. Low-level calibration check standard should be less than or equal to the LOQ.
Internal Standards (IS)	Every field sample and standard	IS intensity in the samples within 30-120% of intensity of the IS in the ICAL.	Reanalyze all samples with IS failures. If reanalysis confirms matrix interference, report sample and narrate.	Flagging is not appropriate.	Samples suffering from matrix effect should be diluted until criteria are met, or an alternate IS should be selected.
Method Blank (MB)	One per preparatory batch.	No analytes detected > ½ RL or > 1/10 the amount measured in any sample	Correct problem; reanalyzed any sample associated with a blank that fails criteria, except when the sample analysis results in a non-detect.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Results may not be reported without a valid MB.
Initial and Continuing Calibration Blank (ICB/CCB)	Once with each ICAL after every 10 samples and at the end of an analytical sequence	Determined concentration ≤ LOD	Determine source of possible contamination, perform maintenance and recalibrate	Flagging is not appropriate.	Results may not be reported without a valid calibration blank. For CCB, failures due to carryover may not require an ICAL.
Interference Check Solutions (ICS) (also called Spectral Interference Checks) ICS-A and ICS-AB	Daily after ICAL	ICS-A: Absolute value of observed results ≤ LOD for non-spiked project analytes. ICS-AB: Within ± 20% of true value	Correct problem; recalibrate instrument	Flagging is not appropriate.	All analytes must be within the LDR.

Matrix: Discrete/ISM Soil/Sediment & Aqueous
Analytical Group: Metals
Analytical Method: EPA 6020A
SOP Reference: CA-627

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Laboratory Control Sample (LCS)	One per preparatory batch.	See **Worksheet #15**	Reanalyze and/or re-prep all associated samples unless recoveries are high with no detection of analytes.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Results may not be reported without a valid LCS.
Matrix Spike (MS)	One per preparatory batch per matrix	For matrix evaluation use LCS recovery acceptance criteria.	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Re-prep if sufficient	Flagging is not appropriate.	If MS results are outside the limits, the data shall be evaluated to the source of difference, i.e., matrix effect or analytical error.
Matrix Spike Duplicate (MSD) or Matrix Duplicate (MD)	One per preparatory batch.	RPD of all analytes ≤ 20%	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Re-prep if sufficient sample is available when appropriate	Flagging is not appropriate.	The data shall be evaluated to determine the source of difference.
Dilution Test	One per preparatory batch	Five-fold dilution must agree within ± 10% of the original measurement for samples with concentrations > 50 x LOQ	Perform Post Digestion Spike	Flagging is not appropriate.	Only applicable for samples with concentrations > 50 X LOQ (prior to dilution). Use along with MS/MSD or PDS data to confirm matrix effects.
Post-Digestion Spike (PDS) Addition	When dilution test fails or analyte concentration in all samples <50 x LOD	Recovery within 80-120%.	Contact the client to determine if additional measures are required	Flagging is not appropriate.	Criteria apply for samples with concentrations < 50 X LOQ prior to dilution.

Matrix: TCLP Soil
Analytical Group: Metals
Analytical Method: EPA 6010C
SOP Reference: CA-608

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Linear Dynamic Range (LDR) or High-level Check Standard	Every 6 months and with major maintenance	90-110% recovery	Perform maintenance and/or reanalyze at lower concentration	Flagging is not appropriate.	Data cannot be reported above the calibration range without an established/passing high-level check standard.
Initial Calibration (ICAL)	Daily ICAL prior to sample analysis.	Correlation coefficient ≥ 0.99	Recalibrate and/or perform necessary equipment maintenance	Flagging is not appropriate.	Minimum one high standard and a calibration blank. No samples shall be analyzed until ICAL has passed.
Initial Calibration Verification (ICV)	Once after each ICAL	All reported analytes within ± 10% of the expected value.	Repeat ICAL and reanalyze all samples analyzed since the last successful calibration verification	Flagging is not appropriate.	No samples shall be analyzed until calibration has been verified with a second source.
Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence.	All reported analytes within ± 10% of the expected value.	Repeat ICAL and reanalyze all samples analyzed since the last successful calibration verification	If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Results may not be reported without a valid CCV.
Low-level Calibration Check Standard (Low Level ICV)	Daily following calibration	80-120% recovery	Recalibrate and/or perform necessary equipment maintenance	Flagging is not appropriate.	No samples shall be analyzed without a valid low-level calibration check standard. Low-level calibration check standard should be less than or equal to the LOQ.
Method Blank (MB)	One per preparatory batch.	No analytes detected > ½ RL or > 1/10 the amount measured in any sample	Correct problem; reanalyzed any sample associated with a blank that fails criteria, except when the sample analysis results in a non-detect.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Results may not be reported without a valid MB.

Matrix: TCLP Soil
Analytical Group: Metals
Analytical Method: EPA 6010C
SOP Reference: CA-608

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Initial and Continuing Calibration Blank (ICB/CCB)	Once with each ICAL after every 10 samples and at the end of an analytical sequence	Determined concentration ≤ LOD	Determine source of possible contamination, perform maintenance and recalibrate	Flagging is not appropriate.	Results may not be reported without a valid calibration blank. For CCB, failures due to carryover may not require an ICAL.
Interference Check Solutions (ICS) (also called Spectral Interference Checks) ICS-A and ICS-AB	Daily after ICAL	ICS-A: Absolute value of observed results ≤ LOD for non-spiked project analytes. ICS-AB: Within ± 20% of true value	Correct problem; recalibrate instrument	Flagging is not appropriate.	All analytes must be within the LDR.
Laboratory Control Sample (LCS)	One per preparatory batch.	QC acceptance criteria specified by DOD QSM 5.0 Tables 5 and 6	Reanalyze and/or re-prep all associated samples unless recoveries are high with no detection of analytes.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Results may not be reported without a valid LCS.
Matrix Spike (MS)	One per preparatory batch per matrix	For matrix evaluation use LCS recovery acceptance criteria.	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Re-prep if sufficient	Flagging is not appropriate.	If MS results are outside the limits, the data shall be evaluated to the source of difference, i.e., matrix effect or analytical error.
Matrix Spike Duplicate (MSD) or Matrix Duplicate (MD)	One per preparatory batch.	RPD of all analytes **≤** 20%	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Re-prep if sufficient sample is available when appropriate	Flagging is not appropriate.	The data shall be evaluated to determine the source of difference.

Matrix: TCLP Soil
Analytical Group: Metals
Analytical Method: EPA 6010C
SOP Reference: CA-608

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Dilution Test	One per preparatory batch	Five-fold dilution must agree within ± 10% of the original measurement for samples with concentrations > 50 x LOQ	Perform Post Digestion Spike	Flagging is not appropriate.	Only applicable for samples with concentrations > 50 X LOQ (prior to dilution). Use along with MS/MSD or PDS data to confirm matrix effects.
Post-Digestion Spike (PDS) Addition	When dilution test fails or analyte concentration in all samples <50 x LOD	Recovery within 80-120%.	Contact the client to determine if additional measures are required	Flagging is not appropriate.	Criteria apply for samples with concentrations < 50 X LOQ prior to dilution.

Matrix: TCLP Soil
Analytical Group: Mercury
Analytical Method: EPA 7470A/7471B
SOP Reference: CA-615

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Method Blank (MB)	One per preparatory batch	No analytes detected >1/2 RL or 1/10th the amount in any sample	Correct problem; reanalyze any sample associated with a blank that fails criteria, except when the sample analysis resulted in non-detect	If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Results may not be reported without a valid MB.
Laboratory Control Sample (LCS)	One LCS per preparatory batch	82-119%	Reanalyze and/or re-prep all associated samples unless recoveries are high with no detection of analytes.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Results may not be reported without a valid LCS
Sample Duplicate or MSD	One per preparatory batch	RPD ≤ 20%	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Re-prep if sufficient sample is available when appropriate	Flagging is not appropriate.	The data shall be evaluated to determine the source of difference
Matrix Spike (MS)	One per preparatory batch per matrix	For matrix evaluation, use LCS recovery acceptance criteria	Evaluate the date to determine if the failed criteria are due to sample matrix or laboratory error. Re-prep if sufficient sample is available when appropriate	Flagging is not appropriate.	If the MS results are outside the limits, the data shall be evaluated to the source of difference
Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analytical batch	All analytes within ± 10% of expected value	Repeat ICAL and reanalyze all samples analyzed since the last successful calibration verification.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Results may not be reported without a valid CCV.
Initial Calibration (ICAL)	Daily ICAL prior to sample analysis	Correlation coefficient ≥0.99	Recalibrate and/or perform necessary equipment maintenance.	Flagging is not appropriate	Minimum one high standard and a calibration blank. No samples shall be analyzed until ICAL has passed.
Initial Calibration Verification (ICV)	Once after each ICAL	All analytes within ± 10% of expected value	Repeat ICAL and reanalyze all samples analyzed since the last successful calibration verification	Flagging is not appropriate	No samples shall be analyzed until calibration has been verified with a second source.

QAPP Worksheet #29 – Project Documents and Records

(UFP-QAPP Manual Section 3.5.1; EPA 2106-G-05 Section 2.2.8)

Sample Collection and Field Records:

Record	Generation	Verification	Storage location/archival
Field logbook or data collection sheets	Field Task Leader	Project Manager	Project File
Chain-of-Custody Forms	Field Task Leader	Project Manager	Project File
Air Bills	Field Task Leader	Project Manager	Project File
Contractor Daily QC Reports	Field Task Leader	Project Manager	Project File
Deviations	Field Task Leader	Project Manager	Project File
Corrective Action Reports	Field Task Leader	Project Manager	Project File
Correspondence	Field Task Leader	Project Manager	Project File

Project Assessments:

Record	Generation	Verification	Storage location/archival
Field audit checklists	Not Planned	Not Planned	Not Planned
Data verification checklists	Staff Chemist	Project Chemist	Project File
Data validation report	Staff Chemist	Project Chemist	Project File
Data usability assessment(DUA) report	Staff Chemist	Project Chemist	Project File

Laboratory Records:

Record	Generation	Verification	Storage location/archival
System Audits	NELAP/Laboratory	NELAP/Laboratory	Laboratory QA File
Performance Evaluation	NELAP/Laboratory	NELAP/Laboratory	Laboratory QA File

Laboratory Data Deliverables:

Record	Metals
Narrative	X
COC	X
Summary Results	X
QC Results	X
Chromatograms	X

QAPP Worksheets #31, #32, #33 – Assessments and Corrective Action

(UFP-QAPP Manual Sections 4.1.1 and 4.1.2; EPA 2106-G-05 Sections 2.4 and 2.5.5)

Assessments:

Assessment Type	Responsible Party & Organization	Number/Frequency	Estimated Dates	Assessment Deliverable	Deliverable due date
ELAP Accreditation	A2LA	Annually	NA	Certification	NA
Data Review	Naoum Tavantzis, AECOM	Once	Within 45 days after receipt of data	Validation Report	Within 45 days after receipt of data
External Laboratory Audit	A2LA	Bi-annually	NA	Written Audit Report	NA
Internal Laboratory Audit	Katahdin	Annually	NA	Written Audit Report	NA

Assessment Response and Corrective Action:

Assessment Type	Responsibility for responding to assessment findings	Assessment Response Documentation	Timeframe for Response	Responsibility for Implementing Corrective Action	Responsible for monitoring Corrective Action implementation
Readiness Review	Project Manager	Readiness Review Corrective Action Response	24 hours from receipt of Readiness Review Memorandum	As directed by PM	AECOM QAM
Field Sampling Technical Systems Audit (TSA)	Not Planned	Not Planned	Not Planned	Not Planned	Not Planned
On-site analytical TSA	Not Planned	Not Planned	Not Planned	Not Planned	Not Planned
PT samples	Laboratory QAM	Accreditation	Per Accrediting Authority	Laboratory Technical Director	Laboratory QAM
Management Reviews	AECOM Task Manager	QA Management Response	48 hours from receipt of QA Management Report	As assigned in QA Management Response	AECOM QAM
Field Audit	Not Planned	Not Planned	Not Planned	Not Planned	Not Planned
Laboratory Internal Audit	Laboratory Director or Manager	Corrective Action	48 hours after notification	Laboratory Director, Manager, and/or QA Manager	Laboratory QA Manager

QAPP Worksheet #34 – Data Verification and Validation Inputs

(UFP-QAPP Manual Section 5.2.1 and Table 9; EPA 2106-G-05 Section 2.5.1)

The validation will be based on a graded approach, with additional validation as necessary if problems are identified.

Item	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records			
1	Approved QAPP	X	
2	Contract	X	
3	Field SOPs	X	
4	Laboratory SOPs	X	
Field Records			
5	Field logbooks/ Daily Reports	X	X
6	Equipment calibration records (as applicable)	X	X
7	Chain-of-Custody Forms	X	X
8	Sampling diagrams/surveys	X	X
9	Relevant Correspondence	X	X
10	Change orders/deviations	X	X
11	Field audit reports (as applicable)	X	X
12	Photographs	X	X
13	Field corrective action reports	X	X
Analytical Data Package [(a)]			
14	Cover sheet (laboratory identifying information)	X	X
15	Case narrative	X	X
16	Sample receipt records	X	X
17	Sample chronology (i.e. dates and times of receipt, preparation, & analysis)	X	
18	Communication records	X	X
19	LOD/LOQ establishment and verification	X	
20	Standards Traceability	X	
21	Instrument calibration records	X	
22	Definition of laboratory qualifiers	X	X
23	Results reporting forms	X	X
24	QC sample results	X	X
25	Raw data[(b)]	X	X
26	Electronic data deliverable[(b)]	X	X

[(a)] Compiled in accordance with the applicable sections of:

- Department of Defense, 2017. *Quality Systems Manual Version 5.1.* January 2017
- MEDEP requirements: https://www.maine.gov/dep/maps-data/egad/index.html#ed

[(b)] All data, including XRF, will be submitted in MEDEP format with the Draft Final RI Report.

QAPP Worksheet #35 – Data Verification Procedures

(UFP-QAPP Manual Section 5.2.2; EPA 2106-G-05 Section 2.5.1)

Records Reviewed	Requirement Documents	Process Description	Responsible Person, Organization
Chain of custody forms and shipping forms	Chain of Custody, Shipping Documents	Chain of custody forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the chain of custody should be initialed by the reviewer, a copy of the chain of custody retained in the site file, and the original and remaining copies taped inside the cooler for shipment.	Appropriate field investigation Task Leaders for the individual media
Review of field logbooks	Field Logbooks	Review for completeness and accuracy	Appropriate field investigation Task Leaders
Field sampling TSAs	Technical System Audit Reports	Assessment of field sampling process prior to start of, or as close to the start of sampling as possible. Internal technical reviews of the sampling process are conducted prior to acceptance of the method proposed.	QA Manager or designee
Field data validation TSAs	Technical System Audit Reports	Complete review and assessment of field data. Internal technical reviews and assessments of field data are conducted concurrently with and following data collection.	QA Manager or designee
Fixed laboratory analytical data review	Laboratory Data Package	Data controls are compared to this QAPP and DoD QSM v 5.0 Attachment A in a Three Tiered process using a minimum 100% peer review.	PM or QA Manager
Fixed laboratory TSAs	Laboratory Data Package	ELAP audit and internal quality audits	QA Manager
Fixed laboratory data verification/validation	Data Validation Reports	100% data verification/validation for investigative samples and field QC.	AECOM Project Chemist
Fixed laboratory data validation TSAs	Data Validation Reports	Calculate and assess laboratory DQIs.	QA Manager, or designee

QAPP Worksheet #36 – Data Validation Procedures

(UFP-QAPP Manual Section 5.2.2; EPA 2106-G-05 Section 2.5.1)

Data Validator: AECOM

Analytical Group/Method	Inorganic Data
Data deliverable requirements	Environmental Restoration Information System (ERIS), .csv
Analytical specifications	WS #28 and Laboratory SOP
Measurement performance criteria	WS #12, WS#15, and WS#28
Percent of data packages to be validated	100%
Percent of raw data reviewed	100%
Percent of results to be recalculated	0
Validation procedure	*National Functional Guidelines for Organic/Inorganic Superfund Data Review* (2017), EPA-540-R-2017-001
Validation code	Per Guidelines
Electronic validation program/version	N/A

QAPP Worksheet #37 – Data Usability Assessment

(UFP-QAPP Manual Section 5.2.3 and Table 12; EPA 2106-G-05 Sections 2.5.2 – 2.5.4)

The Data Usability Assessment (DUA) is an evaluation at the conclusion of data collection activities that uses the results of both data verification and validation in the context of the overall project decisions or objectives. Using both quantitative and qualitative methods, the assessment will determine whether project execution and the resulting data meet project DQOs (**Worksheet #11**). Both sampling and analytical activities will be considered with the ultimate goal to assess whether the final, qualified results support the decisions to be made with the data.

The following personnel are responsible for participating in the DUA:

- AECOM Project Manager: Rosa Gwinn
- AECOM Project Chemist: Naoum Tavantzis
- AECOM Risk Assessor: Gretchen Welshofer
- AECOM Field Task Leader: Amibeth Salvatore

The DUA will be documented as a discussion within the RI report and refer to the Data Validation Report that will appear in an appendix of the RI report. The Data Validation Report will follow the specifications given in **Worksheet #36**.

The following sections summarize the processes used to determine whether the collected data are of the right type, quality, and quantity to support the environmental decision-making for the project, and describes how data quality issues will be addressed and how limitations on the use of the data will be handled.

Step 1	**Review the project's objectives and sampling design.** The key components established in the DQOs (**Worksheet #11**) will be reviewed to ensure that they are still applicable. Also, the sampling design and how it was implemented in the field will be reviewed for consistency with the stated objectives. For example, at this step the DUA will: • Reevaluate whether comparison criteria (i.e., PALs; **Worksheet #15**) were updated since UFP-QAPP generation and if laboratory quantitation limits (QLs) were sensitive enough for those changes (e.g., QLs remain lower than new criteria). Project data must meet the measurement performance criteria for sensitivity and project QLs specified in **Worksheets #15 & 28**. • Discuss the limitations and impact on the use of project data if validation reports indicate that project specific sensitivity goals or QLs were not achieved for a specific sampling or laboratory group, data set or sample delivery group (SDG), matrix, analytical group, or concentration level.
Step 2	**Review the data verification and data validation outputs** All available Quality Assurance (QA) reports, including both field and laboratory generated forms, will be reviewed for deviations from planned activities identified in Step 1 (e.g., number and locations of samples, holding time exceedances, damaged samples, non-compliant PT sample results, and SOP deviations) and determine their impacts on the data usability. Validated data will be summarized and/or compiled to identify patterns, trends, and anomalies as they related to the DQIs precision, accuracy/bias, representativeness, comparability, and completeness. Descriptions of each DQI and examples of how each may be incorporated into the usability report follows.

Step 2 (cont.)	**Precision** Precision is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is usually expressed as standard deviation, variance, percent difference, or range, in either absolute or relative terms. QC measures for precision include field duplicates, laboratory duplicates, MSDs, analytical replicates, and surrogates. To meet the needs of the data users, project data must meet the measurement performance criteria for precision specified in **Worksheet #12** of this QAPP. Precision errors may be the result of one or more of the following: field instrument variation, analytical measurement variation, poor sampling technique, sample transport problems, or spatial variation (heterogeneous sample matrices). To identify the cause of imprecision, the field sampling design rationale and sampling techniques will be evaluated by the reviewer, and both field and analytical duplicate/replicate sample results will be compared. For example, if poor precision is indicated in both the field and analytical duplicates/replicates, then the laboratory may be the source of error. If poor precision is limited to the field duplicate/replicate results, then the sampling technique, field instrument variation, sample transport, medium inhomogeneity, or spatial variability may be the source of error. If data validation reports indicate that analytical imprecision exists for a particular data set or SDG, then the impact of that imprecision on usability will be discussed in the usability report.
Step 2 (cont.)	**Accuracy/Bias** Accuracy is the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) due to sampling and analytical operations. Examples of QC measures for accuracy include Matrix Spikes, Laboratory Control Samples, and equipment blanks. A measurement is accurate when the reported value does not differ from the true value or known concentration of the spike or standard. To meet the needs of the data users, project data must meet the measurement performance criteria for accuracy/bias specified in **Worksheet #12** of this QAPP. The usability report will: • Discuss and compare data on contamination and accuracy/bias (when bias is observable) for each matrix, analytical group, and concentration level. • Describe the limitations on the use of project data if extensive contamination, inaccuracy, or bias exists or when inaccuracy is limited to a specific sampling or laboratory group, data set or SDG, matrix, analytical group, or concentration level. • Discuss the impact of any qualitative and quantitative trends in bias on the sample data.
Step 2 (cont.)	**Representativeness** Representativeness is the measure of the degree to which data accurately and precisely represent a characteristic of a population, a parameter variation at a sampling point, a process condition, or an environmental condition. It is achieved through a well-designed sampling program and by using standardized sampling strategies, techniques, and analytical procedures. To meet the needs of the data users, project data must meet the measurement performance criteria for sample representativeness specified in **Worksheet #12** of this QAPP. **Worksheet #28 & 35** discusses how the QA/QC activities (e.g., review of sampling design and SOPs, field sampling TSAs, analysis audits, etc.) and QC sample data will be reviewed to assess sample representativeness. For example, if field duplicate precision checks indicate potential spatial variability, additional scoping meetings and subsequent resampling may be needed to collect data that are more representative of a nonhomogeneous site. The usability report will: • Discuss the impact of field duplicate and triplicate imprecision on site representativeness. For example, when data variability is high among field replicate data sets (i.e., high relative standard deviation) calculation of the 95% upper confidence limit (UCL) of the population mean is more likely to overestimate the true mean of the DU and therefore achieve better statistical coverage (ITRC, 2012). • Discuss the impact of laboratory and field sampling methods on sampling results and how they reflect site conditions. • Discuss the effect of site heterogeneity on sampling results in light of sampling methods used. • Describe the limitations on the use of project data when sampling results are nonrepresentative for all data or for a specific sampling, group, data set or SDG, matrix, analytical group, or concentration level.

Step 2 (cont.)	**Comparability** Comparability is the degree to which different methods, data sets, and decisions agree or can be represented as similar. Comparability describes the confidence (expressed qualitatively or quantitatively) that two data sets can contribute to a common analysis and interpolation. The results of this study will be used as a benchmark for determining comparability for data collected during any future sampling events using the same or similar sampling and analytical SOPs. At this time, data will not be compared to other datasets or data using different sampling or analytical SOPs. To ensure future comparability of data generated for the site, standard sample collection procedures and approved analytical methods will be employed. Sample analyses will be performed by the laboratory using approved methods and procedures. Comparability criteria will be considered met for the project if, based on data reviewed, the sample collection and analytical procedures are determined to have been followed, or defined to show that variations did not affect the values reported. Deviations to sampling scope will be documented in sampling nonconformance reports which may contain some of the discussion of comparability. The usability report will describe the limitations on the use of project data when project-required data comparability is not achieved for the overall project or is limited to a specific sampling or laboratory group, data set or SDG, matrix, analytical group, or concentration level.
Step 2 (cont.)	**Completeness** Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under correct, normal circumstances. To meet the needs of the data users, project data must meet the measurement performance criteria for data completeness. Completeness criteria will be considered met if 90% of planned ISM increments are collected and 100% of all other planned sample data are collected. As applicable, the usability report may also: • Describe how the amount of valid data will be determined as a percentage of the number of valid measurements for each matrix, analytical group, and concentration level. • Describe how critical data was assessed for completeness when certain sample locations or analytes and matrices are more critical than others in making project decisions. • Evaluate the impact of missing information. Ensure that enough information was obtained for the data to be usable to meet the DQOs (**Worksheet #11**).
Step 3	**Verify the assumptions of the selected statistical method** The use of statistical methods for data assessment will likely be limited to estimating a 95% UCL (or mean as appropriate for the analyte) for the assessment of risks. ISM incorporates mechanical methods of achieving appropriate coverage of a DU. By applying an informed field program, ISM is designed to capture the true population distribution. In accordance with ITRC ISM guidance, the 95% UCL will be calculated as either the Student's-t UCL or Chebyshev UCL as appropriate for the observed data. Discretely collected data will be collected to confirm the extent of potential MC contamination at each DU. Statistical analysis will not be used on discrete data.
Step 4	**Implement the statistical method** Where statistical methods are used, the underlying assumptions will be assessed during the DUA. The consequences of selecting the incorrect alternative will be discussed and uncertainty tolerances will be considered.
Step 5	**Document data usability and draw conclusions** The DUA will determine and document whether the data can be used as intended given any deviations and corrective actions that may have occurred. Limitations on data use will be considered and discussed as appropriate and the performance of the sampling design assessed. Conclusions will be drawn taking any data limitations into consideration and documented in the RI report.

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Attachment A

AECOM Standard Operating Procedures

Field Sampling SOP MC-1
Quality Control Process

1.1 THREE-PHASE CONTROL PROCESS

The Quality Control (QC) personnel are responsible for verifying compliance with project requirements through implementation of the three-phase control process. This process ensures that project activities comply with the approved plans and procedures.

Elements of the three-phase control process are: (1) Preparatory Phase, (2) Initial Phase, and (3) Follow-Up Phase. Each control phase is important for obtaining a quality product. However, the preparatory and initial inspections are particularly valuable in preventing problems. Production work is not to be performed on a definable feature of work until a successful preparatory and initial phase inspection has been completed and documented.

1.1.1 Preparatory Phase

Preparatory phase inspections are performed prior to beginning a definable feature of work. The purpose of the inspection is to review contracts, plans, specifications, SOPs, and other applicable documents and to verify that necessary resources (i.e., equipment and personnel), conditions, and controls are in place before work starts. This inspection phase is conducted with the people responsible for performing each definable feature of work to include managers, supervisors, and applicable subcontractors ensuring all involved know what is expected and understand their role. The client is invited to attend but is not required. The PM is responsible for ensuring that:

- Appropriate plans and procedures are developed, coordinated, and approved;
- Personnel required for the activity are identified and positions filled;
- Training has been identified and completed;
- Preliminary work and coordination have been completed;
- Equipment and materials required to perform the activity have been identified and are available; and
- Reviews have been performed.

The QC personnel are responsible for assisting the PM in conducting preparatory phase inspections and verifying the following conditions:

- Appropriate plans and procedures have been developed, approved, reviewed, and are available;
- Personnel identified are available and meet the requirements/qualifications for the position or waivers have been obtained;
- Required training has been performed, documented and acknowledged; and
- Preliminary work and coordination have been completed;

Deficiencies identified during preparatory phase inspections will be documented and corrective action taken prior to beginning work. The QC personnel will verify that corrective action has been complete and is appropriate before production work begins.

1.1.2 Initial Phase

Initial phase inspections are performed when a work process begins for each crew or team performing the definable feature of work. The purpose of the inspection is to:

- verify that the work to be performed will be in compliance with procedures and contract specifications,
- verify that equipment and personnel on site meet the requirements established during the preparatory phase,
- review acceptable level of workmanship for site personnel who will be conducting the definable feature of work,
- review preparatory phase inspection report, and
- resolve any differences of interpretation.

The initial phase is the first documented QC personnel field compliance inspection for a definable feature of work. Initial phase inspections may be repeated when acceptable levels of quality are not demonstrated or at the discretion of the QC personnel.

- Equipment is on-hand, functional, in specification, and appropriate for the job;
- Required personnel resources are on site and properly qualified to perform the definable feature of work in accordance with the preparatory phase;
- Material and supplies are on-hand and meet contract specifications;
- Level of quality expected is understood by workers;
- Compliance with procedures and specifications;
- Acceptable level of workmanship is being performed;
- Corrective action taken during the preparatory phase inspection has resolved the deficiency and prevents recurrence; and
- Quality issues and any differences of interpretation by workers are resolved.; and
- Briefing on the process improvement program and FCR process has been completed.

Deficiencies identified during initial phase inspections will be documented and corrective action taken. The QC personnel will verify that corrective action has been completed and is appropriate to prevent recurrence of the condition. When corrective action cannot be completed in a timely manner or the root cause is not known, immediate corrective action that fixes the deficiency may be taken, verified, and work continued pending root cause analysis and more appropriate corrective action.

1.1.3 Follow-up Phase

Follow-up phase inspections are performed after a work process has begun and periodically throughout the work process. The purpose of the inspection is to evaluate whether the process is being completed in accordance with agreed upon standards and to evaluate whether the level of quality meets QC acceptance criteria. The QC personnel are responsible for monitoring work processes and verifying continued compliance with WP and QC criteria requirements. Follow-up phase inspections are excellent opportunities to observe work processes and identify possible process improvements.

Deficiencies identified during follow-up phase inspections will be documented and corrective action will be taken. The QC personnel will verify that corrective action has been completed and is appropriate to prevent recurrence of the condition. When corrective action cannot be completed in a timely manner or the root cause is not known, immediate corrective action that fixes the deficiency may be taken, verified, and work continued pending root cause analysis and more appropriate corrective action.

1.2 NONCONFORMANCE/CORRECTIVE ACTION

Nonconformances shall be addressed via corrective action in a manner described in this QCP section.

1.2.1 Nonconformance Identification

Circumstances that prevent a work process to control the output from conforming to the contract requirements will be promptly identified, documented, investigated, and corrected appropriately. All project personnel have the responsibility, as part of their normal work duties, to promptly identify and report conditions adverse to quality. The status of NCRs will be maintained in a log and progress of their resolutions shall be documented and reviewed to ensure prompt attention to their conclusion.

1.2.2 Resolution, Corrective Action, and Verification

The appropriate level of management is responsible for evaluating the cause of a NCR and will recommend solutions for correcting the deficiency identified. Actions and technical justifications for an action proposed to resolve the NCR shall be reviewed and approved by personnel responsible for the technical aspect of the work.

Corrective action is the specific action or actions taken to correct the immediate situation and to reduce or prevent the likelihood of future occurrences. Examples of corrective action for the immediate situation include rerunning a portion of a test/operation that was not conducted in accordance with procedures, calibrating test equipment found to be out of calibration, rework of a specific activity, and rerunning any required tests. QC personnel will be responsible for verifying implementation of corrective action, monitoring the effectiveness of preventive action, and reporting any findings to the appropriate management level.

The QC personnel shall maintain an NCR log. The NCR log will be used to track and control each nonconforming condition. At a minimum the log will contain, the date each nonconforming condition was discovered, the NCR tracking number, a brief description of the condition, the location, the department/manager responsible for disposition, the recommended disposition, the NCR closure date, and status of all nonconformance reports. The NCR log status will be maintained in the project files and available on-site.

1.2.3 Material and Equipment Nonconformance

QC personnel ensure that the following requirements are implemented:

- Materials and/or equipment that do not conform to prescribed technical and/or quality requirements are tagged or otherwise identified, documented, and reported as nonconforming. The documentation shall include the following information:
  - Identification of the technical and quality requirement(s) with which the item is not in compliance.
  - Identification of the current status of the item (i.e., whether the item is on hold or whether its use is conditional).
- Nonconforming materials and equipment are segregated, when possible, from conforming materials and/or equipment to the extent necessary to preclude their inadvertent use and commingling.
- The status of nonconforming material and/or equipment and the progress of their resolution are documented and routinely reviewed to ensure prompt attention to conclusion.

1.2.4 Deficiency Reporting

Deficiencies and nonconforming conditions are very similar and are conditions that, once identified, must be resolved or corrected prior to acceptance of an item or product. A deficiency is a condition that can be corrected quickly by standard methods during the normal course of work. A deficiency usually is not systemic in nature.

It will be the responsibility of all project personnel to identify deficiencies and notify their supervisor or manager as soon as the conditions are identified. Determination of any deficiencies must be supported with objective evidence. Deficiencies will be evaluated, resolved, or corrected and may be considered as opportunities to improve the process (**Section 1.2.7**, Lessons Learned).

1.2.5 Preventive Action

Preventive action is the specific action or actions taken to prevent or reduce the likelihood of future occurrences of nonconformance. Examples of preventive actions are clarifying or refining procedures, allowing for additional training, and/or enhancing monitoring.

Preventive action measures will be selected to prevent or reduce the likelihood of future occurrences and will address root causes to the extent identifiable. Selected measures will be appropriate in relation to the seriousness of the nonconformance and will be realistic in terms of the resources required to implement them. Preventive action measures will be communicated with affected staff, and a record of preventive action taken shall be documented as part of the NCR and maintained for project record.

1.2.6 Trend and Root Cause Analysis

1.2.6.1 *Trend Analysis*

As necessary, the PM or designee, as a part of a periodic assessment, shall perform a Project trend analysis. QC personnel shall verify the implementation of any preventive actions resulting from the trend analysis.

This management assessment shall propose and initiate measures necessary to deal with any problems requiring preventive action. When preventive action necessitates a revision to the project procedures, the PM (or designee) shall issue an administrative FCR describing the necessary change. QC personnel shall verify implementation of the preventive action.

The operations project team reviews results from the following sources and performs a trend analysis, when sufficient information and data are available to ensure that the analysis is meaningful. A trend analysis should be conducted once at least every 6 months for projects of one year or longer duration.

The trend analysis of QC and/or QA audits, subcontractor/supplier surveillance reports and nonconformance will include the following information:

- Total number of audit findings and observations, surveillance reports, and NCRs for each area of the QCP.
- A summary of the root causes for the nonconformance consolidated for each area of the QCP.
- Trends that are developing or that have developed.

1.2.6.2 *Root Cause Analysis*

The operations project team appointed by the PM shall determine root cause of a severity level 1 nonconformance. The root cause determination will depend upon project specific factors impacting the product development, product conformity or process performance. The nonconformity may be classified using an event and causal factors following the root cause analysis. The root cause analysis shall identify corrective actions to prevent recurrence. The record of the root cause analysis and corrective action taken shall be maintained on file with QC personnel as a part of the project record.

1.2.6.3 *Preventive Action*

For the period under review, the project operations team shall determine the root cause(s) of potential repetitive nonconformities and evaluate the need for action to prevent their recurrence. The project operations team shall prepare a report identifying the nonconformities for each area of the project processes/procedures, a consolidated summary of root causes of the nonconformities, and a statement of trends that are developing or have developed, and submit the report to the PM. The PM shall provide appropriate actions to prevent recurrence of the adverse trends. The Project team and QC personnel shall verify implementation of the preventive actions and report the results to the PM. The record of trend analysis and preventive action taken shall be maintained on file by QC personnel as a part of the project record.

1.2.7 Lessons Learned

During the course of field activities, data or information may be discovered that could eliminate or reduce challenges and/or offer opportunities for quality and productivity improvements through value engineering. Lessons learned are documented and communicated as soon as possible to allow access by project personnel. These lessons learned are considered valuable tools in updating plans and procedures for subsequent field activities. Lessons learned will be reviewed and distributed by the AECOM Project Quality Manager (PQM) to other applicable AECOM Project locations.

1.2.8 Field Change Request Form Process

An FCR form is to be completed for initiating changes to an approved, documented process. Any field team member assigned to perform or supervise a task that recognizes the necessity for a change in the task is responsible for initiating, completing, and submitting the FCR for review and approval of appropriate field changes. The FCR process includes review and approval of the recommended change by the Field Team Lead, PQM, Health & Safety Officer (as appropriate), PM and appropriate Client Representatives prior to process alteration in the field and incorporation into a revised work plan element. The client may ask that the FCR be reviewed by appropriate regulatory personnel if it is deemed to be a significant change to a process or overall scope of work. When an FCR is approved, changes to procedures will be reviewed with project personnel during the morning meeting/safety briefing prior to implementation. FCRs will be numbered sequentially and will be maintained in the project files on-site. FCRs will be included as an appendix to the Final Report Supplement.

FCRs should be approved or disapproved in no more than one week.

Field Sampling SOP MC-2

Decontamination

2.1 PURPOSE AND SCOPE

This document defines the SOP for decontamination. This procedure is to be used together with the UFP-QAPP and the other SOPs. Health and safety procedures and equipment for the investigation are detailed in the SSHP. Applicable SOPs are listed below:

- SOP MC-4 Incremental Sampling
- SOP MC-5 Field XRF Screening
- SOP MC-6 Surface and Subsurface Soil Sampling

Site and/or Sample Cross-Contamination

The overall objective of a multimedia sampling program is to obtain samples that accurately depict the chemical, physical, and/or biological conditions at the sampling site. Extraneous contaminants can be brought onto the sampling location and/or introduced into the medium of interest during the sampling program (e.g. using sampling equipment that is not properly or fully decontaminated). Trace quantities of contaminants can consequently be captured in a sample and lead to false positive analytical results and, ultimately, to an incorrect assessment of the contaminant conditions associated with the site. Decontamination of sampling equipment (e.g., all non-disposable equipment that will come in direct contact with samples) and field support equipment (e.g., vehicles) is, therefore, required prior to, between, and after uses to ensure that sampling cross-contamination is prevented, and that on-site contaminants are not carried off-site.

2.2 EQUIPMENT DECONTAMINATION PROCEDURES

The following sections present equipment decontamination procedures and necessary equipment.

2.2.1 Equipment List

The following is a list of equipment that may be needed to perform decontamination:

- Brushes
- Wash tubs
- Buckets
- Scrapers, flat bladed
- Hot water - high-pressure sprayer
- Sponges or paper towels
- Alconox detergent (or equivalent)
- Potable tap water
- Laboratory-grade de-ionized water
- Garden-type water sprayers
- Appropriate Health and Safety equipment (i.e., nitrile gloves, safety glasses, etc.)
- Appropriate IDW containers

2.2.2 Decontamination

This section presents the procedures for decontamination of equipment.

2.2.2.1 *Sampling Equipment*

The following steps will be used to decontaminate sampling equipment:

- Personnel will dress in suitable safety equipment to reduce personal exposure as required by the SSHP.
- Gross contamination on equipment will be scraped off at the sampling or construction site.
- Equipment that cannot be damaged by water will be placed in a wash tub containing Alconox or low-sudsing non-phosphate detergent along with potable water and scrubbed with a bristle brush or similar utensil. Equipment will be rinsed with tap water in a second wash tub followed by a de-ionized water rinse.
- Equipment that may be damaged by water will be carefully wiped clean using a sponge and detergent water and rinsed with de-ionized water. Care will be taken to prevent equipment damage.

Following decontamination, equipment will be placed in a clean area or on clean plastic sheeting to prevent contact with contaminated soil. If the equipment is not used immediately after decontamination, the equipment will be covered or wrapped in plastic sheeting, foil, or heavy-duty trash bags to minimize potential contact with contaminants.

2.2.2.2 *Equipment Leaving the Site*

Vehicles used for activities in non-contaminated areas shall be cleaned on an as-needed basis, as determined by the site safety officer, using soap and water on the outside and vacuuming the inside. On-site cleaning will be required for very dirty vehicles leaving the area.

2.2.2.3 *Decontamination Solutions*

A decontamination solution should be capable of removing, or converting to a harmless substance, the contaminant of concern without harming the object being decontaminated. The preferred solution is a mixture of detergent and water, which is a relatively safe option compared to chemical decontaminants. A solution recommended for decontaminating consists of 1 to 1.5 tablespoons of Alconox per gallon of warm water. Skin surfaces should be decontaminated by washing with hand soap and water. The decontamination solution must be changed when it no longer foams or when it becomes extremely dirty. Rinse water must be changed when it becomes discolored, begins to foam, or when the decontamination solution cannot be removed.

2.2.2.4 *Responsible Authority*

Decontamination operations at each hazardous waste site shall be supervised by the site safety officer. The site safety officer is responsible for ensuring that all personnel follow decontamination procedures and that all contaminated equipment is adequately decontaminated. The site safety officer is also responsible for maintaining the decontamination zone and managing the wastes generated from the decontamination process.

Site activities should be conducted with the general goal of preventing the contamination of people and equipment. Bagging monitoring instruments, avoiding contact with obvious contamination, and employing dust suppression methods that would reduce the probability of becoming contaminated and, therefore, reduce the need and extent of decontamination. However, some type of decontamination will always be required on site. A sample personnel decontamination set-up guideline and a sample decontamination equipment and supplies list are included in the SSHP.

The Occupational Safety and Health Administration (OSHA) require that proper PPE must be worn when operating steam or pressure washing equipment. A rain suit, boots, hard hat, and a face shield are recommended to be worn. All personnel must be kept out of the path of steam or water spray.

2.2.2.5 *Wastewater*

Liquid wastewater from decontamination may be containerized, labeled, and stored for later disposal as required by project specific requirements. Liquid wastewater from decontamination may be discharged to ground on a project specific basis following acceptance from the project team and stakeholders.

2.2.3 Emergency Decontamination

Hazardous waste facilities should also have in place emergency decontamination procedures, in order to prevent the loss of life or severe injury to site personnel. In the case of threat to life, decontamination should be delayed until the victim is stabilized; however, decontamination should always be performed first, when practical, if it can be done without interfering with essential lifesaving techniques or first aid, or if a worker has been contaminated with an extremely toxic or corrosive material that could cause severe injury or loss of life. During an emergency, provisions must also be made for protecting medical personnel and disposing of contaminated clothing or equipment.

2.2.4 Documentation

Sampling personnel will be responsible for documenting the decontamination of sampling and drilling equipment. The documentation will be recorded with waterproof ink in the sampler's field notebook with consecutively numbered pages. The information entered in the field book concerning decontamination should include the following:

- Decontamination personnel
- Date and start and end times
- Decontamination observations
- Weather conditions
- IDW handling

Field Sampling SOP MC-3

Sampling, Handling, Documentation, and Tracking

3.1 PURPOSE

This document defines the SOP for sample handling, documentation, and tracking. This procedure is intended to be used together with the UFP-QAPP and other SOPs. Health and safety procedures and equipment for the investigation are detailed in the APP/SSHP. Applicable SOPs are listed below:

- SOP MC-4 Incremental Sampling
- SOP MC-5 Field XRF Screening
- SOP MC-6 Surface and Subsurface Soil Sampling

3.2 SAMPLE IDENTIFICATION

Samples collected during site activities will have discrete sample identification numbers. These numbers are necessary to identify and track each of the many samples collected for analysis during the life of this project. In addition, the sample identification numbers will be used in the database to identify and retrieve the analytical results received from the laboratory.

Each sample is identified by a unique code that indicates the site name, sample matrix/method, sample location, sample unit, and sequential sample number (for duplicate, triplicate, and equipment blanks). Sample identification codes are found in UFP-QAPP Worksheet #18.

The sampling locations, sample type, and sample sequence identifiers are established prior to field activities for each sample to be collected. On-site personnel will obtain assistance in defining any special sampling requirements from the Project Manager.

3.3 SAMPLE LABELING

Sample labels are filled out as completely as possible by a designated member of the sampling team prior to beginning field sampling activities each day. All sample labels are filled out using waterproof ink. At a minimum, each label will contain the following information:

- Sampler's company affiliation
- Site location
- Sample identification code (i.e., FPIS01)
- Date and time of sample collection
- Analyses required
- Method of preservation (if any) used
- Sample matrix (i.e., soil)
- Sampler's signature or initials

3.4 SAMPLE HANDLING

This section discusses proper sample containers, preservatives, and handling and shipping procedures. The UFP-QAPP summarizes the information contained in this section and also includes the sample holding times for each analyte.

3.4.1 Sample Containers

Certified, commercially clean sample containers are obtained from the contract analytical lab. The contract laboratory will label the bottles to indicate the type of sample to be collected. Required preservatives are prepared and placed in the bottles at the laboratory prior to shipment to the site. Appropriate sample containers for the specific analyses required are listed in the UFP-QAPP.

3.4.2 Sample Preservation

Sample preservation efforts will commence at the time of sample collection and will continue until analyses are performed. Samples will be stored on ice at 4°C in coolers immediately following collection. The ice will be double bagged in plastic storage bags. Additional sample preservation requirements are listed in the UFP-QAPP. Chemical preservatives, if necessary, will be added to the sample containers by the laboratory prior to shipment to the field, unless otherwise specified in the UFP-QAPP.

3.4.3 Sample Handling and Shipping

The sample containers are wiped clean of all sample residue and then wrapped in protective packing material (bubble wrap) and taped. Samples will then be placed right side up in a cooler and surrounded with ice (double bagged using plastic bags). Additional protective packing material is used around the upright samples as necessary. A temperature blank provided by the contract laboratory are placed in each sample cooler shipped.

A COC form will accompany each cooler. The COC is put in a plastic bag and attached to the inside lid of the cooler. The cooler lid is taped closed with a custody seal for delivery to the laboratory. Once the cooler has been packed and the COC has been secured inside the cooler, the cooler is sealed on both ends using several wraps of reinforced strapping tape. The tape should be applied from the back of the cooler and over the top of the cooler to pull the front of the cooler lid down. The wraps of strapping tape should cover the hinges of the cooler lid.

Once the strapping tape has been applied, two signed and dated custody seals will be place on two corners of the cooler. One custody seal will be placed on top of the strapping tape on one end of the cooler across the seam of the cooler and the cooler lid, on the front of the cooler. The other custody seal will be placed on top of the strapping tape across the seam between the cooler and cooler lid on the other end of the cooler, on the back of the cooler. The custody seals will be covered with one complete wrap of clear tape.

All water drain valves on the sample coolers will be sealed using duct tape to prevent leakage of any fluids from the cooler during shipment. Samples will be hand delivered or shipped by

overnight express carrier for delivery to the analytical laboratory. All samples must be shipped for laboratory receipt and analyses within specific holding times. This may require daily shipment of samples with short holding times. The temperature of all coolers will be measured upon receipt at the laboratory.

3.4.4 Holding Times and Analyses

The holding time is specified as the maximum allowable time between sample collection and analysis and/or extraction, based on the analyte of interest and stability factors, and preservative (if any) used. Allowable holding times are listed in the UFP-QAPP. Chemical constituents that will be analyzed and other parameters to be measured during field investigations are identified in the UFP-QAPP.

3.5 SAMPLE DOCUMENTATION AND TRACKING

This section describes documentation required in the field notes, on the SCFSs, on the daily quality control reports (DQCRs), and on the sample COC forms.

3.5.1 Field Notes

Documentation of observations and data acquired in the field will provide information on the acquisition of samples and also provide a permanent record of field activities. The observations and data will be recorded using pens with permanent waterproof ink in a permanently bound weatherproof field log book containing consecutively numbered pages.

The information in the field log book will include the following as a minimum:

- Project name
- Location of sample
- Sampler's printed name and signature
- Date and time of sample collection
- Sample identification code
- Description of samples (matrix sampled)
- Sample depth (if applicable)
- Number and volume of samples
- Sampling methods or reference to the appropriate SOP
- Sample handling, including filtration and preservation, as appropriate for separate sample aliquots
- Analytes of interest
- Field observations
- Results of any field measurements, such as depth to water, pH, temperature, and conductivity
- Personnel present
- Level of PPE used during sampling

Changes or deletions in the field book should be lined out with a single strike mark, initialed, and remain legible. Sufficient information should be recorded to allow the sampling event to be reconstructed without relying on the sampler's memory.

Each page in the field books will be signed by the person making the entry at the end of the day, as well as on the bottom of each page. Anyone making entries in another person's field book will sign and date those entries.

3.5.2 Sample Collection Field Sheets (SCFS)

An SCFS for soil will be completed at each sampling location. The data sheet will be completely filled in. If items on the sheet do not apply to a specific location, the item will be labeled as not applicable or not required. The information on the data sheet includes the following:

- Sample location number
- Date and time of sampling
- Person performing sampling
- Type of sample
- Number of samples taken
- Sample identification number
- Preservation of samples
- Record of any QC samples from site
- Any irregularities or problems which may have a bearing on sampling quality

3.5.3 Daily Quality Control Report

Each sampling crew will also maintain DQCRs to supplement the information recorded in the field logbook. DQCRs will be maintained by members of the field sampling team and cross-checked for completeness at the end of each day by the sampling team members and/or Field Manager. They will be signed and dated by individuals making entries and initials by the reviewer upon completion. Copies of the DQCR will be forwarded to the Quality Assurance Officer for review. The DQCR will include the following information:

- Project name
- Project number
- Personnel on site
- Visitor on site
- Subcontractors on site
- Equipment on site
- Weather conditions
- Field work performed
- Quality control and health and safety activities
- Problem, down time, and standby time
- Name and title of person completing the DQCR

3.5.4 Sample Chain of Custody

During field sampling activities, traceability of the sample must be maintained from the time that the samples are collected until laboratory data are issued. Initial information concerning collection of the samples will be recorded in the field log book as described above. Information on the custody, transfer, handling, and shipping of samples will be recorded on a COC form. The COC is a three-part carbonless form.

The sampler will be responsible for initiating and filling out the COC form. The sampler will sign the COC when the sampler relinquishes the samples to anyone else. One COC form will be completed for each cooler of samples collected daily. The COC will contain the following information:

- Sampler's signature and affiliation
- Project number
- Date and time of collection
- Sample identification number
- Sample type
- Analyses requested
- Number of containers
- Signature of persons relinquishing custody, dates, and times
- Signature of persons accepting custody, dates, and times
- Method of shipment
- Shipping air bill number (if appropriate)

The person responsible for delivery of the samples to the laboratory will sign the COC form, retain the last copy of the three-part COC form, document the method of shipment, and send the original and the second copy of the COC form with the samples. Upon receipt at the laboratory, the person receiving the samples will sign the COC form and return the second copy to the Project Manager. Copies of the COC forms documenting custody changes and all custody documentation will be received and kept in the central files. The original COC forms will remain with the samples until final disposition of the samples by the laboratory. The analytical laboratory will dispose of the samples in an appropriate manner 60 to 90 days after data reporting. After sample disposal, a copy of the original COC will be sent to the Project Manager by the analytical laboratory to be incorporated into the central files.

Field Sampling SOP MC-4

Incremental Soil Sampling

For incremental composite sampling, multiple grab samples are collected over an area of interest or a decision unit (DU) and composited into a single large volume sample. Samples are collected randomly over the DU and these sample increments are composited to obtain an approximately 1 kilogram (kg) sample. The benefit of incremental sampling is that it yields a better estimate of an average concentration of analyzed parameters than would mathematical averaging of discrete samples. A limitation is that it does not provide location-specific concentrations that might be used for determining volume of soil in a remedial action such as excavation or treatment.

This SOP provides descriptions of equipment, field procedures, and QA/QC procedures to be implemented for using IS to collect samples. Specific sample locations will be determined in the field and frequency of collection is presented in the UFP-QAPP. The procedures in this SOP are to be used with the UFP-QAPP and other appropriate SOPs. Applicable SOPs referenced by this SOP are listed below:

- SOP MC-3 Sample Handling, Documentation, and Tracking
- SOP MC-6 Surface and Subsurface Soil Sampling
- SOP MC-2 Decontamination

4.1 INCREMENTAL SAMPLING DESCRIPTION

The following sections detail the equipment needed and the procedures to be followed to implement IS.

4.2 EQUIPMENT LIST

The following general list of equipment will be needed to collect IS soil samples:

- Volumetric soil sampler (i.e., soil probe, hand auger, or 5-gram Terra Core®)
- Magnetic locator (if required)
- Surveyor's flags
- Tape rule marked in 0.01-foot increments
- Field books/field log sheets
- Stainless-steel knives and bowls
- 1-gallon zip sealing bags
- Sample bottle labels
- Label tape (clear)
- Paper towels
- Camera
- Waterproof and permanent marking pens
- Grease pencil or paint pen
- Plastic sheeting
- Nitrile gloves (several boxes, appropriate sizes)
- Handheld GPS

- Handheld pushbutton counter
- Location data and/or figure for sample areas
- Plastic trash bags
- Appropriate health and safety equipment, as specified in the SSHP
- Appropriate decontamination supplies, as specified in SOP MC-2
- Cooler with ice

4.3 DECONTAMINATION

Before any sampling begins, the sampling equipment will be decontaminated according to the procedures contained in SOP MC-2. Sampling equipment will be decontaminated between sampling activities for different Decision Units (DU), but decontamination of sampling equipment will not be required between collecting soil increments within one DU or Sampling Unit (SU).

4.4 INCREMENTAL SAMPLING PROCEDURES

IS will be completed using a systematic-random sampling approach. The DU boundary is typically determined by considering the investigative objectives, soil type, and analytes of concern. The illustrations depict the typical DU configuration for a small-arms range (**Figure 4-1**). If more detail is required a DU can be further subdivided into SUs (**Figure 4-2**).

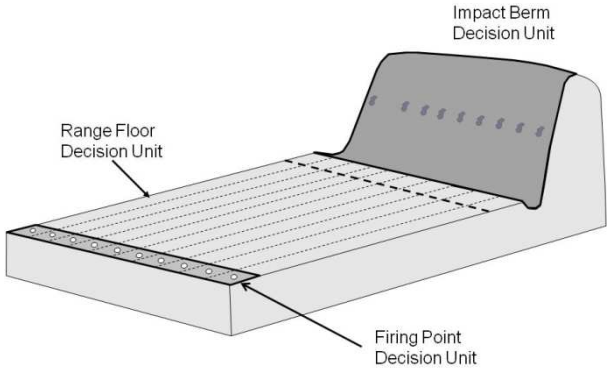

Figure 4-1
Typical DU

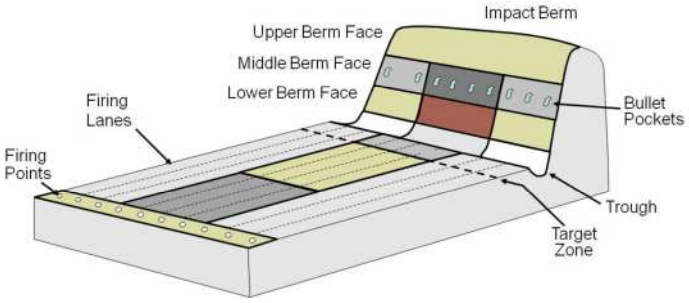

Figure 4-2
DU Subdivided into SUs

The first step will be to mark the boundaries of the DU(s) or SU(s). After the boundaries have been marked, soil samples consistent with systematic-random sampling design IS protocol (**Figure 4-3**) will be collected by a soil sampling person accompanied by a MEC avoidance technician. The MEC avoidance technician will use a magnetic locator to assist with identifying potential MEC at sampling locations. After each sampling location has been cleared, a soil aliquot will be collected. Sampling locations will be adjusted if anomalies are detected. This process will be repeated until all aliquots within a DU/SU have been collected.

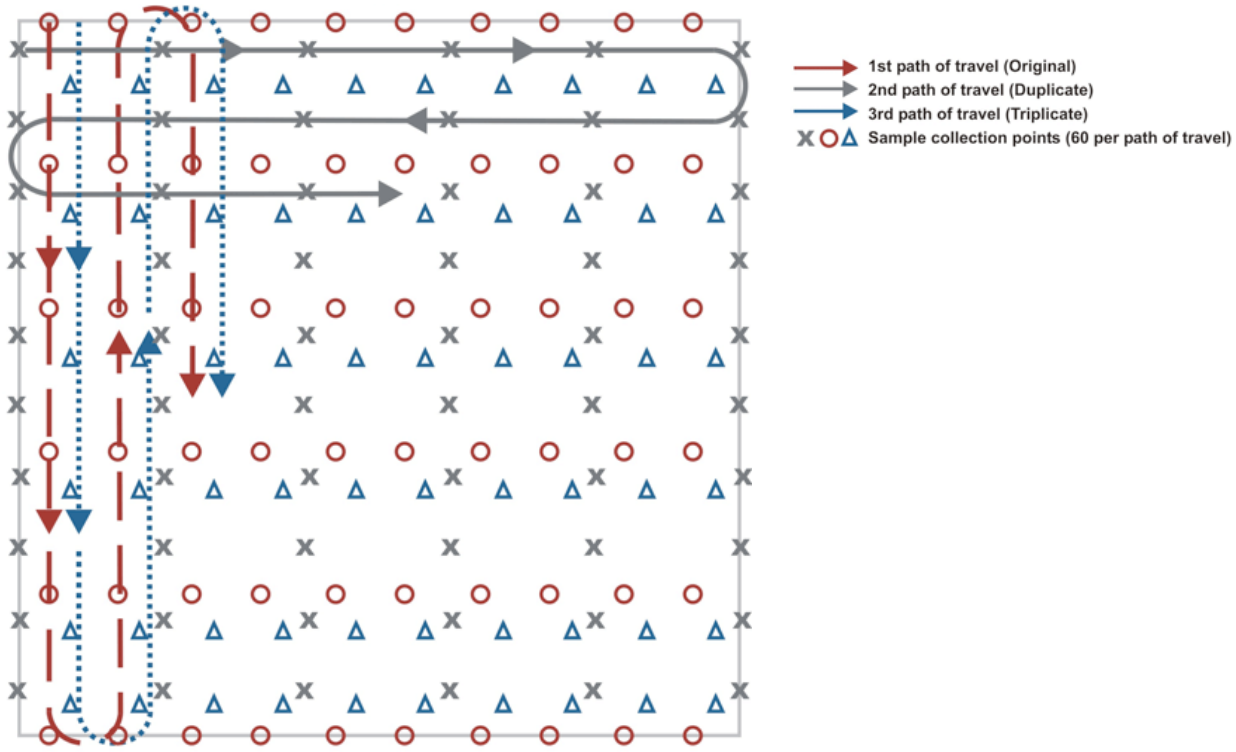

Figure 4-3
Systematic-Random Sampling Design
(ITRC, 2012)

4.4.1 Marking of DUs/SUs and Sampling Locations

The boundaries of each DU/SU will be marked prior to sampling. The boundaries will be marked in such a way that field personnel will not collect any samples outside the DU/SU boundaries. The following procedures will be used by the field crews to locate and mark the DU/SUs in the field:

1. The list of geo-referenced corner coordinates of the DU/SU will be provided to the field crew.
2. The field crew will locate the corners of the DU/SU at a given AOC/site by using a global position system (GPS) with sub-meter accuracy.
3. Once located in the field, the DU/SU corners will be marked by placing a surveyor's flag into the ground. The DU/SU corners will be clearly marked on the flags with a grease pencil or paint pen to denote the site name and DU/SU.
4. Once the DU/SU corners are flagged, colored twine or cord will be stretched between corners to visibly mark DU/SU boundaries. This will ensure the soil aliquots are collected within the boundary.

5. Once the boundaries of a DU/SU have been marked, a soil sampler (accompanied by a MEC avoidance technician) will choose, access, and collect soil samples from the sampling locations.

4.4.2 Sample Collection

For the planned IS as part of this RI, stainless steel hand tools (either an auger or soil probe) will be used. Incremental samples will be collected from the 0 to 0.5-foot interval using the following procedure:

1. The MEC avoidance technician will clear each sampling location immediately prior to sampling and will offset the sample location as necessary to avoid any metallic anomalies Collect the aliquot using a soil probe or hand auger.
2. Using a 5-gram sampler, collect 5 grams of soil from the 0.5 foot interval. Add sample to bag. Increments shall be collected with the same sampling device in order to target a fixed volume per increment and achieve the desired sample mass
3. Label the sample containers and place on ice, complete the COC, and pack the cooler(s) for shipment.

4.4.3 Sample Processing and Analysis

All collected IS soil samples will be processed by the laboratory following similar methods to those described in Appendix A of EPA Method 8330B. A copy of the contract analytical laboratories SOP for IS sample processing under Method 8330B is contained in the UFP-QAPP. Required analyses for each collected IS sample are specified in the UFP-QAPP.

4.4.4 Field QA/QC Procedures and Samples

Duplicate and triplicate samples will be collected as specified in the UFP-QAPP to evaluate IS sampling variability in a similar manner as the primary sample. The duplicate and triplicate samples will require the same number of aliquots as the primary sample. Appropriate sample volumes will be collected for laboratory MS/MSD analysis on identified primary samples (**Section 4.4.4.1** below). Equipment blank samples will also be collected from decontaminated non-disposable sampling equipment. No other IS QA/QC samples are planned for the RI.

4.4.4.1 *Matrix Spike and Matrix Spike Duplicates (MS/MSD)*

MS/MSD are used to assess the potential for matrix effects. Samples will be designated for MS/MSD analysis on the chain of custody form and on the bottles. For IS sampling, the laboratory will use soil from the processed IS samples for the MS/MSD.

4.4.5 Sample Identification, Handling, and Documentation

Samples will be identified, handled, and recorded as described in this SOP and SOP MC-3. The parameters for analysis and preservation are specified in tables contained in the UFP-QAPP.

4.4.6 Documentation

Each field activity must be properly documented to facilitate a timely and accurate reconstruction of events in the field (see SOP MC-3). A SCFS will be completed for each IS soil sample submitted for chemical analysis.

4.4.6.1 *Field Logbook*

The most important aspect of documentation is thorough, organized, and accurate record keeping. All information pertinent to the investigation and not documented on the boring log will be recorded in a bound logbook with consecutively numbered pages. All entries in logbooks will be made in waterproof ink and corrections will consist of line-out deletions that are initialed and dated. Entries in the logbook will include the following, as applicable:

- Project name and number
- Sampler's name
- Date and time of sample collection
- SU grid layout, quadrant sampling locations, and increment collection locations and depths
- Sample number, location, and depth
- Sampling method
- Observations at the sampling site
- Unusual conditions
- Information concerning drilling decisions
- Decontamination observations
- Weather conditions
- Names and addresses of field contacts
- Names and responsibilities of field crew members
- Names and titles of any site visitors
- Location, description, and log of photographs (if taken)
- References for all maps and photographs
- Information concerning sampling changes, scheduling modifications, and change orders
- A detailed description of IS sampling activities including increment and grid information
- Summary of daily tasks and documentation on any scope of work changes required by field conditions
- Signature and date by personnel responsible for observations

Field investigation situations vary widely. No general rules can include each type of information that must be entered in a logbook for a particular site. A site-specific logging procedure will be developed to include sufficient information so that the sampling activity can be reconstructed without relying on the memory of field personnel. The logbooks will be kept in the field team member's possession or in a secure place during the investigation. Following the investigation, the logbooks will become a part of the project file.

4.4.7 Sample Collection Field Sheets (SCFS)

An SCFS will be completed at each SU. The data sheet will be completely filled in. If items on the sheet do not apply to a specific location, the item will be labeled as not applicable or not required. Sheets will not be completed for each aliquot, just for the final composite sample. The information on the data sheet includes the following:

- Sample location number
- Date and time of sampling
- Person(s) completing sampling
- Type of sample
- Number of samples taken
- Sample identification number
- Preservation of samples
- Record of any QC samples from site
- Any irregularities or problems which may have a bearing on sampling quality

4.5 REFERENCES

Interstate Technology Regulatory Council (ITRC). 2012. *Incremental Sampling Methodology.* Technical and Regulatory Guidance. February.

United States Army Corps of Engineers. 2009. Implementation of Incremental Sampling (IS) of Soil for the Military Munitions Response Program. Environmental and Munitions Response Center of Expertise. Interim Guidance 09-02.

United States Army Corps of Engineers. 2013. Incremental Sampling Methodology (ISM) Implementation of Incremental Sampling (IS) for Metallic Residues. Engineer Research Development Center, ERDC TR-13-5. August.

Field Sampling SOP MC-5

Field X-ray Fluorescence Screening

5.1 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for the operation of a field x-ray fluorescence (XRF) instrument for measuring metals concentrations in soil.

5.2 MATERIAL

a. Work Plan
b. Personal protective equipment (PPE)
c. Field logbook
d. XRF Instrument & Manual
e. Clear plastic bags or clear 8 ounce glass jars
f. Standard reference materials (SRM)

5.3 CALIBRATION

1. Prepare standard samples by filling XRF sample cups with SRMs and covering with Mylar (or similar) plastic sheeting. SRMs should span both below and above the expected range of sample concentration.
2. Check the XRF equipment factory calibration by analyzing each SRM. Each SRM reading should be within 10% of the certified value for the analytes of concern. Retain or copy supplier's calibration document in project file.
3. Calibration checks will occur before and after sampling and at least once every 4 hours of operation. All calibration checks will be documented in the field logbook.
4. SRMs will also be analyzed by reading concentrations through the same plastic bags being used for sampling. Document to show that reading through the plastic bag shows no analytical bias or interference.

5.4 FIELD OPERATIONS

1. Fill a 1-gallon plastic bag ½ to ¾ full or an 8 oz. glass jar completely full with the soil sample using hand auger, trowel, or by hand.
2. Thoroughly mix contents of sample bag being sure to break up aggregates of soil and discarding material >2mm in diameter. If necessary, run sample through 60-mesh sieve to segregate and remove all large grains or use a rubber mallet to disaggregate sample within bag.
3. Per XRF instrument manufacturers specifications, ensure the sample collection time is set between 15 and 30 seconds per reading.
4. During XRF use, when the radiation shutter is open:
   - do not place hands, feet, or other body parts in the radiation field;
   - do not measure samples on a table or raised surface, radiation can travel through non-metal surfaces to objects/body parts below;
   - do not look into the beam path;
   - do not point the XRF at anyone;
     - do not hold the XRF from the front.

5. Collect, at minimum, 4 readings per sample by shooting XRF analyzer through the clear plastic bag. Ensure neither the sample or instrument moves during sample collection duration. The 4 reading locations should be randomly chosen to gather data representative of the entire sample.
6. The sample reading (metal concentration) and internal standard deviation (error) will be recorded for each reading and sample in the field logbook.
7. Co-located duplicate readings will be taken once every 10 samples.
8. After all XRF analyses, the soil samples will be returned to their initial field sampling locations.
9. Plastic sample bags will not be reused for multiple samples and will be disposed of as municipal waste.

5.5 PRECAUTIONS

- If the sample taken has a moisture content >20%, the XRF readings may lose accuracy as the moisture within the sample can interfere with the incoming or outgoing x-rays. It is highly recommended that the sample be dried before collecting readings. Drying can occur in a warm ambient air environment or by heating with a toaster or conventional oven.
- The XRF instrument has a radioactive source and when in operation actively emits high energy x-rays. The instrument should always be used per the manufacturer's recommendations. Never point the instrument at another person or anything other than the sample in question during operation
- Radiation monitoring equipment should be used when handling or operating the XRF instrument. Radiation monitors or badges should be worn by all working with or near the instrument with the understanding that the maximum permissible whole-body dose of occupational exposure is 5 Roentgen Equivalent Man (REMs) per year.

5.6 SAFETY

The U.S. Department of Agriculture's (USDA) Office of Homeland Security & Emergency Coordination Radiation Safety Division has guidelines for the use and possession of portable X-ray fluorescence analyzers (XFAs). In addition to following the all recommendations for use outlined in the manufacturer's user manual, field personnel will conform to the following as specified by the USDA (USDA, 2017):

All servicing or cleaning of an XFA involving exposure of the radioactive sources must be performed by the manufacturer or by an authorized representative of the manufacturer. Before removing the XFA from its place of storage, make sure it is locked in the transport case. When transporting the XFA in a vehicle, block and brace it to prevent shifting or movement, and lock the XRA in the vehicle when it is unoccupied. When the indicator light is flashing, and the shutter is open, the primary x-ray beam is on and radiation is being emitted from the front of the XFA.

After completing each measurement, immediately close the radiation shutter. Always maintain the XFA under constant view and immediate control when it is not in storage. At job sites, do not walk away from the XFA when it is left on the ground. When the XFA is not in use at a temporary job site, it must be securely locked in the operator's vehicle (or other appropriate locked storage location). Return the XFA to its proper locked storage location at the end of the work shift.

5.7 REFERENCES

EPA Method 6200 – Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment

U.S. Department of Agriculture, Office of Homeland Security & Emergency Coordination Radiation Safety Division. Portable X-Ray Fluorescence Analyzer https://www.dm.usda.gov/ohsec/rsd/xfa.htm. Accessed January 2017.

Olympus Delta™ Family: Handheld XRF Analyzers (model DS2000) User Manual (shipped with equipment from supplier; see attachment for table of contents)

Attachment A

Olympus Delta™ Family: Handheld XRF Analyzers User Manual Table of Contents

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Field Sampling SOP MC-6
Surface and Subsurface Sampling

6.1 PURPOSE AND SCOPE

This document defines the SOP for collecting surface soil samples. This SOP provides descriptions of equipment, field procedures, and QA/QC procedures implemented for the collection of surface soil samples. Specific sample locations and frequency of collection are presented in the UFP-QAPP. This procedure is intended to be used together with the UFP-QAPP and other SOPs. Health and safety procedures and equipment for the investigation are detailed in the SSHP. Applicable SOPs are listed below:

- SOP MC-3 – Sample Handling, Documentation, and Tracking
- SOP MC-2 – Decontamination

6.1.1 Reference Standards

Wherever an ASTM designation is cited in this document, it shall mean the American Society for Testing and Materials Standard Specification of that designation appearing in the "1994 Annual Book of ASTM Standards," published by the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania. "EM 1110-2-1906" refers to United States Department of the Army, "Engineering and Design, Laboratory Soil Testing," 30 December 1970.

6.2 PROCEDURES FOR SOIL SAMPLING

Surface soil samples will be collected using stainless-steel hand utensils or, for drilling rig borings, a stainless-steel split-spoon sampler. Surface soil samples will be collected from 0 to 0.5 feet below ground surface (bgs).

6.2.1 Equipment List

The following list of equipment will be needed to collect surface soil samples:

Equipment for Surface Soil Sampling with Hand Utensils

- Stainless-steel spoon or trowel
- Surveyor's stakes and flags
- Ruler marked in 0.1-foot increments
- Field books/field sheets
- Stainless-steel knife, bowl
- Sample bottles provided by the laboratory
- Sample bottle labels
- Label tape (clear)
- Paper towels
- Camera and film
- Waterproof and permanent marking pens
- Plastic sheeting

- Plastic bags
- Appropriate health and safety equipment, as specified in the SSHP
- Appropriate decontamination supplies, as specified in SOP MC-2
- Ice chest with ice

6.2.2 Decontamination

Before drilling or sampling begins, the drilling and sampling equipment will be decontaminated according to the procedures contained in SOP MC-2. Drilling and sampling equipment will be decontaminated between boring and sampling locations. Sampling equipment will also be decontaminated between collections of samples from different depths at the same location.

6.2.3 Surface Soil Sampling Procedures

This method of soil sample collection is to be used in situations where the bedrock is shallow, or other conditions will not permit the use of auger or drilling methods. The following procedure should be used to collect shallow soil sampling using hand utensils:

- Decontaminate sampling equipment according to SOP MC-2.
- Record the sample location on a site map and in the field logbook.
- Don a clean pair of nitrile gloves.
- Clear and remove vegetation and any surface debris such as rocks, as necessary.
- Using a decontaminated spoon or trowel, remove soil from a 1 square foot area until the specified sampling depth is reached. Removed soil should be placed on plastic sheeting.
- Collect the soil for the analytical parameters from the specified depth using a decontaminated stainless-steel sampling spoon. If more soil is necessary to fill the remaining sample jars, the area is to be expanded without increasing the depth.
- Composite the soil by thoroughly mixing the soil from the sampling point in a decontaminated stainless-steel bowl with the sampling spoon. Fill the jar for the specified analysis. The required analyses and appropriate containers are listed in the UFP-QAPP.
- Label, store and document sample according to SOP MC-3.
- Record applicable information on the Sample Collection Field Sheet.
- Identify the location for future reference using surveying stakes and flags.

6.2.4 Subsurface Soil Sampling Procedures (Direct Push)

Direct push samples will be collected using a dual tube sampling system. The outer rods in this system remain in the ground while the inner rod and sample liner are extracted to retrieve a soil sample from the desired interval. Soil samples may be collected continuously throughout the depth of the direct push boring or from discrete intervals. The direct push rods will be

decontaminated between boring locations, but not between samples at the same boring since a new acetate liner is used for each sample.

At each sampling location, the assembled inner and outer rods will be advanced by a combination of hydraulic down pressure and percussion hammering. After the target depth is reached, the inner rod will be withdrawn and the liner filled with the soil sample will be retrieved.

The following procedures will be followed after the soil sample has been retrieved:

- Don a clean pair of nitrile gloves

- Cut the acetate liner along the length of the sample and measure the recovery. Record the sampling interval and recovery on the drilling log.

- Determine and identify the size of the recovered sample. This will be for soil classification and stratigraphic logging and may be used for chemical analysis.

- Examine the soil sample and record the soil description on the drilling log in accordance with the Unified Soil Classification System (USCS).

- Homogenize an approximate 1-foot interval of the soil sample by thoroughly mixing it in a stainless-steel bowl. Use the homogenized soil to fill the appropriate sample containers. Record the sample interval and analysis requested on the Drilling Log.

- Label, store, transport, and document the samples according SOP MC-3.

- Complete photographic documentation.

- If no other samples will be collected from the boring, abandon the boring by backfilling the hole with hydrated granular bentonite. Pour the granular bentonite down the hole in approximate 1-foot to 2-foot lifts, and then pour approximately ½ gallon of potable water down the hole to hydrate the bentonite. Continue this from the bottom of the hole to the ground surface.

6.2.5 Subsurface Soil Sampling Procedures (Hand Auger)

Soil collected using a hand auger will be collected at 6-inch depth intervals using a stainless-steel hand auger. Procedures are listed below:

- Decontaminate the hand auger and other sampling equipment according to SOP MC-2.

- Don a clean pair of nitrile gloves.

- Using a decontaminated hand auger handle and bucket, advance a borehole to the specified sampling depth. Place the recovered soil on plastic sheeting.

- Record the sample interval, soil description (USCS), and required analysis on the Drilling Log.

- Fill the sample containers with the soil sample from the appropriate depth interval.

- If no other samples will be collected from the boring, abandon the boring by backfilling the hole with hydrated granular bentonite. Pour the granular bentonite down the hole in approximate 1-foot to 2-foot lifts, and then pour approximately ½ gallon of potable water down the hole to hydrate the bentonite. Continue this from the bottom of the hole to the ground surface.

6.2.6 Field Quality Assurance/Quality Control Procedures and Samples

Field Quality Assurance/Quality Control samples are designed to help identify potential sources of external sample contamination and to evaluate potential error introduced by sample collection and handling. All QA/QC samples are labeled with QA/QC identification numbers and sent to the laboratory with the other samples for analyses.

6.2.6.1 *Duplicate Samples*

Duplicate samples are samples collected to assess precision of sampling and analysis. For the soil sampling, a duplicate sample will be collected at the same time as the initial sample. The initial sample containers for a particular parameter or set of parameters will be filled first, then the duplicate sample bottles for the same parameter(s), and so on until all necessary sample bottles for both the initial sample and the duplicate sample have been filled. The duplicate soil sample will be handled in the same manner as the primary sample. The duplicate sample will be assigned a QA/QC identification number, stored in an iced cooler, and shipped to the laboratory on the day it is collected. Duplicate samples will be collected for all parameters. The soil will be divided evenly and then homogenized separately. Duplicate samples will be blind to the laboratory.

6.2.6.2 *Matrix Spikes and Matrix Spike Duplicates*

Matrix spikes (MS) and matrix spike duplicates (MSD) are used to assess the potential for matrix effects. Samples will be designated for MS/MSD analysis on the chain of custody form and on the bottles. It may be necessary to increase the sample volume for samples where this designation is to be made.

6.2.7 Sample Identification, Handling, and Documentation

Samples will be identified, handled and recorded as described in this SOP and SOP MC-3. The parameters for analysis and preservation will be specified in the UFP-QAPP.

6.2.8 Documentation

Each field activity must be properly documented to facilitate a timely and accurate reconstruction of events in the field (see SOP MC-3). Sample Collection Field Sheets will be completed for all soil samples submitted for chemical analysis.

6.2.8.1 *Field Logbook*

The most important aspect of documentation is thorough, organized, and accurate record keeping. All information pertinent to the investigation and not documented on the boring log will be recorded in a bound logbook with consecutively numbered pages. All entries in logbooks will be made in waterproof ink and corrections will consist of line-out deletions that are initialed and dated. Entries in the logbook will include the following, as applicable:

- Project name and number
- Sampler's name
- Date and time of sample collection
- Sample number, location, and depth
- Sampling method
- Observations at the sampling site
- Unusual conditions
- Information concerning drilling decisions
- Decontamination observations
- Weather conditions
- Names and addresses of field contacts
- Names and responsibilities of field crew members
- Names and titles of any site visitors
- Location, description, and log of photographs (if taken)
- References for all maps and photographs
- Information concerning sampling changes, scheduling modifications, and change orders
- Summary of daily tasks (including costs) and documentation on any cost or scope of work changes required by field conditions
- Signature and date by personnel responsible for observations

Field investigation situations vary widely. No general rules can include each type of information that must be entered in a logbook for a particular site. A site-specific logging procedure will be developed to include sufficient information so that the sampling activity can be reconstructed without relying on the memory of field personnel. The logbooks will be kept in the field team

member's possession or in a secure place during the investigation. Following the investigation, the logbooks will become a part of the final project file.

COVER SHEET
STANDARD OPERATING PROCEDURE

OPERATION TITLE: **PROTOCOL FOR GROUNDWATER/SURFACE WATER INTERFACE SAMPLING USING A PORE WATER SAMPLER**

ORIGINATOR NAME: **Brian Beneski**
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Division of Remediation

APPROVALS:

Division of Remediation Director:

David Wright — *Print name*
David Wright — *Signature*
12/1/2016 — *Date*

Bureau of Remediation and Waste Management Director:

David Burns — *Print name*
David Burns — *Signature*
12/4/16 — *Date*

QMSC Chair:

Bill Longfellow — *Print name*
Bill Longfellow — *Signature*
12/30/16 — *Date*

Department Commissioner:

Paul Mercer — *Print name*
[signature] — *Signature*
1-3-2017 — *Date*

DISTRIBUTION;

( ) Division of Remediation.....By:_____Date:_____

1.0 APPLICABILITY

This Standard Operating Procedure (SOP) applies to all programs in the Maine Department of Environmental Protection's (MEDEP) Division of Remediation (DR). It is also applicable to all parties that may submit data that will be used by the DEP/DR.

This SOP is not a rule and is not intended to have the force of law, nor does it create or affect any legal rights of any individual, all of which are determined by applicable statutes and law. This SOP does not supersede statutes or rules.

2.0 PURPOSE

The purpose of this document is to describe the MEDEP/DR standard operating procedure (SOP) for collecting groundwater samples using a pore water sampler.

3.0 RESPONSIBILITIES

All MEDEP/DR Staff must follow this procedure when performing this task. All Managers and Supervisors are responsible for ensuring that their staff are familiar with and adhere to this procedure. MEDEP/DR staff reviewing data by outside parties are responsible for assuring that the procedure (or an equivalent) was utilized appropriately.

4.0 GUIDANCE AND PROCEDURES

4.1 INTRODUCTION

It is often difficult to determine the extent and origin of contamination using solely surface water sampling techniques. In some cases, a surface water body may be clean but the groundwater beneath it may be contaminated. Thus, sampling the groundwater prior to its discharge to a surface water body may lead to a better understanding of the extent and origin of contamination. This can be accomplished by using a pore water sampler.

Underlying this procedure is the assumption that surface water bodies are common discharge points for groundwater. Thus, a sample of the water beneath a stream or riverbed would be characteristic of the groundwater in the area. This SOP identifies sampling protocols to be followed when collecting samples using a pore water sampler.

4.2 PLANNING

A well developed conceptual site model (CSM) is imperative for effective pore water sampling. Prior to conducting any sampling event, a sampling plan should be developed (see SOP# RWM-DR-014 - Development of a Sampling and Analysis Plan). Included in the sampling plan should be specifics regarding the anticipated substances of concern, data quality objectives, the laboratory conducting analysis and Quality Assurance/Quality Control (QA/QC).

4.3 EQUIPMENT

The following is a list of equipment utilized for collecting groundwater samples using the pore water sampler method.

- Peristaltic Pump
- Tubing – Two types of tubing are needed for this sampling technique. Low Density Polyethylene (LDPE) tubing with an inside diameter (ID) of 0.17-inch or 0.25-inch is the standard size tubing used with pore water samplers. Note that the 0.25-inch ID tubing fits over the top opening of the pore water sampler. Using 0.17-inch ID tubing requires a small piece of 3/8-inch outer diameter (OD) silicone tubing to connect with the pore water sampler. The same silicone tubing must be used with a peristaltic pump to collect a pore water sample.
- A knife or other tool to cut tubing to desired lengths will be required.
- Field Parameter Instruments – devices for measuring dissolved oxygen (DO), conductivity and pH of pore water and surface water.
- Turbidity Meter – If testing for dissolved metals turbidity must be measured to determine whether the sample must be field-filtered prior sample collection.
- Sample Filters – 0.2 to 0.45 micron (µm) in-line filters are appropriate for dissolved metals.
- Power Supply – A power supply will be necessary to operate the peristaltic pump.
- GPS Unit – To record geospatial locations of pore water samples.
- Life Preservers – when working around or near waters.
- Hip Waders – This sampling method will likely require the sampler to wade into stream or river in order to insert pore water sampler in a suitable location.
- Boat – Depending on the depth and size of a water body, a boat may be required to access sample points. Even if sample points are accessible by wading, boats and canoes can also act as equipment barges to help transport equipment between sample locations.
- Pore Water Samplers – A pore water sampler comes in two parts, a strengthening rod and the pore water sampler itself, both made of stainless steel. The pore water sampler is basically a hollow tube with narrow slits at the tip that allow groundwater to percolate through. The strengthening rod slides into the pore water sampler, and while in place, blocks all water from entering pore water sampler. Both pieces are placed in a PVC

sheath for protection. Although the pore water sampler is fairly sturdy, exercise caution during use, as once either piece becomes bent, the equipment is useless. Bring at least as many pore water samplers as there are sampling locations, as onsite decontamination is difficult and not recommended. Once pore water samplers have been used **do not** re-insert the strengthening rod until after the sampler has been decontaminated and cleared of sediment.

- Permanent Pore Water Samplers – A pore water sampler modified for long-term deployment. This may be necessary for silty and/or organic rich sediments where low turbidity samples are required and traditional pore water samplers will not meet the DQOs for the site.

- Sample Collection Containers – These will be provided by the lab, and will vary depending on parameters to be sampled.

4.4 PORE WATER SAMPLER PROCEDURES

4.4.1 MOBILIZATION/ RECONNAISSANCE

Prior to sampling, suitable access points to pore water sampling locations should be identified and reviewed to assure safe sampling. Surface water body flow data should be consulted prior to sampling if available, and pore water sampling should not be conducted during a flood stage. Stream flow information for some sites within the State of Maine can be found at the following USGS website:

http://me.water.usgs.gov/

4.4.2 SAMPLING PROCEDURE

Upon arriving at the site, collect field parameter measurements from the surface water body or bodies that are either being recharged by or recharging site groundwater. This will provide some comparative data to field parameter measurements of pore water samples.

Once an appropriate sampling location has been determined, carefully insert a pore water sampler into the river/streambed to desired depth. Do not remove the strengthening rod until the sampler has been securely placed into the sediment. The pore water sampler should be inserted deep enough as to ensure the sample collected will contain only groundwater and no surface water. Typically, this depth is at least 8 inches. Once this has been accomplished, remove the strengthening rod from the pore water sampler and connect the pore water sampler to a peristaltic pump using appropriate tubing described in Section 6.0 of this SOP. Turn the pump on and purge for several minutes until purge water is relatively clear. Record field parameter measurements of the purge water prior to collecting the sample. If the purge water is not visually free of sediment, it should be documented in field notes (see MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of A Trip Report).

If sampling for metals, it is recommended that turbidity be measured. If turbidity is above 20 NTUs, it is recommended that an additional sample be collected that has been filtered through a 0.2-0.45 μm inline particulate filter.

After water has been sufficiently purged, decrease pumping rate if necessary (e.g., to fill 40ml VOA vials) and begin collecting sample. Pumping rate should be low enough to ensure that surface water is not drawn into the sample. A low flow purging and sampling protocol is not required, but if desired, refer to MEDEP/DR SOP# RWM-DR-003 - Groundwater Sampling Using Low Flow Purging and Sampling for Long-term Monitoring. In general, coarse sediments (sands) are the most transmissive; with experience, samplers can actually "feel" the type of sediment as the pore water sampler is advanced. If the formation intercepted by the sampler screen is not transmissive enough for collection of sample, gently advance and/or pull back the sampler in an attempt to find a more transmissive zone. If the formation does not allow adequate transmission of water, it may require a change in sampling location. This change is made at the discretion of the sampler and should be documented in the field notes (see MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of a Trip Report).

Neither the tubing nor the pore water sampler should be reused at subsequent sampling locations without appropriate decontamination. Do not put the strengthening rod back into a pore water sampler after the sample has been collected, as sediment in the sampler must be flushed out first. Rather, place both pieces separately into the plastic sheath.

If pore water sampling is to be repeated, use of permanent pore water samplers should be considered. Repeatable sampling points should be marked with a grade stake or similar method of marking a location. Additionally, all points should be located and identified with GPS.

4.5 DECONTAMINATION

Decontamination procedures generally follow MEDEP/DR SOP# RWM-DR-017 – Equipment Decontamination Protocol. Additionally, it should be noted that in the course of sampling, sediment will build up in sampler that must be carefully flushed out. For this reason, it is best if decontamination is conducted with a large amount of water available for continuous flushing. If possible, bring as many pore water samplers as there are sampling locations, as onsite decontamination can be difficult.

5.0 QUALITY ASSURANCE/QUALITY CONTROL

Data quality objectives should be stated in the sampling plan. Quality Assurance/Quality Control (QA/QC) samples may be collected if needed to meet your data quality objectives. The following typical types of QA/QC samples may be collected as part of the QA/QC program for porewater sample collection.

5.1 EQUIPMENT BLANKS

If unable to used dedicated equipment, equipment blanks may be collected at a rate of 5%, one equipment blank every twenty samples collected.

5.2 DUPLICATE SAMPLES

It is recommended that duplicate samples be collected at a rate of 5% to assess sample location variability.

5.3 BACKGROUND SAMPLES

Background samples should be collected as part of the pore water evaluation. Background sample requirements should be outlined in the SAP.

5.4 TRIP BLANKS

Trip blanks are recommended when collecting samples for volatile organic compound analysis (e.g. EPA 8260).

7.0 DOCUMENTATION

Documentation is one of the most important aspects of any sampling event. Documentation should be completed with the idea that someone not present during the actual event may need to repeat the event exactly as it was conducted originally. During the sampling event or immediately upon the completion of the event, diagram a map of the area and locate sampling points (and corresponding sample container numbers) on the map. Be sure to also record observational data concerning the groundwater such as the approximate depth of the screen when the sample was collected, detection of odor or contamination, color and turbidity. The sampler should record in the field book any and all information that is pertinent to the sample. All deviations from the procedures in the Site SAP and/or outlined in this or in any other SOP followed for groundwater sampling using a pore water sampler must be documented in field notes. Refer to the MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of A Trip Report. It is very important that all information regarding a sampling event (or any events/activities) be accurately recorded. Record all information obtained while sampling such as sample numbers, measurements taken, observations made and other comments. A trip report package should also be completed for the event, as outlined in MEDEP/DR SOP# RWM-DR-013.

When checking in samples at the laboratory for analysis, a Chain of Custody (COC) form must be completed. Refer to MEDEP/DR SOP# RWM-DR-012 – Chain of Custody Protocol for requirements for COC protocol.

8.0 HEALTH AND SAFETY

As part of the overall work plan at a hazardous substance site, a site specific health and safety plan (HASP) must be developed and adhered to by all personnel working at the site. Refer to MEDEP/DR SOP# RWM-DR-014 – Development of a Sampling and Analysis Plan.

All personnel must understand that if a sample cannot be obtained safely, the sample should not be taken at all. If a sample cannot be obtained due to safety considerations it should be documented in the sampler's field book.

All personnel should be aware of the potential dangers associated with this particular sampling method. These dangers include, but are not limited to, strong water currents, slippery substrate, roots or sharp objects beneath the water's surface that may cause a fall or other personal injury. If sampling in water that is greater than three feet deep, or when otherwise working where drowning may be a hazard, all DEP personnel are required to wear life jackets (see SOP No. LW-WRR-001-, Use, selection, and maintenance of Personal Floatation Devices and Anti-Exposure Clothing. All necessary precautionary measures should be heeded when performing this sampling technique.

9.0 REFERENCES

USEPA SOP #EH-03, Sediment Pore Water Sampling using a Micro Push Point, September 2003.

USEPA SESDPROC-513-R2, Pore Water Sampling, February 2013.

S-8 SURFACE WATER GRAB SAMPLING STANDARD OPERATING PROCEDURE

1.0 Scope and Application

The purpose of this standard operating procedure is to delineate protocols for sampling surface water. This procedure can be applied to the collection of surface water samples from streams, rivers, ditches, lakes, ponds and lagoons. Surface water samples provide an indication of the amount of contaminant in the surface water. It is therefore important to collect a representative sample.

2.0 Material

a. Field logbook
b. Sample bottles
c. Personal protective equipment (PPE)
d. Nitrile gloves
e. Stainless steel or polytetrafluoroethylene (PTFE)-lined bucket
f. Peristaltic pump
g. 0.45µM disposable filters
h. Disposable peristaltic pump tubing
i. Filter funnel (if using gravity filtration)
j. Cooler with ice
k. Zip ties, stakes and/or other anchoring systems
l. Water quality meter (Horiba Water Quality Checker or equivalent)
m. Hand held global positioning system (GPS) (Trimble GeoXT, equivalent or better)
n. Numbered stake(s) and/or survey flag(s)
o. Camera
p. Additional Grab Equipment (if necessary)
    a. Long-handled dip sampler (PTFE or stainless steel)
    b. Short-handled dip sampler (PTFE or stainless steel)

3.0 Procedure

a. For all surface water samples, mark the sampling locations on a site map. Collect the GPS location and record the coordinates in the field logbook. Photograph and describe each location, and place a numbered stake above the visible high water mark on the bank closest to the sampling location, and/or mark adjacent trees with surveyor's flagging. The photographs and descriptions must be adequate to allow the sampling station to be relocated at some future date by someone other than the original sampling crew. Use the long handled dip sampler where access is poor or non-contact with water is suggested in the site safety and health plan.
b. Sampling should be performed deliberately and methodically to minimize disturbance of bottom sediments, yet as quickly as possible to ensure a representative sample. To prevent contamination of the exterior of the sample container, and/or potential contamination of the surface water sample by laboratory contaminants on the exterior of the bottle, the sample container should never be dipped into the water, rather a decontaminated, long-handled or measuring cup-type PTFE or stainless steel sampler, collection tubing, or a sampling bucket

should be used to collect samples.

c. Put on the appropriate PPE before sampling (refer to the site safety and health plan).
d. Collect general water quality parameter data at each sampling location (pH, conductivity, dissolved oxygen) with the water quality meter.

A grab sample is collected from a single point in the waterbody. Grab samples can be collected with a by using a suspended or hand-held polypropylene 5-gal container, disposable bailer, open-mouth bottle, dip sampler, or tubing placed at the collection point in the stream. The following sections describe methods of collection that may be utilized.

3.1 Sampling via tubing intake in the waterway

Since the collection of this sample is completed with the use of a peristaltic pump, any filtering takes place immediately upon collection via pressure filtration.

a. All equipment and supplies necessary should be moved to be placed appropriately for the collection of the sample.
b. If the collection/filtration tubing will be secured to a location within the waterbody, any stakes or anchor system to secure the tubing should be installed. Alternatively, one member of the sampling team may stand downstream of the collection point and hold the tubing in place for the collection of the sample, approximately 2/3 up from the bottom of the stream
c. Set up the sample collection system. Install one end of the collection/filtration tubing through the peristaltic pump. Secure the waterway end of the tubing to the previously set up stake or other securing mechanism or hold the tubing in the water for collection.
d. Attached any filter necessary to the tubing collection system.
e. Pass approximately 200 mL of collection water through the tubing and filter back into the waterway downstream of the collection site before collecting the sample volume if filtering the sample.
f. Once any sampling bottles have been filled, stop the pump.

The following two methods describe the sample collection process only, any samples that need to be filtered, will then have to complete this processing through the processes described in Section 3.4.

3.2 Sampling with the PTFE or stainless steel sampler (long-handled or measuring cup-type):

a. Remove the cap from the sample bottle.
b. Dip a sample of surface water using the sampler.
c. Tilt sample bottle and gently pour sample from sampler into the bottle. Allow the sample to trickle down the side of the bottle. Avoid aerating the sample.
d. Add preservative, as required, if not already in bottle and no filtration is required.
e. Replace cap, and place in cooler.

3.2 Sampling with stainless steel or PTFE-lined bucket:

a. Remove cap from sample bottle.
b. Gently dip collection bucket in the water. Fill bucket and carefully lift from water body.

c. Tilt sample bottle and gently pour sample from bucket into the bottle. Allow the sample to trickle down the side of the bottle. Avoid aerating the sample.
d. Add preservative, as required, if not already in bottle.
e. Replace cap, and place in cooler.

OR --

f. Use smaller sampling cup to transfer sample from bucket to sample bottle as in section 3.1 above.

3.3 Both filtered and unfiltered samples may be taken for metals analyses. Bulk samples for filtration may be collected using the stainless steel or PTFE-lined bucket method described above. Sample filtration must be performed immediately upon retrieval of the bulk sample. Set up filtration equipment prior to collecting sample. Filtration may be accomplished by gravity, or pressure using a peristaltic pump.

Gravity filtration will be accomplished as follows:

a. Place a 0.45µM membrane in a decontaminated filter funnel.
b. Slowly pour sample into the funnel and collect filtrate directly into appropriate sample container(s).
c. Add preservative(s) as required. Immediately cap container and place in cooler.
d. Dispose of filter membrane.

Pressure filtration will be accomplished as follows:

a. Using previously assembled disposable tubing, 0.45µM in-line filter, and peristaltic pump, filter sample from collection bucket into appropriate container.
b. Adjust pump rate to avoid aeration of sample.
c. Fill container, preserve as required, immediately cap container and place in cooler.
d. Dispose of filter and tubing.

4.0 Maintenance

Refer to manufacturer's specifications for maintenance procedures on generators and pumps.

5.0 Precautions

a. Avoid disturbing bottom sediments.
b. Consult the site safety and health plan prior to collecting any samples for PPE, such as dermal and respiratory protection and personal flotation devices, when sampling in or near deep water or from boats.
c. Always decontaminate the sampling and filtration equipment, and change gloves between sampling locations to minimize the risk of cross contamination.
d. Always set up generators downwind of working area. Never service generators onsite.

6.0 References

EPA, 1991. *Compendium of ERT Surface Water and Sediment Sampling Procedures*. EPA/540/P-91/005.

EPA, 2007. *Surface Water Sampling*. SESDPROC-201-R1.

USGS, 2000. *Interagency Field Manual for the Collection of Water-Quality Data*. Open File Report 00-213.

Field Sampling SOP MC-9
Sediment Sampling

7.1 PURPOSE AND SCOPE

This document defines the SOP for discrete sediment sampling. This procedure is to be used together with the UFP-QAPP and the other SOPs. Health and safety procedures and equipment for the investigation are detailed in the SSHP.

7.2 EQUIPMENT

The following is a list of equipment that may be needed during sediment sampling activities:

- nitrile gloves (several boxes, appropriate sizes)
- handheld GPS
- field books/field log sheets
- sample bottles provided by laboratory
- sample bottle labels
- label tape (clear)
- waterproof and permanent marking pens
- soil probe
- stainless-steel spoon
- 1-gallon zip-sealing bags
- camera
- appropriate health and safety equipment, as specified in SSHP
- appropriate decontamination supplies, as specified in SOP MC-2
- cooler with ice

7.3 DECONTAMINATION

Before any sampling begins, the sampling equipment will be decontaminated according to the procedures contained in SOP MC-2. Sampling equipment will be decontaminated between sampling activities for different Decision Units (DU), but decontamination of sampling equipment will not be required between collecting soil increments within the DU.

7.4 PROCEDURES

7.4.1 Sample Collection

This method of sediment sample collection is to be used in an area with no standing water or shallow, ponded water (less than 2 feet deep).

- Decontaminate sampling equipment according to SOP MC-2
- Record sample location on a site map and in the field logbook
- Don a clean pair of nitrile gloves and any other personal protective equipment necessary, listed in the SSHP.
- Use the soil probe to collect sediment from the 0.5 foot interval.

- Remove probe from the sediment and place the sample immediately into a clean zip-sealing bag. Zip the bag closed and composite the sample by using your hands on the outside of the closed bag to thoroughly mix the sample.
- Use a clean, sampling spoon to fill the sample jar with the mixed sediment. The required analyses and appropriate containers are listed in the UFP-QAPP.
- Label, store, and document sample according to MC-3
- Record applicable information on the Sample Collection Field Sheet

7.4.2 Field QA/QC Procedures

Field Quality Assurance/Quality Control samples are designed to help identify potential sources of external sample contamination and to evaluate potential error introduced by sample collection and handling. All QA/QC samples are labeled with QA/QC identification numbers and sent to the laboratory with the other samples for analyses.

7.4.1 Duplicate Samples

Duplicate samples are samples collected to assess precision of sampling and analysis. For the soil sampling, a duplicate sample will be collected at the same time as the initial sample. The initial sample containers for a particular parameter or set of parameters will be filled first, then the duplicate sample bottles for the same parameter(s), and so on until all necessary sample bottles for both the initial sample and the duplicate sample have been filled. The duplicate sample will be assigned a QA/QC identification number, stored in an iced cooler, and shipped to the laboratory on the day it is collected. Duplicate samples will be collected for all parameters. The sediment will be divided up evenly and then mixed separately. Duplicate samples will be blind to the laboratory.

7.4.2 Matrix Spikes and Matrix Spike Duplicates

Matrix spikes (MS) and matrix spike duplicates (MSD) are used to assess the potential for matrix effects. Samples will be designated for MS/MSD analysis on the chain of custody form and on the bottles. It may be necessary to increase the sample volume for samples where this designation is to be made.

7.4.3 Sample Identification, Handling, and Documentation

Samples will be identified, handled, and recorded as described in this SOP and SOP MC-3. The parameters for analysis and preservation will be specified in the UFP-QAPP.

7.4.4 Documentation

Each field activity must be properly documented to facilitate a timely and accurate reconstruction of events in the field (see SOP MC-3). Sample Collection Field Sheets will be completed for all samples submitted for chemical analysis.

7.4.5 Field Logbook

The most important aspect of documentation is thorough, organized, and accurate record keeping. All information pertinent to the investigation will be recorded in a bound logbook with consecutively numbered pages. All entries in logbooks will be made in waterproof ink and corrections will consist of line-out deletions that are initialed and dated. Entries in the logbook will include the following, as applicable.

- Project name and number
- Sampler's name
- Date and time of sample collection
- Sample number, location, and depth
- Sampling method
- Observations at the sampling site
- Unusual conditions
- Decontamination observations
- Weather conditions
- Names and addresses of field contacts
- Names and responsibilities of field crew members
- Names and titles of any site visitors
- Location, description, and log of photographs (if taken)
- References for all maps and photographs
- Information concerning sampling changes, scheduling modifications, and change orders
- Summary of daily tasks (including costs) and documentation on any cost or scope of work changes required by field conditions
- Signature and date by personnel responsible for observations

Field investigation situations vary widely. No general rules can include each type of information that must be entered in a logbook for a particular site. A site-specific logging procedure will be developed to include sufficient information so that the sampling activity can be reconstructed without relying on the memory of field personnel. The logbooks will be kept in the field team member's possession or in a secure place during the investigation. Following the investigation, the logbooks will become a part of the final project file.

Attachment B

AECOM Field Forms

AECOM

Americas

Daily Tailgate Meeting

S3AM-209-FM5

Instructions: Conduct meeting prior to sending crews to individual tasks. Require attendance of all AECOM employees and subcontractors. Invite personnel from simultaneous operations for coordination purposes. Review scope of work and briefly discuss required and applicable topics**. This meeting is a daily refresher, not a full orientation**. Task-specific discussions associated with Task Hazard Assessment (THA) follow this meeting at the task location immediately before individual task is started.

AECOM Supervisor Name: **Phone Number:**	
AECOM SH&E Rep. Name: **Phone Number:**	
Meeting Leader:	

Date:	**Project Name/Location:**	**Project Number:**
Today's Scope of Work:		

Muster Point Location:	**First Aid Kit Location:**	**Fire Extinguisher Location:**	**Spill Kit Location:**

1. Required Topics	**2. Discuss if Applicable to Today's Work**
☐ Fitness for Duty requirements, all sign in / sign out	☑ ■ **Check ☑ as reviewed or mark ■ as not applicable**
☐ Required training (incl. task specific) completed and current	☐ ☐ Biological/ Chemical / Electrical Hazards
☐ SH&E Plan onsite - understood, reviewed, signed by all (incl. scope, hazards, controls, procedures, requirements, etc.)	☐ ☐ Ergonomics - Lifting, Body Position
☐ Pre-Job Hazard Assessments (JHA/JSAs) available and understood	☐ ☐ Lock Out/ Tag Out
☐ Task Hazard Assessments (THAs) are to be completed for each task immediately prior to conducting	☐ ☐ Short Service Employees - visual identifier and mentor/ oversight assignment
☐ STOP WORK Right & Responsibility- all task changes/changed conditions re-assess with THA	☐ ☐ Simultaneous/ Neighbouring Operations
☐ Requirement to report to supervisor any injury, illness, damage, near miss, unsafe act / condition	☐ ☐ Slip/ Trip/ Fall Hazards
☐ Emergency Response Plan – including muster point, first aid kit, fire extinguisher, clinic/hospital location	☐ ☐ Specialized PPE Needs
☐ Personal Protective Equipment (PPE) - Required items per hazard assessments in good condition / in use by all	☐ ☐ Traffic Control
☐ Equipment/machinery inspected (documented as required) and in good condition - operators properly trained/certified	☐ ☐ Waste Management/ Decontamination
☐ Work area set up and demarcation/ barricades in place to protect workers, site staff, and the public	☐ ☐ Weather Hazards / Heat Stress / Cold Stress
☐ Required checklists/records available, understood (describe):	☐ ☐ Subcontractor Requirements (e.g., JHAs, THAs, procedures, reporting, etc.)
☐ Lessons Learned / SH&E improvements (describe):	☐ ☐ Work Permits / Plans required (e.g., Fall Protection, Confined Space, Hot Work, Critical Lifts, etc.); in place, understood (identify/attach):
	☐ ☐ Other Topics (describe/attach):
	☐ ☐ Client specific requirements (describe):

3. Daily Check Out by Site Supervisor	
Describe incidents, near misses, observations or Stop Work interventions from today:	Describe Lessons Learned/ Improvement Areas from today:

The site is being left in a safe condition and work crew checked out as fit unless otherwise specified as above.

Site Supervisor Name	**Signature**	**Date** **Time** **(at end of day / shift)**

Worker Acknowledgement / Sign In Sign Out sheets applicable to this meeting are on reverse and, if applicable, attached.

All employees:

- **STOP WORK if concerned / uncertain about safety / hazard or additional precaution is not recorded on the THA.**
- **Be alert and communicate any changes in personnel or conditions at the worksite to the supervisor.**
- **Reassess task, hazards, & mitigations on an ongoing basis; amend the THA if needed.**

SITE WORKERS (including AECOM Contractors and Subcontractors): Your signature below means that you understand:

* The requirement to participate in creating, reviewing, & updating hazard assessments (THA) applicable to your task(s).
* The hazards & control measures associated with each task you are about to perform.
* The permit to work requirements applicable to the work you are about to perform (if it includes permitted activities).
* That no tasks or work is to be performed without a hazard assessment.
* Your authority & obligation to "Stop Work" intervene, speak up/ listen up.

Your initials (right columns) certify that you arrived & departed fit for duty, & have reported all incidents/near misses; meaning:

* You are physically and mentally fit for duty.
* You are not under the influence of any type of medication, drugs, or alcohol that could affect your ability to work safely.
* You are aware of your responsibility to immediately report any illness, injury (regardless of where or when it occurred), or impairment/fatigue issue to the AECOM Supervisor.
* You signed out as fit / uninjured unless you have otherwise informed the AECOM Supervisor.

Print Name & Company	Signature	Initials & Sign In Time	Initials & Sign Out Time
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit

(Attach additional Site Worker sign-in/out sheets if needed) Identify number of attached sheets: _____

SITE VISITOR / SITE REPRESENTATIVE

Name	Company Name	Arrival Time	Departure Time	Signature

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Americas

Task Hazard Assessment

S3AM-209-FM6

Customer	**Permit No.**
Location	**Job No.**
Description of Task	**Date**

Basic Task Steps (explain how the task will be carried out)	**Hazards** (identify all hazards and potential hazards)	**Risk** (initial)	**Precautions** (describe how that hazard will be controlled)	**Risk** (final)	**Initials**
			Highest Risk Index		

Review and attach to Tailgate Meeting as required. Number and attach additional pages if necessary.

Worker/Visitor acknowledgement and review of this content on back of this document.

Risk Matrix on Reverse

Originator _____ (Print Name) _____ (Signature)

Supervisor _____ (Print Name) _____ (Signature)

THIS FORM IS TO BE KEPT ON JOB SITE.

AECOM

WORKER SIGN ON

NAME (Please Print) SIGNATURE

I participated in the development and understand the content of this Task Hazard Assessment.

VISITOR SIGN ON

NAME (Please Print) SIGNATURE TIME

Risk Rating Matrix

Probability	Severity				
	5 - Catastrophic	4 – Critical	3 – Major	2 – Moderate	1 - Minor
5 – Frequent	25	20	15	10	5
4 – Probable	20	16	12	8	4
3 – Occasional	15	12	9	6	3
2 – Remote	10	8	6	4	2
1 - Improbable	5	4	3	2	1

Risk Rating (Probability x Severity)	Risk Acceptance Authority
1 to 4 (Low)	Risk is tolerable, manage at local level
5 to 9 (Medium)	Risk requires approval by Operations Lead/Supervisor & Safety Manager
10 to 25 (High)	Risk requires the approval of the Operations Manager & Safety Director

Severity – Potential Consequences				
	People	Property Damage	Environmental Impact	Public Image/Reputation
Catastrophic	Fatality, Multiple Major Incidents	>$1M USD, Structural collapse	Offsite impact requiring remediation	Government intervention
Critical	Permanent impairment, Long term injury/illness	>$250K to $1M USD	Onsite impact requiring remediation	Media intervention
Major	Lost/Restricted Work	> $10K to $250K USD	Release at/above reportable limit	Owner intervention
Moderate	Medical Treatment	> $1K to $10K USD	Release below reportable limit	Community or local attention
Minor	First Aid	</=$1K USD	Small chemical release contained onsite	Individual complaint

Probability		
Frequent	Expected to occur during task/activity	9/10
Probable	Likely to occur during task/activity	1/10
Occasional	May occur during the task/activity	1/100
Remote	Unlikely to occur during task/activity	1/1,000
Improbable	Highly unlikely to occur, but possible during task/activity	1/10,000

Task Hazard Assessment Follow-Up/Review.

First Break **Initial**

Lunch Break **Initial**

Second Break **Initial**

Emergency Meeting / Assembly Area

Emergency Contact #

Emergency Radio Channel

Area is safe and housekeeping completed at the end of task/shift.

Supervisor (print name)

Signature

Date: _____

AECOM Technical Services Inc.

DAILY QUALITY CONTROL REPORT

Report Number: _____
Project Title: _____
Location: _____
Contract/DO Number: _____

WEATHER	BRIGHT SUN	CLEAR	OVERCAST	RAIN	SNOW
TEMPERATURE	< 32	32 - 50	50 - 70	70-85	>85
WIND	STILL	MODERATE	HIGH		
HUMIDITY	DRY	MODERATE	HUMID		

Personnel \ Site Visitors On-Site

No.	Name	Hrs.	Affiliation	Location/Description of Work
a.				
b.				
c.				
d.				
e.				
f.				
g.				

Sampling equipment on site:

Type	Serial Number	Calibration Verification	Time	Parameter	Standard	Reading

Field Changes: YES_____ NO_____

If yes, filed Nonconformance and Corrective Action Report number (NCR No.):_____

Health & Safety (Briefing held, PPE, injuries, near misses, etc.)	
Work Performed (including sampling)	
QA Activities	**Daily Report**_____ **Review of COC**_____ **Track Progress Report against QAPP**_____
QC Activities	**# Duplicates**_____ **Equipment calibrated complete to standards**_____ **# Equipment Blanks**_____ **# MS/MSD**_____ **# Field Blanks**_____
Problems Encountered Resolved	
Additional Information	
Activities Scheduled for the Next Day	

Contractor Verification: On behalf of the contractor, AECOM, I certify this report is complete and correct, and all materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as may be noted above.

_____ _____

Signature Date

Date:_____

AECOM Technical Services Inc.
Nonconformance and Corrective Action Report

Report Number:_____ **Location:**_____

Project Title:_____ **Contract Number:**_____

Description of Nonconformance and Cause:	
Proposed Disposition:	

Submitted by: _____ **Date:** _____

Approved by: _____

Actual Disposition approved by Project Manager:	
Implementation of Disposition assigned to:	

Completed by: _____ **Date:** _____

Verified by: _____ **Date:** _____

AECOM

Site ID: _____
Arrival Time: _____
Departure Time:_____

Soil Sample Collection Log

Site Name/Location: _____ Date: _____

On-Site Personnel: _____ Log Preparer: _____

Sample ID: _____

Soil Sample Characterization

Grain Size (%)	
Silt/Clay (<0.06 mm)	
Sand (0.06 – 2 mm)	
Gravel (2.64 mm)	
Cobble (64 – 256 mm)	
Organic Content	LOW / MED / HIGH
Color	
Moisture (%)	
Bullets or Bullet Fragments?	YES / NO

Sample Collection Tools Used: _____

Sample Types

☐ Incremental (always taken Triplicate)– No. of Increments: _____

☐Discrete – Depth interval: _____

XRF Result: _____

XRF Error: _____

Quality Control Samples

☐Duplicate ☐MS/MSDs ☐Field Blank ☐Equipment Blank ☐N/A

Notes:

_____

_____

_____

_____

_____

_____

AECOM

PHOTOGRAPHIC RECORD

Client Name:	**Site Location:**	**Project No.**
Army National Guard	Williston Local Training Area, North Dakota	60520956

Photo No. 1	
Location of Photo:	
Description:	

Photo No. 2	
Location of Photo:	
Description:	

Attachment C

Analytical Laboratory ELAP Certification and Standard Operating Procedures (on CD)

Appendix B

Site Safety and Health Plan

AECOM

Final Site Safety and Health Plan
Military Munitions Response Program
Bangor Range/Bangor, Maine

Munitions Response Site MEHQ-002-R-01
Maine Army National Guard

Army National Guard

Contract No. W9133L-14-D-0001
Deliver Order No. 0006

MARCH 2018

Signature Sheet

Site Safety and Health Plan
Remedial Investigation at
Bangor Range MRS
Bangor, Maine

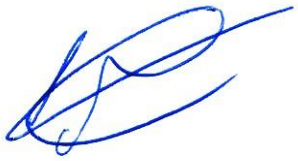
Plan Preparer:

3/14/2018

Victoria Kirkpatrick
Project Support
(30) 820-3624

Date

Plan Concurrence:



3/14/2018

Alberto Munuera
Project & Area Safety, Health and Environment Manager
(540) 431-7908

Date

Plan Approver:

3/14/2018

Rosa Gwinn
Project Manager
(301) 820-3123

Date

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List of Acronyms and Abbreviations

°F	degrees Fahrenheit
AHA	Activity Hazard Analysis
bpm	beats per minute
CFR	Code of Federal Regulations
CPR	Cardiopulmonary Resuscitation
DEET	diethyl-m-toluamide
DU	Decision Unit
EM	Engineering Manual
EZ	exclusion zone
HAZWOPER	Hazardous Waste Operation and Emergency Response
HSEMS	Health, Safety, and Environment Management System
HSM	Health and Safety Manager
ISM	Incremental sampling methodology
MC	munitions constituent
MMRP	Military Munitions Response Program
MRS	Munitions Response Site
MSE	Medical Surveillance Evaluation
OSHA	Occupational Safety and Health Administration
PM	Project Manager
PPE	Personal Protective Equipment
RAC	Risk assessment code
RI	Remedial Investigation
SDS	Safety Data Sheet
SH&E	Safety, Health, and Environmental
SOP	standard operating procedure
SPF	Sun Protection Factor
SSHP	Site Safety and Health Plan
SZ	Support Zone
TLV	Threshold Limit Value
TZ	Transition Zone
USACE	United States Army Corps of Engineers
WBGT	Wet Bulb Globe Thermometer
WP	Work Plan

SECTION ONE: INTRODUCTION

The following Site Safety and Health Plan (SSHP) is intended solely for use during the field activities to be performed as part of the remedial investigation (RI) at Bangor Range Munitions Response Site (MRS). The Bangor Range is located in Penobscot County Maine, approximately 0.93 miles west of Bangor National Airport in Bangor, Maine. Based on results of Site Inspection (SI), the Army National Guard (ARNG) determined an RI should be conducted under the Military Munitions Response Program (MMRP). The objective of the RI is to determine the nature and extent of munitions constituents (MC) remaining at the MRS from historical small arms training use. Soil sampling will be performed to determine if metals associated with small arms training remain in earthen berm and concrete structure soil in concentrations that would pose a risk to human health and the environment. Specifications herein are subject to review and revisions based on actual conditions encountered in the field.

This SSHP provides the basis for health and safety requirements, guidelines, and procedures that will be used at Bangor Range during the planned field activities. This SSHP provides a site description, hazard/risk analysis, staff organization, personal protective equipment (PPE) to be used, standard operating procedures, site control measures, decontamination procedures, emergency response plans, and site record keeping requirements. This SSHP will be updated should new tasks be added.

SECTION TWO: PROJECT AND SITE DESCRIPTION

2.1 SITE DESCRIPTION

The Bangor Range MRS is located on the west side of Hildreth Street North approximately 0.8 miles north of its intersection with Hammond Street Street, and approximately 0.9 miles west of Bangor National Airport in Bangor, Maine (Figure 1 of the Work Plan). The area surrounding the MRS is predominantly forested; the properties surrounding the MRS include the Maine Army National Guard (MEARNG) Regional Training Institute to the north, storage units and commercial buildings to the south, and the Bangor International Airport to the east. No residences exist in the vicinity of the former range. The MRS is a 6.7-acre area that includes a historical concrete target foundation structure and two historical berm impact areas referred to as the Concrete Structure, Earthen Berm 1 and Earthen Berm 2, respectively (discussed in greater detail below; Figure 2 of the Work Plan). The concrete structure and berms, which were used during small arms training, are surrounded by a mixed hardwood and coniferous tree community. Soils at the MRS are classified as silt loams with significant organic content. Access to the site is unrestricted and includes developed access to berms along Hildreth St N and the Regional Training Institute driveway. Currently, the majority of the MRS is owned by the City of Bangor; small portions of the MRS are owned by Hardy Associates, Inc. and Dunbar & Brawn Construction, Inc.

The MRS boundary presented in the 2009 Preliminary Assessment (Malcolm Pirnie, 2009) was based on the MRS' use as a1,000 yard known distance range, and included approximately 79.8 acres. During the 2011 Historical Records Review (HRR; Parsons Infrastructure and Technology Group [Parsons] 2011), the MRS boundary was reviewed and modifications were made based on application of standard Safety Danger Zones (SDZs) tempered by topographic conditions that limit bullet trajectory. The HRR revised the MRS acreage to include 266.6 acres. The MRS boundary was subsequently divided into two MRSs to distinguish between the former ranger area (firing point, target area, and range floor; MEHQ-002-R-01) and the remainder of the MRS (including the SDZ; MEHQ-002-R-02). Based on the results of the 2012 Site Inspection (SI; Parsons, 2012), the Bangor Range MRS boundary was refined to 6.7 acres and includes the area where MC contamination was found to have exceeded the selected screening criteria. The Bangor Range SDZ MRS (MEHQ-002-R-02; 259.9 acres) was recommended for No Further Action.

According to the visual survey conducted during the 2012 SI, Berm 1 is an earthen berm 800 yards downrange from the historical firing point, and measures approximately 30 feet long by 6 feet wide. This historical firing point is developed into storage units and a commercial building at the intersection of Hammond Street and Hildreth Street N. The same survey recorded Berm 2 as an earthen berm 1,000 yards downrange from the historical firing point, and measuring approximately 30 feet long by 6 feet wide. The concrete structure measures approximately 12 feet deep with one wall collapsed inward. No munitions and explosives of concern or small arms debris were observed during the visual survey, and there is no historical evidence for MEC being present at the MRS.

A feature of potential interest is Shaw Brook, a surface water body located west of the MRS. Vegetation is very dense at the MRS and Shaw Brook is approximately 400 feet west of the MRS target features. Migration of solid (particulate) MC from the berms and concrete structure is unlikely to reach the brook due to the retardation of transport from vegetation and adhesion to soil.

2.2 PROJECT DESCRIPTION

This purpose of the RI field work is to collect sufficient information to characterize the nature and extent of metals MC (lead, copper, antimony, and zinc) in soil resulting from former military activities at the MRS. Data collected during field activities will be used to evaluate human health and environmental risks from metals MC. The results of the RI will be used to develop future remedial action alternatives as part of the Feasibility Study and support informed risk management decisions.

In coordination with the ARNG and stakeholders, AECOM will mobilize field teams typically comprising two to four scientists to the MRS. Field teams will have the requisite qualifications, including Hazardous Waste Operations and Emergency Response (HAZWOPER) certification, first aid/CPR, and ARNG-required security training. Each scientist will understand the WP and SSHP, and have training in sampling techniques and munitions awareness (Recognize, Retreat, Report). The field event will be 1 week or less in duration. At the Bangor Range MRS, AECOM will determine the lateral extent of MC and establish decision unit (DU) boundaries based on X-ray fluorescence (XRF) analysis of the surface soil. To determine vertical extent of MC, AECOM will collect subsurface soil samples by hand auger at select locations where XRF readings at the surface exceed screening thresholds. Based on DU boundaries, surface soil samples will be collected with hand tools using incremental sampling methodology (ISM).

2.3 PHASES OF WORK

The phases of work that may be conducted include:

1. Mobilization
2. Estimate lateral extent of MC using XRF
3. Determine vertical extent of MC where XRF readings exceed screening threshold
4. Establish DU boundaries based on XRF data and collect soil samples by ISM
5. Identify background DU and collect soil samples by ISM
6. Site restoration and demobilization

SECTION THREE: HAZARD AND RISK ANALYSIS

3.1 HEALTH HAZARD CONTROL PROGRAM

An objective of this SSHP is to ensure that all operations, materials, and equipment will be evaluated to determine the presence of hazardous environments or if hazardous or toxic agents could be released into the work environment.

The Activity Hazard Analysis (AHA) tables for the project work are presented at the end of this section. The AHAs identify all activities, substances and environments that present a hazard and recommend hazard control measures.

Key elements of the AHAs that are required for a Health Hazard Control Program are:

- The written procedures and AHAs are included in this SSHP as certification of the hazard/risk assessment process
- Each AHA identifies the workplace and activity evaluated
- The AHA identifies the name of the person who prepared the AHA and certifies that the evaluation has been performed
- The analysis identifies the date of the evaluation

AECOM requires hazard identification, risk evaluation, control measures, and written procedures to manage health, safety, and environment risks on the job. Hazard and risk assessments were reviewed by the Project & Area Health and Safety Manager (HSM), to ensure that all operations, materials, and equipment were evaluated and that the hazards and risks associated with the work will be communicated to personnel. The potential hazards associated with work on the site include chemical, physical, and biological hazards.

The Health and Safety Officer, Joe Witte, will manage the AHAs on site and with the help of the field crew, improve upon or add to existing analyses as new potential hazards are noticed. The AHAs will be reviewed daily to confirm the tasks covered; however, each time a new phase is begun, the corresponding analyses will be read to review the potential safety concerns with each team member prior to each phase of work. The Health and Safety Officer will conduct the required safety and health inspections on a daily basis.

3.2 STATEMENT OF SAFETY AND HEALTH POLICY

The written corporate Safety Health and Environmental (SH&E) Policy, signed by the CEO, includes a statement of management commitment to provide a safe and healthful workplace for all employees, and sets forth the goals of the program. The Health, Safety, and Environment Management System (HSEMS) detail the responsibilities of management, employees, and expectations for continued improvement toward a zero incident culture. The SH&E Policy and HSEMS are included in **Attachment A** to this SSHP.

Our key SH&E program expectations for this and every other project include:

- Excellence in safety-related behavior by our employees and our subcontractor personnel;

- Strong support of our safety programs by project management;
- High quality and properly targeted safety training;
- The development of appropriate health and safety programs and AHAs for all field projects;
- Reporting of all identified near misses and safety observations, including timely follow-up and corrective action implementation;
- Meeting or exceeding all client SH&E expectations; and
- Meeting or exceeding all regulatory requirements.

Thus, the AECOM accident experience objective for this project is the same as for any other: ZERO ACCIDENTS. We strive to accomplish this through established programs that require training, pre-job briefings/hazard analyses, periodic site safety inspections, mandatory follow-up of site safety violations, and, if necessary, penalties for employee non-compliance.

AECOM's primary goal is that all employees go home at the end of each workday without having sustained an injury. Additional safety objectives and goals for this task include the following:

- Conduct work in accordance with applicable OSHA, ARNG, and other applicable safety regulations;
- Complete the project with zero injuries and illnesses and no property damage;
- Provide prompt identification and correction of health and safety concerns; and
- Obtain 100 percent participation of employees in the maintenance of a safe work environment.

The AECOM SH&E Program is behavior-based, with the conviction that accidents causing injuries or illness to personnel, or having an impact on the environment, are preventable. The key to prevention is the modification of behaviors at all levels of the organization. AECOM employees have the right and the responsibility to stop work if they observe conditions or actions that are placing themselves or others at risk.

3.3 HAZARD COMMUNICATION PROGRAM

Elements of the AECOM written Hazard Communication Program are presented below and follow the general guidance of U.S. Army Corps of Engineers (USACE) Engineer Manual (EM) 385-1-1 06.B.01 (USACE, 2014).

Materials to be brought onsite will have a safety data sheet (SDS) maintained in an accessible location for workers to review.

Materials anticipated to be brought onsite include:

- Liquinox (for decontamination)
- Sample preservative (nitric acid in small volumes)

As part of the Health and Safety Officer daily activities, an inventory of hazardous materials will be prepared with the quantities expected to be on site. The inventory will be updated if any

additional materials are brought on site, and as frequently as necessary to reflect accurate quantities.

Unless each container has appropriate labeling, all chemical containers will be labeled with the following information:

- Product name and identity of the hazardous chemical(s)
- Appropriate hazard warnings
- Name and address of the chemical manufacturer, importer, or other responsible party

Labels on incoming containers of hazardous materials will not be removed or defaced. Labels are also required when a hazardous substance is transferred from a primary container to a secondary container. Labels on secondary containers must indicate the product name or the names of the hazardous substances contained therein, as well as related physical and health hazards and their associated target organs. Labels may incorporate words, pictures, symbols, or combinations thereof to ensure the appropriate information is provided to the end user.

Acceptable labeling systems must include Global Harmonize Standards information including pictograms and other elements. Additional information includes the National Fire Protection Association Diamond, the Hazardous Materials Identification System, the Chemical Hazard Identification and Training system, or similar can also be present.

Employee requirements for reviewing SDS for specific safety and health protection procedures are presented.

AHAs incorporate information contained in the SDSs, which are provided in **Attachment B**.

SDS information will be followed in the use and disposal of material and selection of hazard control and emergency response measures.

The Health and Safety Officer will obtain an SDS for each chemical before it is used. SDSs will generally be received by the person ordering the product. SDSs for products frequently used should be kept on file because additional copies may not be included in repeat shipments.

The Health and Safety Officer will review each SDS when it is received to evaluate whether the information is complete and to determine whether existing protective measures are adequate.

The Health and Safety Officer will maintain a collection of all applicable and relevant material SDSs in an area that is accessible by all employees at all times. An electronic database is an acceptable method of maintaining the SDSs.

The Health and Safety Officer will replace SDSs when updated sheets are received and will communicate any significant changes to those who work with the chemical.

SDSs are required for all hazardous materials brought on site by project personnel.

General household products to be used for their specific purpose, as well as food, drugs, and cosmetics brought into the workplace for employee consumption, are exempt, as are supplies in the first-aid kit, such as isopropyl alcohol and antibacterial wipes.

Employees bringing hazardous materials on to a site or project must submit SDSs to the Health and Safety Officer. The Health and Safety Officer may restrict the use of certain hazardous

materials on a site or project due to occupational health risk, hazardous physical properties of the material, or potential employee sensitivity to odor or irritating properties of the material.

Other personnel working in the same area shall be provided with the following information on chemicals used by or provided to AECOM personnel:

1. Names of hazardous chemicals to which they may be exposed while on the jobsite.
2. Precautions the employees may take to lessen the possibility of exposure by usage of appropriate protective measures, such as ventilation or isolation of the work. In some cases, as an administrative control measure, a task may be delayed to a time when a minimal number of employees are present in the area.
3. Location of SDSs.

Employees will be trained initially and periodically when use of hazardous or toxic agents is altered or modified to accommodate changing on-site work procedures.

Training shall cover the following topics:

1. Requirements and use of the hazard communication program on the project
2. The location of all hazardous or toxic agents at the project site
3. Identification and recognition of hazardous or toxic agents on the project site
4. Physical and health hazards of the hazardous or toxic agents pertinent to project activities
5. Protective measures employees can implement when working with project-specific hazardous or toxic agents

Periodically, employees are required to perform hazardous non-routine tasks. Prior to starting work on such projects, each employee must be provided with information about hazards to which they may be exposed, as follows:

1. Specific chemical hazards associated with munitions (metals MC in soil)
2. Protective/safety measures that must be taken
3. Measures that have been taken to lessen the hazards, including ventilation, respirators, presence of another employee, and emergency procedures as applicable

Provide training to all employees who have the potential to be exposed to hazardous materials: a) at the time of the initial task assignment; b) whenever new chemicals are introduced into the workplace, and c) more frequently where required by site-specific conditions or client-specific requirements.

This training will include the following:

1. Applicable regulatory requirements
2. Location of the program, inventory, and SDS
3. Site-specific chemicals used and their hazards (chemical, physical, and health), including:

a. General characteristics of chemicals
b. Signs and symptoms of exposure

4. How to detect the presence or release of chemicals including the location, types, and usage of any portable and fixed monitoring or detection equipment and their associated alarms, where applicable
5. Safe work practices and methods employees can take to protect themselves from chemical hazards, including the use of respiratory protection
6. How to read a SDS
7. Site- or project-specific information on hazard warnings and labels in use at the location, if applicable
8. Site-specific evacuation and rescue procedures in the event of chemical release, including the location of staging areas and personnel accounting procedures

The following documentation will be maintained in the project file:

1. Chemical Inventory
2. SDSs
3. Training records

3.4 HAZARD ASSESSMENT

The potential hazards associated with work on the site include chemical, physical and biological hazards. AECOM policies require hazard identification, risk evaluation, control measures, and written procedures to manage health, safety, and environment risks on the job. Hazard and risk assessments were conducted by the HSM to ensure that all operations, materials, and equipment were evaluated and that the hazards and risks associated with the work will be communicated to personnel.

Written procedures addressing each identified hazard and AHAs for each critical task were prepared (**Section 3.8**). These procedures and AHAs are included in this section as certification of the hazard/risk assessment process.

Risk Assessment Codes (RACs) were assigned using Department of the Army methods, taking into account the mitigation of risk by instituting the controls and procedures described herein. The Health and Safety Officer will manage the AHAs on site and with the help of field personnel, improve upon or add to existing analyses as new potential hazards are noticed. The AHAs will be reviewed daily to confirm the tasks covered; however, each time a new phase is begun, the corresponding analyses will be read to review the potential safety concerns with each team member prior to each phase of work. The Health and Safety Officer will conduct the required safety and health inspections.

3.5 CHEMICAL HAZARDS

Based on prior studies, contaminants of concern on the site have been determined to include the metals (lead, copper, antimony, and zinc). The main routes of exposure for field personnel

include inhalation, ingestion, skin or eye contact, and dermal absorption of contaminants in soil. In order to protect site personnel from the hazards associated with site contaminants of concern, a personal protection program will be implemented to control potential chemical exposures.

3.6 PHYSICAL HAZARDS

There is a risk of injury from physical hazards at the site. Personnel should be aware of the fact that when protective equipment is worn, visibility, hearing, and manual dexterity are impaired. Slips, trips, and falls are the most common cause of on-site injuries.

3.6.1 Slip/Trip/Fall Hazards

As with any field project, uneven work surfaces and other slipping or tripping hazards may be present. Tripping is the most likely physical hazard that will be encountered. The terrain at the Bangor Range MRS is mostly forested with dense concentrations of continental glacial lakes. Personnel must use caution when walking on unstable or uneven terrain. Proper site housekeeping, removal of trash, and orderly stacking and removal of materials will reduce slipping and tripping hazards. Proper site housekeeping will be the responsibility of all site personnel. The Health and Safety Officer will conduct regular inspections assessing slip, trip and fall hazards.

3.6.2 Hand Tools and Portable Equipment

Field personnel will use hand tools and portable equipment during field activities. To prevent possible injury to the body, some general guidelines should be applied:

1. Keep tools in good repair and used only for the task for which they were designed.
2. Remove damaged or defective tools from service.
3. Keep surfaces and handles clean and free of excess oil to prevent slipping.
4. Do not carry sharp tools in pockets.
5. Clean tools and return to the toolbox or storage area upon completion of a job.
6. Do not throw tools from place to place, from person to person, or drop from heights.
7. Use non-sparking tools in atmospheres with flammable or explosive characteristics.
8. Inspect all tools prior to start-up or use to identify any defects.

3.6.3 Portable X-ray Fluorescence Analyzer

The U.S. Department of Agriculture's (USDA) Office of Homeland Security & Emergency Coordination Radiation Safety Division has guidelines for the use and possession of portable X-ray fluorescence analyzers. In addition to following the all recommendations for use outlined in the manufacturer's user manual, field personnel will conform to the following as specified by the USDA (USDA, 2017):

- All servicing or cleaning of an XRF analyzer involving exposure of the radioactive sources must be performed by the manufacturer or by an authorized representative of the manufacturer. Note: XRF analyzer models used during this project will be tube based and not contain a radiation source.
- Before removing the XRF analyzer from its place of storage, make sure it is locked in the transport case.
- When transporting the XRF analyzer in a vehicle, block and brace it to prevent shifting or movement, and lock the XRF in the vehicle when it is unoccupied.
- When the indicator light is flashing, and the shutter is open, the primary x-ray beam is on and radiation is being emitted from the front of the XRF analyzer.
- When the radiation shutter is open:
    - do not place hands, feet, or other body parts in the radiation field;
    - do not look into the beam path;
    - do not point the XRF at anyone;
    - do not hold the XRF from the front.
- After completing each measurement, immediately close the radiation shutter.
- Always maintain the XRF analyzer under constant view and immediate control when it is not in storage. At job sites, do not walk away from the XRF when it is left on the ground.
- When the XRF analyzer is not in use at a temporary job site, it must be securely locked in the operator's vehicle (or other appropriate locked storage location).
- Return the XRF analyzer to its proper locked storage location at the end of the work shift.

The model of XRF used will be tube based and will not contain a radiation source. Field personnel will wear radiation dosimeters during XRF use to monitor exposure. Dosimeter data will be downloaded and reviewed at the end of each field day. Field personnel will review AECOM Radiation safety policy S3AM-120-PR1 (Attachment D) and take the online safety training provided by ThermoScientific on "Radiation Safety for X-ray Tube Based Instruments" prior to working with XRF analyzers.

3.6.4 Hand Safety

Personnel are to perform work that could expose them to hand injury. All personnel are to wear protective gloves specific to their task at hand. If cold conditions exist, glove liners should be worn underneath all protective gloves. Physical protection gloves (i.e., leather) should be worn as necessary. Hands are to be kept clean to prevent slipping and contamination. Hand tools should be kept in good repair and sharp tools should be handled with extra care. All tools should be properly stored. The use of fixed open blades is prohibited.

Nitrile gloves will be worn when contact with contaminated soil or water is anticipated. If both chemical and physical protection are required, nitrile will be worn under the leather or work gloves.

3.6.5 Manual Lifting

Back injuries are among the leading occupational injuries reported by industrial workers. Back injuries such as pulls and disc impairments can be reduced by using proper manual lifting techniques. Leg muscles are stronger than back muscles, so workers should lift with their legs and not with their backs. If the load is too heavy, workers should not attempt to lift it alone. Lifting is always easier when performed with another person, and manual or mechanical assistance should always be used when it is available.

The following guidelines will be followed whenever lifting objects that are of odd size or shape, or that weigh over 50 pounds.

1. Get help when lifting heavy loads. Heavy loads will only be lifted using a two-person lift.
2. When moving heavy objects such as containers, use a dolly or other means of assistance.
3. Plan the lift. If lifting a heavy object, plan the route and where to place the object. In addition, plan communication signals to be used (i.e., "1, 2, 3, lift," etc.).
4. Wear sturdy shoes that are in good condition and supply traction when performing lifts.
5. Keep your back straight and head aligned during the lift and use your legs to lift the load; do not twist or bend from the waist. Keep the load in front of you; do not lift or carry objects from the side. Keeping the heavy part of the load close to your body will help maintain your balance.

3.6.6 Noise

The use of heavy equipment is not anticipated, and no investigation activities are anticipated to produce noise at or above the action level of 85 decibels on the A-weighted scale. However, should conditions warrant, all AECOM personnel within 25 feet of operating equipment, or near an operation that creates noise levels high enough to impair conversation, shall wear hearing protective devices (either muffs or plugs). AECOM personnel who are in the Medical Surveillance program are automatically enrolled in the AECOM Hearing Conservation Program and have had baseline and, where appropriate, annual audiograms. Personnel will wash their hands with soap and water prior to inserting earplugs to avoid initiating ear infections.

3.6.7 Temperature Extremes

Local weather conditions and the required use of PPE may produce an environment that requires restricted work schedules to protect employees from heat or cold stress. The Health and Safety Officer will observe workers for any potential symptoms. Please see **Section 8** for more information on heat and cold stress.

3.6.8 Other Weather-Related Hazards

Other weather-related hazards include heavy rains, damaging winds, thunderstorms, tornados, floods, wildfires, and lightning, etc. These hazards correlate with the season in which site activities occur. Weather forecasts will be checked prior to site work each day on the National

Oceanic and Atmospheric Administration website and will be monitored throughout the day by cell phone or radio. If threatening weather conditions are predicted, the Health and Safety Officer will determine if work can continue without endangering the health and safety of site personnel by using the following guidelines:

1. Potential for lightning strikes
2. Potential for heat or cold stress
3. Limited visibility
4. Inclement weather-related working conditions
5. Roads becoming impassable

Outside work will be suspended during severe weather, including electrical storms. The Health and Safety Officer will monitor storms and activate a lightning safety plan at the count of 30 seconds from the flash to the bang (6 miles away) and activities will not resume for 30 minutes from the last observed strike. This is called the 30:30 Rule. Personnel will seek shelter in the vehicles or a nearby building, as designated during the morning safety briefing.

3.6.9 Flammable and Combustible Materials

All work areas shall be kept free of unnecessary debris. No flammable and combustible liquids will be brought on site. During all on-site activities, the following practices will be used for fire prevention and protection:

1. Smoking on site is prohibited in designated work areas and other areas where smoking may create a fire hazard (e.g., dry vegetation)
2. A designated smoking area will be established when operations on site begin
3. Fire extinguishers will be available at all work and support areas
4. A fire extinguisher will be available in all project vehicles (10-B:C)
5. Fire extinguishers will be inspected monthly
6. Defective firefighting equipment will be replaced immediately
7. Fires or open flame devices are prohibited on site

All employees will be trained in the use of fire extinguishers and the hazards involved in incipient stage firefighting before being allowed to work on the project site as per 29 Code of Federal Regulations (CFR) 1910.157(g)(1).

Only fires in the incipient stage will be addressed using portable fire extinguishers. Regardless of the size and nature of the fire, and the Team's ability to respond, all fires will be reported immediately to the local fire department.

For this project, fire extinguishers will be placed in each motor vehicle (10B:C) one ABC rated extinguisher will be available (2A:20B:C). Only UL-listed extinguishers will be used.

The potential for fire will be low; if a fire should occur, it would be expected to fall into Class A, B, or C. These classifications are defined as follows:

- **Class A** – Fires in ordinary combustible materials such as wood, cloth, paper, trash, rubber, and plastic.
- **Class B** – Fires in flammable liquid, oil, grease, tar, oil-based paint, lacquer, and flammable gas.
- **Class C** – Fires involving energized electrical equipment or systems, resulting in the extinguishing media conducting electricity. When electrical equipment or systems are de-energized, extinguishers for Class A or B fires can be used safely.

Extinguishers are rated according to the classification and size of the fires against which they are effective. Extinguisher ratings are found on the extinguisher label. A rating consists of a letter indicating the classification of fire on which the extinguisher is effective and a rating number indicating the relative extinguishing effectiveness. The significance of the rating number varies with the classification of fire for which the extinguisher is rated. The following rating criteria are used:

For extinguishers rated for Class A fires, the rating number indicates relative effectiveness, the higher the number, the more effective the extinguisher. The minimum recommended rating for extinguishers rated for Class A fires is 2A.

For extinguishers rated for Class B fires, the rating number represents the average size (in square feet) of the fire the extinguisher could put out.

No number is used for extinguishers rated for Class C fires, because Class C fires are essentially either Class A or B fires involving energized electrical wiring and equipment.

3.6.10 Illumination

It is expected that site activities will be conducted only during daylight hours.

3.6.11 Vehicle Safety

Personnel must use caution when operating personal or company vehicles. The following field/site vehicle safety items should be followed:

1. All staff members operating a motor vehicle must possess a current, valid driver's license. AECOM authorized drivers have completed the AECOM vehicle safety either online or through one of the approved training resources.
2. All local speed limits and traffic regulations will be followed. Headlights will be used from sunset to sunrise, during fog, or other unfavorable conditions. All uncontrolled intersections (no traffic lights or traffic signs) will be treated as a four-way stop. The driver will exercise extreme caution at uncontrolled intersections.
3. Cell phone use (even with a hands-free device) is prohibited when driving. The use of any other portable headphones, earphones, or other listening devices is also prohibited. Operators will not eat, drink, or smoke, while the vehicle is in motion. Driving includes the time spent in traffic or while stopped at red lights or stop signs. If a Global Positioning System (GPS) is used, it must be mounted such that it does not interfere with the driver's range of vision. The GPS will not be programmed while driving. GPS units

and GPS units on smart phones may only be used if factory installed or secured to the vehicle with a bracket that allows the driver to view the image without having to take their eyes off the road.

4. Rental vehicles are maintained by the rental company and inspected prior to release. Drivers are responsible for inspecting the vehicle prior to use. Basic safety checks include tire condition/pressure; lights; turn signals; a clean windshield and adequate window washer fluid; gauges/warning lights indicating normal condition; mirrors properly adjusted; and brakes with adequate pedal pressure for proper breaking. Form SAM-005-PR will be used to document the inspection on a weekly basis.
5. Specific vehicle travel routes and parking areas will be identified at field sites. Traffic cones, or other markings, will be used as needed, to define roads and parking. If parking on the shoulder of an active road, employees will park as far off the road as possible. If work is required alongside an active road, park the vehicle behind the area of work to provide a barrier against out of-control vehicles.
6. The operator and all passengers shall use seat belts at all times when a motor vehicle is in motion. No employee may ride in the bed of a pickup truck unless seating and restraints are provided for this specific use. Articles, tools, equipment, etc. placed in vehicles will be stored so as not to interfere with vision or the proper operation of the vehicle in any way. All items in the vehicle must be secured to prevent them from flying about or out of the vehicle during sudden stops, turning, etc.
7. Trucks or vehicles with obstructed rearview mirrors must observe the following procedures when backing up: Position an employee to act as a spotter at the rear of the vehicles, in the driver's line of sight, to ensure that the area behind the truck is clear. If no other employee is present, then the driver must step out of the vehicle and check the area behind the vehicle before backing up. As an added precaution, avoid backing up whenever possible.

3.7 BIOLOGICAL HAZARDS

Potential biological hazards at Bangor Range include bloodborne pathogens, hantavirus, reptiles, invertebrates, mammals, and plants. Employee awareness and knowledge of the potential biological hazards will help reduce the risks associated with these hazards. Biological agents that may cause health hazards are diverse; consequently, their health effects are also diverse.

3.7.1 Bloodborne Pathogens

During site activities, workers can potentially be exposed to bloodborne pathogens when rendering first aid or Cardiopulmonary Resuscitation (CPR). Avoiding contact with biological agents is the best way to prevent adverse health effects caused by them. Recognition of potential hazards is essential. As a general rule, employees will not come into contact with any item that may appear to result from medical waste disposal. When avoidance is impractical or impossible, such as when administering first aid, PPE and personal hygiene will be used to prevent adverse effects. Employees designated to perform tasks involving occupational exposure including

designated first-aid providers, shall receive bloodborne pathogens training at the time of initial assignment to the job.

Employees are at risk of contracting infectious diseases each time they are exposed to bloodborne pathogens. Any exposure incident may result in infection and subsequent illness. Since it is possible to become infected from a single exposure incident, it is the practice of AECOM to prevent exposure incidents whenever possible.

To ensure employees are effectively informed concerning potential workplace health hazards, and in accordance with the requirements set forth in 29 CFR 1910.1030 and EM 385-1-1 Section 3, AECOM has established an exposure control plan for bloodborne pathogens. The purpose of this plan is to identify those tasks and procedures for which occupational exposure to bloodborne pathogens may occur, to identify the positions whose duties include those tasks, and to implement controls that will significantly reduce the risk of infection by bloodborne pathogens. The plan also includes provisions for affected employees to receive Hepatitis B vaccinations, training, and, if necessary, confidential medical evaluations and follow up.

The site-specific exposure control plan includes:

- Work practice controls: Provide adequate supplies for providing first aid and CPR, and treat all contact with human blood and bodily fluids as potentially infectious. Hand washing facilities/supplies shall be readily accessible for all employees.
- PPE: Provide PPE at no cost to the employee. Typical equipment includes, but is not limited to, gloves, face masks, eye protection, and CPR shield. PPE will be considered appropriate if it does not permit blood or other potentially infectious materials to reach or pass through clothes, skin, or mucous membranes of the eyes or mouth under normal conditions of use and for the duration of time the equipment will be used. PPE must be readily accessible and will be removed prior to leaving the work area.
- Housekeeping: Use universal precautions when cleaning or decontaminating any surface or equipment that may be contaminated. Appropriate PPE will be used for protection during decontamination.
- Post-Exposure Activities:
    - Report all occupational bloodborne pathogen exposures to the Incident Hotline (800-348-5046) immediately after initial decontamination and first aid is accomplished. Following the report of an exposure incident, a confidential medical evaluation with an occupational physician will be arranged as soon as possible, ideally no later than 1-2 hours after the incident has occurred.
    - Report incident to Health and Safety Officer, Project Manager (PM), and HSM.
    - Make initial notification in IndustrySafe (https://www.industrysafe.com/AECOM/) within 24 hours.
    - AECOM PM will verbally notify the COR of an incident as soon as reasonably possible, but not more than 24 hours after the incident.

The Hepatitis B Vaccination series will be made immediately available to employees who have had an occupational bloodborne exposure incident, whether as a result of their assigned tasks, or

occurring as a result of incidental contact. An employee who declines the vaccination must sign a waiver form.

3.7.2 Hantavirus

Wild rodents (rats and mice) can be infected with hantavirus and pass it in their droppings, urine, or saliva. Avoid touching urine and droppings, or places where these animals have nested. Also, avoid disturbing dried droppings or urine, which can be stirred up in dust and inhaled.

Acute illness may be characterized by the abrupt onset of fever, myalgias, headache, and cough, followed by the rapid development of respiratory failure. Anyone with a potential exposure who develops a rapidly progressing, severe viral illness or unexplained adult respiratory distress syndrome should be evaluated for possible hantavirus infection.

3.7.3 Invertebrates

A large variety of invertebrates may be encountered at Bangor Range including ticks, bees, hornets, wasps, mosquitoes, and spiders.

3.7.3.1 Ticks

Ticks typically have a three stage life cycle, larvae, nymphs, and adults. Ticks are most active in spring and early summer and are most common in open forests. At each stage of life the tick climbs to the top of grasses or shrubs (behavior known as questing). The tick extends its front legs, grabs hold of a passing animal and immediately starts looking for a place to attach, usually traveling upward. The ticks then attach with barb-like mouth parts and begin sucking blood. After one to two days of feeding the ticks drop off, molt and move to the next life stage.

The biological hazard associated with a tick bite is the possibility of contracting Lyme disease. Lyme disease is caused by bacteria called *Borrelia burgdorferi*. This bacterium inhabits the digestive tracts of Black-Legged Ticks, commonly known as a "deer tick." When ticks bite humans, the bacteria can be transmitted to the people. It typically takes 24 hours or more before the Lyme disease bacteria will enter the host, therefore prompt tick identification and removal is important to the prevention of contacting Lyme disease from a tick.

Typical short-term symptoms of Lyme disease include headache, fever, fatigue, and muscle pain that can be characteristic of the flu. A key diagnosis point is a distinctive "bulls-eye" rash, where the redness assumes a ring-shaped pattern that appears a day to a month after the tick bite. If personnel observe the rash, the Health and Safety Officer will take the site worker to get medical observation and treatment. At this initial stage Lyme disease is easily treated with a several week regimen of antibiotics. If left untreated, Lyme disease can spread to the heart, nervous system, and joints. Long term Lyme disease sufferers can have a huge list of varied symptoms including meningitis, brain inflammation, muscle twitching, chronic joint pain, arthritis, and even memory loss. Long term Lyme disease can be misdiagnosed as multiple sclerosis or even Type II diabetes.

Personnel should use the following prevention tactics when working outside:

1. Dress in light-colored clothing to make adhering ticks more visible. Wear long-sleeved shirts and tuck pants into or tape around socks.
2. Use a tick repellant containing DEET (diethyl-m-toluamide). Spray repellant containing 100% DEET onto clothing around wrists and ankles and on a head/neck covering; and repellant containing 30% DEET onto exposed skin.
3. Perform self-searches routinely when in the field to check for ticks.
4. Check body areas where ticks are commonly found: behind the knees, between the fingers and toes, under the arms, in and behind the ears, and on the neck, hairline, and top of the head. Check places where clothing presses on skin.
5. After work, place clothing in hot dryer to kill any loose ticks.
6. Shower and perform a careful whole body search for ticks.
7. If any ticks are found attached, remove using fine tweezers or a "tick tool".
8. Report tick bites and attached ticks to the Incident Hotline (800-348-5046).
9. If a tick is observed on the skin with the head burrowed, remove the tick by firmly grasping the tick's mouthparts at the skin with tweezers, and pulling straight out. Try to avoid squishing the body as this forces more digestive juices into the host, increasing the chance of infection. Ticks may be difficult and painful to remove. The Health and Safety Officer or another First Aid trained coworker may need to assist in this removal.
10. Wash the bite site with soap and treat the bite with an antiseptic. If any symptoms of Lyme disease are present, inform the Health and Safety Officer and seek medical care.

3.7.3.2 Bees, Hornets, and Wasps

Stings from bees, hornets, and wasps cause more deaths than bites and stings from all other insects and spiders. Death is usually a result of an allergic reaction. Other stinging insects include mud daubers. Though the sting from these insects can be extremely painful they are rarely serious.

Honeybees are the only stinging insects that leave a stinger in the wound. Other bees can sting repeatedly. If stung by a bee, check the wound to see if the stinger is still there. The stinger will be clearly visible. If the stinger is still there, scrape or flick it out with something stiff like a credit card. Do not try to pull the stinger out as squeezing injects more venom into the wound. Usual symptoms include a burning pain and swelling.

Unusual symptoms can signal the onset of an allergic reaction. There are two types of allergic reactions. In the first type, the bite or sting site becomes excessively swollen and the patient may experience nausea, vomiting, dizziness, and headache.

The second type of allergic reaction can be life-threatening. A severe reaction can cause body-wide skin itching, hives, or puffiness of the eyes, nose, lips, tongue, and throat. Abdominal pain and vomiting may develop. Breathing difficulties are common. The patient may collapse and go into shock. This kind of reaction presents a true medical emergency.

Allergic reactions usually do not develop after the first sting. After a second or third sting, a reaction can develop. It is difficult to predict whether a person will have a life-threatening allergic reaction. If you or family members are very allergic or have asthma, you are more likely to be allergic to stings and should be careful around stinging insects.

If breathing difficulties, difficulty swallowing, and/or body-wide itching develop, the patient is having a severe allergic reaction and should receive medical attention. If the reaction is not severe, wash the bite or sting area well with soap and water to help prevent infection. If stung or bitten on fingers or hand, remove any rings or jewelry in case of swelling. Your local pharmacist can help you select the best over-the-counter medications to help treat insect and spider bites.

To prevent bee and wasp stings, the following precautions will be taken during field activities:

1. Be aware of the presence of bees and wasps while you are working especially in the vicinity of flowers. Bees tend to sting if they feel threatened or are disturbed.
2. Avoid wearing floral patterns or using floral scents, which will attract bees.
3. Do not leave food, drinks, or garbage out and uncovered.
4. Personnel that are sensitive to bees must make the Health and Safety Officer aware of this and should carry a bee sting kit with them. Wear a Medic-Alert bracelet if extremely allergic to bee or wasp stings.
5. If you are allergic, ask your physician about prescribing an emergency epinephrine kit have on hand.
6. If bees or wasps get trapped inside your vehicle while you are driving, pull over to the shoulder and let the creature escape before you continue driving.
7. Only strike a wasp or bee if you are sure to kill it. If you strike or kill a wasp or bee you will set off its defense pheromone, which will bring unhappy relatives calling.
8. In the event of a mass sting attack, try to stay calm, cover your head if possible, and run steadily to safety. Get into anything that is sealed in such a way as not to allow insect entry, such as a vehicle.
9. All bee stings include an alarm pheromone, which incites their mates to attack, so step one is to get away from a nest/hive quickly. Scrape out stingers as soon as possible. A honeybee sting has a pump attached that continues to introduce venom for 1 minute after stinging. A wasp does not leave its stinger.
10. Apply an ice pack to minimize pain and swelling. Lift limb to heart level to reduce swelling. If the victim has been stung multiple times, is young or old, or is one of the 1% that is super sensitive to stings, watch for signs of systemic allergies. These may include:
    - Headaches;
    - Fever;
    - Nausea;
    - Vomiting;
    - Swelling of the tongue or throat;

- Difficulty in breathing;
- Cramps;
- Drowsiness; or,
- Unconsciousness.

Personnel with known sensitivity to stings should have an epinephrine kit and have it administered, followed by an ice pack and a visit to a hospital. Employees on the site who know they are allergic to bee stings should make the Health and Safety Officer and co-workers aware of that fact, and should have their epinephrine kit with them at all times. Co-workers should know where the kit is located and how to administer it in an emergency. Bee stings can be sensitizers and allergies can develop over time. Because a person has been stung in the past and has had no reaction, does not necessarily mean that the next sting will not bring on an allergic reaction. All employees will be made aware of the symptoms of anaphylactic shock, so that they can recognize it in themselves and co-workers and act accordingly.

3.7.3.3 Mosquitoes

Mosquitoes are responsible for more human deaths than any other living creature. World-wide, nearly four million people die each year from various mosquito-borne diseases.

The mosquito life cycle consists of eggs, larvae or "wrigglers," pupae or "tumblers," and adults. All life stages except adults are aquatic and can occur in a variety of wet or moist places, such as ponds, sloughs, standing pools of water, salt water marshes, artificial containers, hollow trees, low depressions of land, and moist areas of fields, bogs, and forests. Only the female mosquito bites to obtain a blood meal. The male mosquito feeds only on plant juices. The female mosquito may live as long as three weeks during the summer or many months over the winter in order to lay her eggs the following spring.

The majority of mosquitoes spend the winter as eggs within the specific habitat where they will eventually develop into larval, pupal, and adult stages. This means that female adults deposit eggs during late summer in the habitats mentioned above. These eggs then lie dormant throughout the winter until water temperatures are warm enough for hatching to occur the following spring. Mosquito eggs can sometimes lie dormant for several years, particularly when the eggs are deposited in depressions that are not flooded with water each year.

To prevent mosquito bites wear long sleeves, long pants and a hat; go where mosquitoes are not; or use bug dope (or another form of repellant) with 30% DEET. Apply repellent whenever you are outdoors, even for a short period of time. Choose repellents based on how long you plan to be outside and what you will be doing. When you are sweating, physically active, or getting wet, repellents do not last long.

For people sensitive to mosquito bites or are allergic to DEET it is recommended that they wear a head net or special anti-mosquito gear. The Health and Safety Officer should be notified of anyone with a severe allergy to mosquitoes in case of an emergency.

3.7.3.4 Other Invertebrates: Spiders and Caterpillars

Maine has rare occurrences of two venomous spiders, the black widow and the brown recluse.

The brown recluse is a shy, retiring spider that does not attack people and usually only bites in response to being injured. Most reported bites occur when putting on clothing in which the spider is hiding or rolling on a spider in bed. The brown recluse is a medium-sized spider. The legs span an area roughly the size of a quarter to a half dollar, and most are light to medium brown. The most distinguishing characteristic is the violin shaped marking on the top of the body directly above the legs and a semicircular arrangement of the three pairs of eyes. Brown recluse spiders prefer sheltered areas with low moisture levels. Since most brown recluse spiders hibernate in the winter (except for those that live indoors), most bites occur between March and October when humans accidentally disturb their habitat: closets, out-buildings or woodpiles.

Brown recluse
Photo credit: Oklahoma Cooperative Extension Service

Black widow
Photo credit: Oklahoma Cooperative Extension Service

Black widow spiders are very numerous in nearly all parts of the U.S., but cases of reported bites are not common. For the most part, black widows live peacefully in close proximity to humans with little contact. The black widow appears shiny and hairless to the naked eye. The body ranges from a deep glossy black to an occasional dark brown to a reddish brown. The underside of the abdomen has a distinct red or orange hourglass shape. In immature spiders, the color can vary and the hourglass may be white or missing. The black widow bite is sharp and painful, and victims should seek immediate medical attention. The first sign of a bite is acute pain at the site of the bite, with more symptoms following 20 minutes to one hour later.

If bitten by a brown recluse or black widow:

1. Use soap and water to clean the wound and skin around the spider bite.
2. Apply a cloth dampened with cold water or filled with ice.
3. Seek immediate medical attention.

The Browntail Moth Caterpillar is an invasive species found exclusively on the coast of Maine and in Cape Cod. This caterpillar is active from April to late June and poses a threat to both ecological and human health. The surface of the Browntail Moth Caterpillar is covered in tiny poisonous hairs, causing poison ivy-like dermatitis on sensitive individuals. Contact may be direct by touching or indirect through airborne hairs. When the hairs become dislodged or break off of molted skin, they become airborne, causing skin and respiratory symptoms.

Browntail Moth Caterpillar
Photo credit: Maine Department of Disease Prevention and Control

Localized rashes are the most common symptom which, when severe, can last up to several weeks. This reaction is both chemical and physical; toxins in the hairs cause inflammation and irritation on the skin as the hairs become embedded in the skin. In addition, respiratory distress can be serious when the airborne hairs are inhaled. Those with asthma should take extra precaution when in habitats with these caterpillars.

3.7.4 Snakes

According to the Maine Department of Inland Fisheries and Wildlife, there are currently nine species of snakes in the state of Maine, none of which are venomous)Maine Department of Inland Fisheries and Wildlife, 2018). Of the non-venomous snakes, the Common Garter Snake, Northern Water Snake, and Eastern Milk Snake are most abundant.

3.7.5 Mammals

Mammals such as chipmunks, ground squirrels, rats, porcupine, raccoons and beaver have been known to harbor fleas carrying bubonic plague. Their bites can also transmit rabies and infections. Larger mammals inhabiting the state include the black bear and coyotes. To help avoid bears while hiking or walking through the woods, make noise in thick cover, walk in groups, and always be aware of your surroundings. If a black bear is encountered, do not approach the bear; quietly back away and leave the area. Always carry bear pepper spray in case a bear attempts to attack. In the event a bear becomes aggressive and approaches you, make yourself look bigger by raising your arms. Repeat "Hey bear" while backing away. If a bear starts to follow you, stay together; do not run but continue to back away. If the bear tries to charge you, stand your ground, remain calm, and dispense bear pepper spray in a circular motion. If the bear makes contact with you, fight back with anything available such as a knife, sticks, rocks, binoculars, backpack, or by kicking. Coyotes are generally not a threat to humans, unless provoked. Similar to the bear, if you encounter a coyote, be as big and loud as possible as to scare them away. Do not turn your back; wave your arms, clap your hands, and shout loudly.

Some animals pose a special problem because people tend to try to feed them or pet them; the increased contact brings a greater possibility of danger. Avoid wildlife when possible. Identify an evacuation route and shelter when working in areas where wildlife may be encountered.

3.7.6 Plants

Hazardous plants at Bangor Range may include giant hogweed, poison ivy, and poison sumac.[1]. Giant hogweed can grow fifteen feet tall and have flowers up to two feet across. Contact with the sap of this plant followed by exposure to sun can result in painful blisters, burns, or a rash on the skin.

The oil resin on the leaves and stems of poison ivy and poison sumac contains urushiol, which may cause a serious allergic reaction to the skin if touched. The oil can be transferred from contaminated clothing (typically pant legs and boots) and still cause the allergic reaction. A

[1] U.S. Department of Agriculture Plants Database, http://plants.usda.gov/java/stateSearch, Accessed January 2018.

painful rash is created by the body's immune system. The rash shows up 12 to 48 hours after exposure and will last approximately two weeks.

Giant Hogweed

Poison Ivy

Poison Sumac

Photo credits: Maine Department of Agriculture, Conservation, and Forestry (Giant Hogweed) and U.S. Department of Agriculture (Poison Ivy and Poison Sumac)

Giant hogweed is identifiable by white flowers with 50-150 flower rays clustered into an umbrella-shape up to two and a half feet across. In the wild, these plants typically grow seven to fourteen feet tall, but can grow taller, and are accompanied by huge, deeply lobed leaves up to five feet across. The stems are hollow, rigid, and green in color with extensive spots of purple. The stem is two to four inches thick and covered in coarse, prominent white hairs with a thick circle of hairs at the base of the stalk. The seeds are dry, flattened, and oval with tan and brown lines. Giant hogweed grows along streams, rivers, forests, yards, and roadsides. These plans prefer open sites with abundant light and moist soil.

Poison ivy is identifiable by the three 3-inch deep green, ovate, sometimes coarse-toothed, shiny leaflets and has a distinguishing sticky resin on top of the leaves. The leaves are vibrant red in the early spring and late fall. The poison ivy plant grows as a lanky three to five foot high shrub or as a vine and may have tiny yellowish-white flower clusters that bloom from May to June. The plant exudes a resinous, rash-causing sap. It typically grows in rocky or shallow soil areas and often in partial shade low to the ground.

Poison sumac is a small tree or multi-stemmed shrub with grey bark and large compound leaves, each containing 7-13 leaflets. The leaflets are not toothed and are smooth without hair. Clusters of small yellow flowers and small white berries are found on sumac, similar to that of poison ivy. Even after the leaves have fallen, the distinct hanging clusters of white berries can be seen throughout winter. All parts of the plant contain an oil that inflames the skin on contact, causing itchy blisters ad rashes. When burned, the inhalation of smoke from the leaves is extremely hazardous. Poison sumac occurs as single scattered individuals, not in groups, and grows exclusively in very wet or flooded soils, swamps, marshes, and peat bogs.

Avoid any contact with the above plants to prevent exposure. First aid/response to poison plant exposure:

1. Call 911 if the person has trouble swallowing or breathing; or swelling, especially near the eyes or on the face
2. Immediately wash skin thoroughly with soap and water or a product such as Technu, taking care not to touch the face or other parts of the body prior to washing
3. Wash tools and contaminated clothing in strong soap and water because the plant oils can remain active for months
4. Apply cool compresses for 15 to 30 minutes at a time
5. Oatmeal baths or the application of calamine lotion will ease itching discomfort
6. Oral antihistamine may also help, but avoid topical antihistamines, which may make skin more sensitive
7. Seek medical attention for severe cases, if the rash covers a large part of the body, or if the person has blisters or cannot sleep. Steroids may be prescribed by a physician to help stop the spread of the rash in severe cases

3.8 ACTIVITY HAZARD ANALYSES

The Activity Hazard Analyses (AHAs) below list potential hazards associated with each phase of project field work, and associated actions to eliminate or minimize the hazards.

MOBILIZATION/DEMOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 10 January 2018

Project: Bangor Range

Job: Mobilization/Demobilization

Risk Assessment Code (RAC): **M**

Prepared By: Joe Witte Reviewed By: Alberto Munuera

Minimum Protective Clothing and Equipment:
PPE Level D: General work clothes, reflective vest, safety glasses, steal or composite-toe work boots, work gloves

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

SEVERITY	PROBABILITY: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Mobilization/demobilization of manpower, equipment and establishment of work zones.	**Biological Hazards:** Stinging and biting insects, spiders, and snakes Wild animals Poisonous plants	• Use repellents and proper clothing for protection against insects including ticks and mosquitoes • Check the area for poisonous plants and use Ivy Block • Wear long-sleeved shirts and gloves • Avoid animals, do not leave food outside • Work in pairs and stay observant of surroundings • Avoid rodent droppings as they may contain the Hantavirus • Avoid holes and rocks that are potential animal habitats • If contact with insects, animal droppings, or poisonous plants then wash area immediately • Wear protective clothing, including long pants and leather chaps as needed in areas/conditions where snakes may be active.	03.A.05 05.A.06 06.E.01 06.E.02 06.E.03

MOBILIZATION/DEMOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 10 January 2018

Project: Bangor Range

Task: Mobilization/Demobilization

Risk Assessment Code (RAC): M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Mobilization/demobilization of manpower, equipment and establishment of work zones (cont.)	**Physical Hazards:** Driving/vehicle movement (including trucks) Driving on poorly maintained, unpaved track road within Bangor Range	• Obey traffic rules. • Do not exceed15 miles per hour in the work area. • Use caution when entering roadways. • Do not operate vehicles in unsafe conditions (e.g, in deep mud). • Do not use cell phones when operating vehicles. • Wear seat belts • Use caution and wear reflective vests if working near active roads or around heavy equipment. • Leave enough time to get to your destination without hurrying. • Verify back-up alarms are functional for pick-ups or SUVs with obstructed rear view; use a back-up alarm or a spotter when backing up. • Exit vehicle and inspect road conditions prior to driving over questionable terrain/roads. • Use a spotter when driving through narrow passageways • Follow advice from MEARNG and USACE points of contact regarding site access and conditions. • Do not drive or park vehicle on unstable roads or terrain	18.A 18.B 08.B 18.B.03 18.B
	Moving or operation of equipment	• Use trained/experienced operators to run equipment as needed • Inspect equipment prior to use • Back up alarms will be functional • Maintain safe distance from moving mechanical parts; personnel will stay out of swing area of all equipment and from under loads • Maintain eye contact with operator when around moving equipment • No personnel will ride on equipment unless seats are provided • Use caution and wear reflective vests if working near active roads or around heavy equipment • Wear proper PPE (i.e., hard hats, as appropriate)	18.G.02

MOBILIZATION/DEMOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 10 January 2018

Project: Bangor Range

Job: Mobilization/Demobilization

Risk Assessment Code (RAC): M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Mobilization/demobilization of manpower, equipment and establishment of work zones (cont.)	Slips, trips, and falls	• Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible • Keep work area free of debris • Clear ice, snow and mud from steps to reduce slip hazards • Inspect areas daily and findings are recorded on daily inspection reports. • Personnel will wear sturdy all leather work boot with traction sole and composite safety toe	14.D.01 14.D.04 14.D.06 14.D.07 14.D.08
	Use of hand tools (manual and power)	• Inspect tools prior to use • Use tools for their intended use only • Do not use damaged tools • Push, do not pull wrenches • Use, inspect and maintain power tools according to manufacturer's recommendations • Equip power tools with designed guards • Provide electrical power control on each power tool to make it possible for the operator to cut off the power without leaving the point of operation	13.A.02 13.A.02 13.A.02 13.A.02 13.A.02 13.A.03 13.A.13
	Hands or fingers caught between objects, abrasions and lacerations	• Avoid rough or sharp edges of materials/objects being handled • Avoid placing hands between objects/pinch points • Wear leather work gloves	05.H.
	Lifting and handling of equipment and materials	• Use safe lifting techniques, bending at the knees and lifting with the legs. • Use caution and do not twist the back when carrying a load. • Get assistance or use mechanical devices to move loads; one person will not lift more than 50 pounds. • Wear protective gloves when handling materials.	14.A.01 14.A.01 14.A.03 14.A.04 14.A.05

MOBILIZATION/DEMOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 10 January 2018

Project: Bangor Range

Task: Mobilization/Demobilization

Risk Assessment Code (RAC): M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Mobilization/demobilization of manpower, equipment and establishment of work zones (cont.)	Inclement weather (cold stress)	• Monitor temperature, precipitation, and wind speed when working outdoors in damp and cool (below 50 degrees Fahrenheit [°F]) conditions or anytime temperatures are below 32°F • Wear cold weather clothing and provide shelter as needed based on site conditions. • Have warm liquids for drinking; avoid caffeine • Have a change of clothing available in case clothes become wet	06.I.04
	Inclement weather (heat stress)	• Make drinking water available to all workers and encourage workers to drink small amounts of water frequently. • Monitor conditions using Wet Bulb Globe Thermometer (WBGT) • Adjust work/rest regimens based on readings • Use sun screen. • Avoid consuming caffeine.	06.I.06 06.J.01 06.J.03
	Extreme weather	• When there are warnings or indications of severe weather, monitor conditions and take precautions to protect personnel. • Identify evacuation routes and places of shelter prior to starting work each day • Health and Safety Officer will monitor conditions and will call a safety stand down in the event of inclement weather.	01.E
	Fire	• Provide portable fire extinguishers in all equipment and vehicles • Inspect fire extinguishers monthly	09.F.01 09.F.02
	Unsanitary conditions	• Toilet and washing facilities will be accessible nearby • Potable water will be provided for drinking • Provide type II 16-unit first aid kits and make these kits accessible at the site.	02.C 02.D 02.E 02.F 03.B

MOBILIZATION/DEMOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 10 January 2018

Project: Bangor Range

Job: Mobilization/Demobilization

Risk Assessment Code (RAC): M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Mobilization/demobilization of manpower, equipment and establishment of work zones (cont.)	Dust inhalation	• Minimize generation of dust during activities • Stay out of visible dust clouds • Use soil wetting techniques to eliminate visible dust	06.A.04
	Noise exposure	• Use hearing protection during operation of heavy equipment, as necessary	05.C.01
Equipment to be Used Hand tools Vehicles	**Training Requirements & Competent or Qualified Personnel name(s)** Vehicle training	**Inspection Requirements** All equipment will be properly stored, inspected, and/or maintained on a daily basis, or according to manufacturer's recommendations. Records of inspection will be maintained on site. Fire extinguishers, vehicles, and first-aid kits will be inspected by the Health and Safety Officer.	

SOIL SAMPLING
ACTIVITY HAZARD ANALYSIS

Date Prepared: 10 January 2018

Project: Bangor Range

Job: Soil Sampling

Risk Assessment Code (RAC): **M**

Prepared By: Joe Witte Reviewed By: Alberto Munuera,

Minimum Protective Clothing and Equipment:

PPE Level D:
General work clothes, safety glasses, hard hat, safety-toed boots, leather work gloves, chemical resistant gloves (when handling soil with potential metals constituents).

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

SEVERITY	PROBABILITY				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Sample Collection	**Physical Hazards:** Slips, trips, and falls	• Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible • Keep work area free of debris • Clear ice, snow and mud from steps to reduce slip hazards • Inspect areas daily and findings are recorded on daily inspection reports. • Personnel will wear sturdy all leather work boot with traction sole and composite safety toe	14.D.01 14.D.04 14.D.06 14.D.07 14.D.08
	Hands or fingers caught between objects, abrasions and lacerations	• Avoid rough or sharp edges of materials/objects being handled • Avoid placing hands between objects/pinch points • Wear leather work gloves	05.H
	Lifting and handling of equipment and materials	• Use safe lifting techniques, bending at the knees and lifting with the legs • Use caution and do not twist the back when carrying a load • Wear protective gloves when handling materials	14.A.01 14.A.01 05.A

SOIL SAMPLING
ACTIVITY HAZARD ANALYSIS

Date Prepared: 10 January 2018

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Job: Soil Sampling

Risk Assessment Code (RAC): M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Sample Collection	**Biological Hazards:** Stinging and biting insects, spiders, and snakes Rabid or defensive animals Poisonous plants	• Use repellents and proper clothing for protection against insects including ticks and mosquitoes • Check the area for poisonous plants and use Ivy Block • Wear protective clothing, including long-sleeved shirts/pants, gloves and leather boots. • Avoid animals, do not leave food outside • Work in pairs and stay observant of surroundings • Avoid rodent droppings as they may contain the Hantavirus • Avoid holes and rocks that are potential animal habitats • If contact with fauna, animal droppings, or poisonous plants then wash area immediately	03.A.05 05.A.06 06.E.01 06.E.02 06.E.03
	Contaminants (metals constituents) in soil	• Properly use specified PPE – safety glasses and nitrile gloves • Practice contamination avoidance • Follow proper decontamination procedures (disposal of gloves, wash glasses as needed) • Observe good personal hygiene practices (wash hands after removing gloves; wash hands and face prior to eating, drinking, or smoking)	
	Inclement weather (cold stress)	• Monitor temperature, precipitation, and wind speed when working outdoors in damp and cool (below 50°F) conditions or anytime temperatures are below 32°F • Wear cold weather clothing and provide shelter as needed based on site conditions. • Have warm liquids for drinking; avoid caffeine • Have a change of clothing available in case clothes become wet	06.I.04

SOIL SAMPLING
ACTIVITY HAZARD ANALYSIS

Date Prepared: 10 January 2018

Project: Bangor Range

Job: Soil Sampling

Risk Assessment Code (RAC): M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Sample Collection (cont.)	Inclement weather (heat stress)	• Make drinking water available to all workers and encourage workers to drink small amounts of water frequently. • Monitor conditions using WBGT • Adjust work/rest regimens based on readings • Use sun screen. • Avoid consuming caffeine.	06.I.06 06.J.01 06.J.03
	Extreme weather	• When there are warnings or indications of severe weather, monitor conditions and take precautions to protect personnel. • Health and Safety Officer will monitor conditions and will call a safety stand down in the event of inclement weather.	01.E
	Fire	• Provide portable fire extinguishers in all equipment and vehicles. • Inspect fire extinguishers monthly	09.F.01 09.F.02
Equipment to be Used Hand tools Vehicles XRF Analyzer	**Training Requirements & Competent or Qualified Personnel name(s)** ThermoScientific on "Radiation Safety for X-ray Tube Based Instruments"	**Inspection Requirements** All equipment will be properly stored, inspected, and/or maintained on a daily basis, or according to manufacturer's recommendations. Records of inspection will be maintained on site. Fire extinguishers, first-aid kits, and vehicles will be inspected by the Health and Safety Officer. **XRF** When the radiation shutter is open: •do not place hands, feet, or other body parts in the radiation field; •do not look into the beam path; •do not point the XRF at anyone; •do not hold the XRF from the front.	

SECTION FOUR: STAFF ORGANIZATION, QUALIFICATIONS AND RESPONSIBILITIES

Roles and responsibilities for key safety personnel are provided in **Table 4-1**. Copies of resumes for safety personnel are presented in **Attachment C**.

Table 4-1: Roles and Responsibilities of Key Safety Personnel

Position	Description of Key Responsibilities
Health and Safety Officer Joe Witte	• Being present during operations to implement the SSHP • Developing, maintaining, and overseeing implementation of the SSHP • Inspecting site activities to identify safety and occupational health deficiencies and correcting them • Coordinating changes/modifications to the SSHP with the HSM and PM. • Conducting project-specific training • Has stop work responsibility related to safety and health concerns • Implements and enforces the SSHP, along with safety concerns contained in the SOP and reports violations to the PM. • Controls access to established work zones and exclusion zones, if any. • Securing the site until emergency response personnel assume control in the event of an accident or an emergency. • Assisting in the investigation of accidents/incidents and “near misses”. • Notifying and coordinating off-site emergency and medical response agencies. • Enforcing the “buddy system”. • Conducting visitor orientations, on-site safety training, and maintains the visitor log. • Coordinating with health and safety professionals to identify personnel on site for whom special PPE, exposure monitoring, or work restrictions may be required. • Conducting daily field site inspections and safety briefing. • Maintains qualification/certification records for site personnel on electronic and hard copy.
Project Health and Safety Manager Alberto Munuera	• Reviewing and overseeing implementation of the SSHP • Visiting the project site, as requested, to audit the effectiveness of the SSHP • Remaining available, and responding to, project emergencies • Developing modifications to the SSHP, as needed • Evaluating occupational exposure monitoring data and adjusting SSHP requirements, as necessary • Reviewing and signing the SSHP • Determining the need for periodic audits of the operation to evaluate compliance with this plan • Providing health and safety support as requested by the Health and Safety Officer and PM. • Developing, maintaining, and implementing this SSHP. • Responding, as appropriate, to project emergencies. • Overseeing munitions response health and safety program and personnel, establishing policies and standards, and providing guidance • Review and concur with the SSHP • Verify SSHP implementation and compliance • Verify compliance with MR-related Department of Defense publications, USACE documents, as well as local, state, and federal statutes and codes • Issuing a stop work order for unsafe conditions • Interface with PM in matters of health and safety

4.1 PREVENTION OF ALCOHOL AND DRUG ABUSE

Drug and alcohol abuse pose a serious threat to the health and safety of employees, clients, and the general public as well as the security of our job sites, equipment and facilities. AECOM is committed to the elimination of illegal drug use and alcohol abuse in its workplace and regards

any misuse of drugs or alcohol by employees to be unacceptable. The company Substance Abuse Prevention Procedure (SAM-019-PR1) prohibits the use, possession, presence in the body, manufacture, concealment, transportation, promotion or sale of the following items or substances on company premises. Company premises refer to all property, offices, facilities, land, buildings, structures, fixtures, installations, aircraft, automobiles, vessels, trucks and all other vehicles and equipment - whether owned, leased, or used.

- Illegal drugs (or their metabolites), designer and synthetic drugs, mood or mind altering substances, and drug use related paraphernalia unless authorized for administering currently prescribed medication;
- Controlled substances that are not used in accordance with physician instructions or non-prescribed controlled substances; and
- Alcoholic beverages while at work or while on any customer- or company-controlled property.

This policy does not prohibit lawful use and possession of current medication prescribed in the employees name or over-the-counter medications. Employees must consult with their health care provider about any prescribed medication's effect on their ability to perform work safely and disclose any restrictions to their supervisor.

Although some states may pass laws legalizing medical or recreational marijuana use, the use, sale, distribution and possession of marijuana are violations of federal law and company policy, and will subject an employee to disciplinary action up to and including termination in accordance with controlling law.

4.2 PRE-TASK SAFETY AND HEALTH ANALYSIS

Pre-task safety and health analyses are required and have been conducted by the HSM. AHAs are included in the SSHP. The Health and Safety Officer will review project tasks and the AHAs each day prior to and during site activities to ensure that the proper procedures are in place and communicated to the project team. Daily Tailgate Meeting Forms and Task Hazard Assessments will also be completed and reviewed by the Health and Safety Officer with the field team prior to and during site activities (**Attachment D**).

If revisions or additions to tasks or work procedures are needed, these will be identified by the Health and Safety Officer, in conjunction with the HSM, as necessary. If required, an addendum to this SSHP will be prepared and submitted to the ARNG for review and concurrence prior to implementing field changes or additions that are not addressed by this SSHP.

4.3 LINES OF AUTHORITY

The Health and Safety Officer has the authority to enforce safety policies and procedures on the project site, and to stop work if an unsafe condition or act is observed. Any corrective actions instituted will be reported to the HSM, the Area SH&E Manager and the PM. If further action or clarification of policies is required, the situation will be brought to the attention of higher levels of operations and SH&E management.

4.4 NON COMPLIANCE, CORRECTIVE ACTION AND SAFETY INCENTIVES

In accordance with AECOM policy, each violation of written safety procedures is evaluated on a case-by-case basis, with input from project management, human resources, and the SH&E department. Disciplinary actions may range from verbal reprimands to removal from the project to termination, depending on the severity of the infraction.

AECOM adheres to policies of continuous improvement for the safety program. Every individual receives annual training with instructions on reporting near misses (in addition to accident reporting). The AECOM Germantown Office, which is performing the work described in this SSHP, has an awards program for which individuals are recommended by their peers for contributions to safety procedures and process improvements. The Safety Award is presented annually in this program.

4.4.1 Management Accountability

In accordance with AECOM's HSEMS (**Attachment A**), the ultimate leadership on safety is our CEO. He, in turn, holds accountable the Operations Managers for communicating and implementing the HSEMS. Supervisors implement safety systems on programs that are under their control, and the PM is accountable for ensuring that safe operations will be followed on this project at all times. In accordance with AECOM policy, each violation of written safety procedures is evaluated on a case-by-case basis, with input from project management, human resources, and the SH&E department. Disciplinary actions for all employees, including managers and supervisors, may range from verbal reprimands to removal from the project to termination, depending on the severity of the infraction. Safety performance is evaluated as part of the AECOM annual job performance review.

SECTION FIVE: SAFETY AND HEALTH INSPECTIONS

5.1 SPECIFIC ASSIGNMENTS OF RESPONSIBILITIES

The Health and Safety Officer will conduct safety and health inspections daily. The Health and Safety Officer will document observations in the project logbook and on the Daily Health and Safety Report (DHSR). Forms are contained in **Attachment D**. Other inspections will be conducted by the Health and Safety Officer as required by individual project activities and company-specific safety, health, and environment procedures.

At a minimum, the Health and Safety Officer is responsible to perform the following:

Vehicle inspections prior to driving (SAM-005-PR)

Daily housekeeping inspections (SAM-013-PR)

Check contents of the field first aid kits prior to beginning field work (SAM-012-PR)

Review the AHAs prior to beginning field work, or as needed

Daily PPE inspections (SAM-208-PR)

The HSM or designee will conduct any monthly and/or quarterly inspections as necessary during the duration of the project.

5.2 DEFICIENCY TRACKING SYSTEM AND FOLLOW UP PROCEDURES

The Health and Safety Officer will identify and note deficiencies with an assigned due date for corrective actions. In most cases, discrepancies can be corrected immediately or before the following work day. The Health and Safety Officer will perform a review of corrective actions as part of the daily safety briefing. Follow-up inspections will be conducted to ensure correction of any identified deficiency and will also be documented in inspection reports.

The HSM or the Area SH&E Manager may conduct formal audits documented in accordance with AECOM procedures. The results of these audits will be reported to the PM, the Regional Safety Manager, and the Vice President, SH&E.

5.3 EXTERNAL INSPECTIONS AND CERTIFICATIONS

AECOM does not expect any external inspections/certifications during this project. However, regulatory agencies can conduct inspections periodically. If this is the case, the regulatory agency inspector should introduce himself/herself to the Health and Safety Officer and present credentials to verify that he/she is representing a recognized regulatory agency, such as OSHA or Maine Department of Health. Persons who cannot demonstrate their affiliation with a recognized regulatory agency should not be allowed access to the project site or office.

Prior to escorting an inspector on site, the Health and Safety Officer will contact the HSM, and the PM. All site visitors will be required to sign the visitors log and will be given a site safety brief by the Health and Safety Officer. Coordination of any regulatory agency inspection is the responsibility of the Health and Safety Officer who will accompany the inspector during all stages of the inspection.

SECTION SIX: TRAINING

6.1 NEW EMPLOYEE ORIENTATION

AECOM employees complete an initial New Employee Health and Safety Orientation designed to introduce new employees to the AECOM HSEMS at the beginning of their employment and before starting tasks or assignments. In the course of the orientation, the employee's direct supervisor will determine which additional training course the new employee must compete prior to being assigned to specific job tasks. All employees will receive an orientation in the following topics:

The AECOM Corporation HSEMS

- SH&E Policy
- SH&E Philosophy and Employee Responsibilities
- SH&E organization and responsibilities
- SH&E Website

Incident Reporting Requirements

Incident Reporting, Notifications and Investigation

Medical Screening and Surveillance Requirements

Behavior-Based Safety (BBS) principals

Vehicle Safety Requirements

Health and Safety Training Programs

Obtaining and Reviewing Health and Safety Plans and Safe Work Plans

Obtaining Personal Protective Clothing and Equipment

Site Orientation

Hazards Unique to Project Sites

Task-Specific Hazards

Project Specific Requirements

6.2 SITE SPECIFIC TRAINING

Before starting site work, all personnel assigned to the project will attend initial site-specific safety training. This training will cover corporate health and safety policies as well as the activities, procedures, and equipment applicable to the site operation. The Health and Safety Officer will conduct this training, which will specifically include:

Site layout

Potential hazards

Hazard controls

Hazard Communication (HazCom)

- Requirements and use of the project HazCom program
- Location of the hazardous materials on site
- Identification and recognition of hazardous materials on site
- Physical and health hazards of the materials pertinent to project activities
- Protective measures employees can implement when working with hazardous materials on site
- How to detect the presence or release of chemicals used on site

Monitoring protocols

PPE

Safety procedures

Emergency response services, as outlined in this SSHP

The training session will allow site personnel to clarify any issues they do not understand and will reinforce individual responsibilities regarding health and safety during site work.

Workers will fill out the Safety Compliance Agreement (**Attachment D**) during this training session.

SDSs for materials to be brought on site for each day's use are included in **Attachment B**; the Health and Safety Officer will obtain copies of SDS for any additional chemicals brought on site and maintain these in an accessible location. SDS will be reviewed with employees to identify specific safety and health procedures that should be implemented. SDS will be available for use with AHAs for activities in which hazardous materials will be used. Applicable information will be followed for the proper use and disposal of the materials; and for the selection of hazard control and emergency response measures.

6.3 MANDATORY TRAINING AND CERTIFICATION REQUIREMENTS

This project has training requirements for HAZWOPER training and certification. Employees will be trained in the use of fire extinguishers and the hazards involved in incipient stage firefighting before being allowed to work on the project site.

The 40-hour HAZWOPER training requires an annual refresher course in order to maintain certification. First aid and CPR require retraining and recertification as indicated by that particular training certification. Fire extinguisher training must be provided by AECOM at least once annually.

Certifications for all site personnel will be provided as part of the project personnel package to be submitted to the Contracting Officer's Representative (COR) for approval prior to the commencement of field work. All certifications will be kept on site during field activities.

6.4 REQUIREMENTS FOR EMERGENCY RESPONSE TRAINING

AECOM personnel will provide minimal or first-line response to on-site emergencies. This response will include initial first aid/CPR before arrival of Emergency Medical Services (EMS) personnel and use of fire extinguishers for extinguishing a small or incipient fire. At least two personnel will be trained in first aid/CPR and on-site during work activities. All site personnel will be trained in the use of fire extinguishers to provide emergency response.

6.5 SUPERVISORY AND EMPLOYEE SAFETY TRAINING

Supervisors and employees who are assigned to this project are trained per 29 CFR 1910.120 and receive annual 8-hour refresher training as part of this program. These training classes address topics such as hazard recognition and control, selection and use of PPE, selection and use of monitoring equipment, site control, hazardous materials shipping, and regulatory issues. AECOM employees are required to complete courses in BBS and other selected topics, such as vehicle safety and fitness for duty, on an annual basis. Employees considered "authorized drivers" must complete the defensive driving class, either online or through AECOM approved training providers.

The Health and Safety Officer will conduct daily site safety briefings (i.e., tailgate meetings) to all personnel on site, including supervisors, prior to the start of the work shift. The purpose of the briefings is to assist personnel in safely conducting the scheduled work activities. The briefings will include tasks to be performed and work method, general description of job scope, location of work, equipment to be used, physical hazards, chemical hazards, exposure potential, hazard control, PPE, anticipated weather conditions, and emergency response procedures. The briefings will also provide an opportunity to discuss past accidents and near misses that occurred on similar projects or under similar site conditions and identify safety-related performance deficiencies noted during daily activities or safety audits to increase safety awareness. Attendance and subject matters discussed will be documented on the Tailgate Safety Briefing and Task Hazard Assessment Forms (**Attachment D**).

SECTION SEVEN: PERSONAL PROTECTIVE EQUIPMENT

PPE is considered the last line of defense in hazard control. PPE is meant to protect workers when all other methods (elimination, engineering, and administrative) have been exhausted. All employees must be trained in the proper use and maintenance of PPE. See Procedure SAM-208-PR1, Personal Protective Equipment.

A PPE assessment (see SAM-208-FM1) **Attachment D** was performed to help determine PPE requirements. PPE upgrades for individual tasks or steps of a task are to be identified in Job Safety Analyses or AHAs.

7.1 LEVEL D PROTECTION

Level D PPE provides minimal protection against potential chemical hazards such as metals constituents in soil, and should not be worn in any area with respiratory or skin hazards. Minimum Required PPE:

- Hard hat (when overhead hazards exist)
- Safety glasses w/ side shields (may be clear or shaded)
- Safety-toe work boots
- Long pants and shirts with sleeves (short or long- cover shoulders no tank or muscle shirt styles)
- Leather work gloves for materials handling
- ANSI Class 2 retro-reflective vest (Class 3 during periods of limited visibility), when working near vehicular traffic or heavy equipment
- Leather chaps (when operating chain saws or as required in areas/conditions where snakes may be active)
- Face shields (as required in areas/conditions where debris may be airborne)

Level D PPE will be adequate for the majority of tasks conducted during this project, due to the type of activities planned.

7.2 MODIFIED LEVEL D PROTECTION

Modified Level D PPE includes the items listed in Section 5.2 above, *and one or more* of the following items:

- Regular (white) or poly-coated Tyvek (yellow) or Polyvinyl Chloride rain suit
- Safety goggles/face shield
- Chemical-resistant over-boots or chemical-resistant steel-toe/steel-shank boots
- Inner latex (i.e., surgical) gloves

- Chemical-resistant outer gloves (type: nitrile rubber)
- Tape for sealing arm, leg, and zipper joints

Modified Level D PPE will be donned for tasks whenever skin (other than hands) or clothing contact with potentially contaminated soil is expected.

If the Health and Safety Officer encounters unexpected conditions requiring the use of higher levels of PPE, then work will cease until an AHA is completed, modified PPE requirements are assessed, and the SSHP is amended and reviewed

The tasks scheduled for this project should not require the use of Level A, B, or C PPE, and their use is not covered by this SSHP.

7.3 HAZARD ASSESSMENT AND CONTROL

AECOM has adopted an approach to hazard assessment and control that incorporates both qualitative and quantitative methods to identify hazards and the degree to which they may impact employees and operations. The Risk Assessment and Management procedure (SAM-209-PR1, **Attachment D**) details the process.

7.4 WHEN HAZARD ASSESSMENT WILL BE CONDUCTED

Hazard assessments were conducted as part of the initial SSHP preparation and will be conducted anytime a change in site conditions or operations occurs. Additional hazard assessments will be conducted by the HSM and the Health and Safety Officer if site conditions or operations change. AHAs are provided in Section 3.8 of the SSHP.

7.5 HOW HAZARD ASSESSMENT WILL BE CONDUCTED

Hazard assessments were initially conducted by the HSM, who evaluated the hazards expected to be present on site based on available background information and previous experience with similar projects. AHAs will be reviewed and tasks will be re-evaluated each day prior to and during site activities by the Health and Safety Officer, in conjunction with the HSM, as necessary, to ensure that the proper procedures, as identified in this SSHP, are in place and communicated to the project team. If revisions or additions to tasks or work procedures are needed, these will be identified by the Health and Safety Officer, in conjunction with the HSM. An addendum to this will be prepared and submitted to ARNG for review and approval prior to implementing changes or additions that are not covered by this SSHP.

7.6 PERSONAL PROTECTIVE EQUIPMENT TRAINING

Based on the hazard assessment for this site, Level D PPE, as defined in Section 7.1, has been determined as the initial level of protection required. The decision to require the use of optional items (hearing protection, waders, hard hats, and reflective vests) will be made by the Health and Safety Officer, based on the hazard and risk analysis in the field. The Health and Safety Officer may also make the decision to upgrade to Modified Level D, as defined in Section 7.2 of the

SSHP, if site conditions warrant an upgrade. The level of protection worn by site personnel will be enforced by the Health and Safety Officer.

Any recommended changes in the level of protection that involve the use of protective equipment not covered under this SSHP (e.g., respirators) will be documented, and a revised hazard assessment will be prepared by the HSM and submitted to ARNG for review prior to use in the field.

All site workers will have current HAZWOPER training; refresher classes address the use of PPE, including respiratory protection. Training includes:

Identifying when PPE is needed;

Selection of proper PPE;

How to properly don, doff, adjust, and wear PPE;

Limitations of the PPE;

Inspection and testing of PPE;

Care, maintenance, and storage of PPE;

Recognizing when PPE has reached the end of its useful life; and

Proper disposal of used PPE.

PPE will be inspected on a regular basis using SAM-208-FM1 (**Attachment D**).

Levels of PPE to be used for this project are discussed in Section 7.1 and 7.2.

7.7 PERSONAL PROTECTIVE EQUIPMENT RETRAINING

If there is reason to believe that any affected employee who has been trained does not have the understanding and skill required to use the assigned PPE, that employee will be removed from the job site until additional training can be completed. AECOM uses a combination of classroom instruction, on-line modules, and hands-on experience for PPE training.

7.8 IDENTIFYING EMPLOYEE TRAINING

Copies of training certifications (including names and date of training) for on-site personnel will be maintained in project files. The Health and Safety Officer will verify each person's certifications prior to the start of work activities and periodically perform reviews to ensure certifications are update.

SECTION EIGHT: EXPOSURE MONITORING

8.1 TRAINING AND MEDICAL SURVEILLANCE

All personnel must comply with the medical surveillance requirements required by Occupational Safety and Health Administration (OSHA) (29 CFR 1910.120). The AECOM medical surveillance program meets all OSHA criteria for hazardous waste investigations. Personnel must have passed the AECOM medical surveillance examination (or equivalent) within the time frame established (annual or biennial schedule). The PM will verify that all AECOM personnel meet applicable OSHA medical surveillance requirements prior to the start of site work. Documentation regarding medical surveillance clearance will be maintained by the Health and Safety Officer

The requirements of the medical surveillance program include:

- A baseline or pre-assignment baseline exam will be conducted prior to the start of work assignments requiring medical surveillance. All employees whose work assignments involve potential exposure to harmful chemical and/or physical agents should participate in the medical surveillance program. Guidance as to harmful potential exposures is presented in SAM-128-FM1 Medical Surveillance Evaluation (MSE). The form provides the primary guidance for determining whether medical screening is required for an employee and the frequency of periodic exams. The MSE is to be completed by the employee and his/her supervisor at the time of hire for any employee who may work outside an office environment. At each annual performance review, the MSE is to be reviewed for accuracy. Other reviews are required whenever there is a change in job tasks.
- 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 Supervisor, Operations Manager and HSM will identify activities/tasks that will require fit-for-duty assessments.
- Additional site- or project-specific biological monitoring or toxicological screening may be required in addition to this program's scheduled core exams. These medical tests will be specified by the project-specific Health and Safety Officer and will be authorized by the HSM on the exam appointment protocol. No additional medical tests are necessary for work at this project site.
- 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 HSM 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.

All accidents and potential exposures must be reported immediately to the Health and Safety Officer, who will coordinate with the Area or Region Safety, Health, and Environment Manager to arrange for medical exams or tests that may be indicated as part of the AECOM medical surveillance program. Depending on the type of incident, it may be critical to perform tests within 24 to 48 hours. Failure to report an injury or incident immediately will result in

disciplinary action. Based on the nature of the field activities and the hazard assessment results, it is not expected that any airborne contaminants or nuisance dust level exposure limits will be exceeded; therefore, no air monitoring will be performed. Upon changes in site conditions or operations, AHAs may be amended based on an evaluation of potential work exposure. Any amendment to this SSHP will be reviewed and approved by AECOM HSM and accepted by ARNG prior to implementation.

Due to the climate at the Bangor Range and the duration of project, both heat and cold stress are hazards that may be encountered. Therefore, the following control measures shall be followed, as appropriate.

8.2 HEAT STRESS

1. If a worker is wearing permeable clothing.
2. Environmental monitoring or physiological monitoring shall be conducted and work/rest regimens established.
3. Monitoring shall be conducted when temperature exceeds 75°F and 55% humidity.
4. Use of a WBGT instrument is preferred; however, if a WBGT instrument is not available, and the WBGT cannot be obtained from local weather stations, then **Figure 8-1** will be used to estimate the Heat Index.

Degrees F

Relative Humidity (%)	68	70	72	73	75	77	79	81	82	84	86	88	90	91	93	95	97	99	100	102	104	106	108
0	59	61	61	63	64	64	66	66	68	68	70	72	72	73	73	75	75	77	77	79	81	81	82
5	61	61	63	64	63	66	66	68	70	70	72	72	73	75	75	77	79	79	81	81	82	84	84
10	61	63	63	64	66	66	68	70	70	72	73	73	75	77	77	79	81	81	82	84	86	86	88
15	63	63	64	66	66	68	70	70	72	73	73	75	77	79	79	81	82	84	84	86	88	90	91
20	63	64	64	66	68	70	70	72	73	75	75	77	79	81	81	82	84	86	88	90	90	91	95
25	64	64	66	68	68	70	72	73	75	75	77	79	81	82	82	84	86	88	90	91	93	95	97
30	64	66	68	68	70	72	73	73	75	77	79	81	82	84	84	86	88	90	91	93	95	97	99
35	64	66	68	70	72	72	73	75	77	79	81	82	84	86	88	90	91	93	95	97	99	100	102
40	66	68	70	70	72	73	75	77	79	81	82	84	86	88	90	91	93	95	97	99	100	102	
45	66	68	70	72	73	75	77	79	81	81	82	84	86	90	91	93	95	97	99	100			
50	68	70	72	73	73	75	77	79	81	82	84	86	88	91	93	95	97	99	102				
55	68	70	72	73	75	77	79	81	82	84	86	88	90	93	95	97	99	100					
60	70	72	73	75	77	79	81	82	84	86	88	90	91	95	97	99	100						
65	70	72	73	75	77	79	81	82	84	88	90	91	93	97	99	100							
70	72	73	75	77	79	81	82	84	86	88	91	93	95	97	100	102							
75	72	73	75	77	79	81	84	86	88	90	91	95	97	99	102								
80	73	75	77	79	81	82	84	86	90	91	93	97	99	100									
85	73	75	77	79	82	84	86	88	90	93	95	99	100	102									
90	75	77	79	81	82	84	88	90	91	95	97	99	102										
95	75	77	79	81	84	86	88	91	93	95	99	100											
100	75	79	81	82	84	88	90	91	95	100	100	102											

Chart assumes full sunshine and light wind. Using this chart on a cloudy or windy day will result in an overestimation of heat stress

F=Fahrenheit

Figure 8-1: Approximate Wet-Bulb Globe Temperature Chart

5. If **Figure 8-1** is used, direct radiant sun exposure, air velocity, temperature, and humidity and adjustment factors for various work clothing should be taken into consideration.

6. Employees exposed to solar radiation with the potential for sunburn, should be encouraged to use sun screen with a sun protection factor (SPF) of 30 or greater, and should wear hats, long sleeve shirts, sunglasses, and other protective attire.

Work-rest schedules and water intake will be established by the Health and Safety Officer based on the following criteria.

Table 8-1: Heat Stress Exposure Threshold Limit Value (TLV) and Action Limits

Work Cycle (per hour)	TLV (^{o}F)			Action Limit (^{o}F)		
	Light	Moderate	Heavy	Light	Moderate	Heavy
75 to 100% Work	87.8	82.4	NR	82.4	77.0	NR
50 to 75% Work	87.8	84.2	81.5	83.3	78.8	75.2
25 to 50% Work	89.6	86.0	84.2	85.1	80.6	77.9
0 to 25% Work	90.5	88.7	86.9	86.0	84.2	82.4

NR = Not recommended
^{o}F= Fahrenheit

It is expected that workloads will fall into the moderate category (walking about with moderate lifting or pushing, or carrying 10 pounds or less). If the Heat index exceeds 77.0 ^{o}F (for personnel wearing standard work clothing) a work-rest cycle will be established and physiological monitoring will be conducted to assess the effectiveness of the heat stress controls.

Heat Stress Controls

The best approach to avoiding heat-related illness is through preventive heat stress management. Measures to be implemented for this project will include:

Rest Areas – A relatively cool, shaded area will be provided for breaks when ambient temperatures exceed 80^{o}F and workers are wearing regular work clothes. If shade is not available, a canopy will be constructed, or workers will have access to air-conditioned buildings or vehicles. Employees will have access to these rest areas at break times and at any other time a recovery period is needed.

Liquids – Water and electrolyte replacement drinks will be made available. Employees will have access to potable drinking water equivalent to one quart of water per employee per hour during the work shift. Workers should drink 16 ounces before starting work in the morning and after lunch, and 8 to 16 ounces at each break. The water shall be kept reasonably cool (50-60^{o} F) to encourage consumption. Employees will be encouraged to avoid alcohol during non-work hours and caffeine during work hours when heat stress conditions are anticipated.

Acclimatization – When working in a heat stress environment, employees will need to adapt to the hot conditions. Workloads should start at 50% capacity and increase 10 % each day to

achieve 100% capacity. Acclimatization will start to decrease after 3-4 days, and will be gone after one week of not working in a hot environment.

Heat stress controls to be implemented include:

- Allow workers to become acclimatized to the heat (3 to 6 days);
- Provide shaded or air-conditioned break areas;
- Provide sun screen to prevent sun burn; and
- Provide drinking water and electrolyte-replenishing fluids.

Whenever the WBGT reading exceeds the values on the table above for the identified work-rest regime, the Health and Safety Officer will monitor workers for heat stress by measuring temperature and pulse. The Health and Safety Officer will further adjust individual work/rest schedules based on results of physiological monitoring.

- Heart Rate – Heart rate should be measured by the radial pulse as early as possible in the initial rest period (P1) and after two minutes (P2). If P1 is greater than or equal to 110 beats per minute (bpm) and P1-P2 is less than or equal to 10 bpm, shorten the next work cycle by 1/3 without changing the rest period. If the same condition exists at the end of the next work period, that individual should not return to work until repeated measurements are in the acceptable range and they are fully recovered.
- Body Temperature – The body temperature may be measured using a clinical oral thermometer or a clinical ear thermometer. If the body temperature exceeds 99.6°F, shorten the following work period by 1/3 without changing the rest period. If at the next rest period, the temperature still exceeds 99.6°F, that individual should not return to work until their body temperature drops below 99.6°F and they are fully recovered.

The Health and Safety Officer will assess conditions that may cause heat stress in site workers. All site workers will be familiar with the symptoms of heat stress illness described below and will report any symptoms to the Health and Safety Officer immediately. Personnel should monitor themselves and each other for the development of symptoms such as sudden fatigue, nausea, dizziness, irritability, malaise, flu-like symptoms, and lightheadedness.

Conditions related to heat stress:

Heat Rash may result from continuous exposure to heat or humid air. It appears as red papules, usually in areas where the clothing is restrictive, and gives rise to a prickly sensation, particularly as sweating increases.

To prevent heat rash, shower after work, dry off thoroughly, and put on clean, dry clothes. Try to stay in a cool place after work. See a physician if the rash continues to develop.

Heat Cramps are caused by heavy sweating with inadequate electrolyte replacement. Symptoms include muscle spasms and pain in the hands, feet and abdomen.

First Aid for Heat Cramps: Leave the work area, and rest in a cool, shaded place. Drink beverages that contain salt or eat salty food. Taking adequate breaks and drinking electrolyte replacement drinks should prevent cramps from returning.

Heat Exhaustion occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include:

- Pale, cool, moist skin
- Heavy sweating
- Dizziness
- Nausea
- Fainting
- Headache
- Blurred vision
- Vomiting

The key here is that the victim is still sweating, so the cooling system is still working; it's just under severe stress. The body core temperature may be elevated, but not higher than 104ºF. It is important to recognize and treat these symptoms as soon as possible, as the transition from heat exhaustion to the very hazardous heat stroke can be quite rapid.

First Aid for Heat Exhaustion: Treatment involves replacing fluids (rehydration) and salts and removing the person from the hot environment. If symptoms are mild, sipping cool, slightly salty beverages every few minutes may be all that is needed. Removing or loosening clothing and applying a wet cloth or ice packs to the skin also aid cooling.

Heat Stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels, typically at or above 104ºF. Immediate action must be taken to cool the body before serious injury and death occurs. Competent medical help must be obtained. Signs and symptoms are:

- Red, hot, usually dry skin
- Lack of or reduced perspiration (lack of perspiration may be masked for those wearing chemical protective clothing since perspiration from earlier in the day will be present)
- Nausea
- Vomiting
- Dizziness and confusion
- Strong, rapid pulse
- Coma

First Aid for Heat Stroke - THIS IS A MEDICAL EMERGENCY! SUMMON MEDICAL ASSISTANCE IMMEDIATELY!

While awaiting transportation to the hospital, a person should be wrapped in cold, wet bedding or clothing; immersed in a lake, stream, or cool bathtub; or cooled with ice. At the hospital, body cooling is usually accomplished by removing the clothes and covering the exposed skin with

water or ice. To speed evaporation and body cooling, a fan may be used to blow air on the body. Body temperature is measured frequently, often constantly. To avoid overcooling, cooling is stopped when the body temperature is reduced to about 102°F.

8.3 COLD STRESS

Cold stress is a concern when field crews are working outdoors in damp and cool (below 50°F) conditions or anytime temperatures are below 32°F. Personnel should monitor weather forecasts each day and schedule work for the warmer part of the day. While working, ambient temperature, wind speed, and precipitation should be monitored, and a warming regimen should be implemented to allow workers breaks from the cold. Shelter to escape cold, wind, and precipitation, and a source of heat (such as warm packs or portable heaters) should be provided at the worksite. Other cold stress prevention controls include:

1. Changing clothes when work clothes become wet with sweat
2. Avoiding caffeine (which has diuretic and circulatory effects)
3. Ensuring workers drink plenty of warm liquids. It is easy to become dehydrated in cold weather.

When site conditions are as described above, workers should wear at least three layers of clothing, with an inner layer of cotton or synthetic material, a middle layer of down, wool, or similar material to provide insulation, and an outer layer to break the wind and allow some ventilation (e.g., Gortex® or nylon). A hat or hardhat liner will help maintain body heat, and insulated boots and gloves will reduce the chance of frostbite. Workers should keep a change of dry clothing available in case work clothes become wet; drink plenty of warm liquids, avoiding caffeine and alcohol; eat high-calorie snacks to help maintain body metabolism; and work in pairs and watch for signs of cold stress.

Signs of and treatment for cold stress-related illness is presented below in **Table 8-2**.

Hypothermia: Hypothermia results when the body loses heat faster than it can be produced. When this situation first occurs, blood vessels in the skin constrict in an attempt to conserve vital internal heat. Hands and feet are first affected. If the body continues to lose heat, involuntary shivers begin. This is the body's way of attempting to produce more heat, and it is usually the first real warning sign of hypothermia. Further heat loss produces speech difficulty, confusion, loss of manual dexterity, collapse, and finally death. Wet clothes or immersion in cold water greatly increases the hypothermia risk. The progressive clinical presentation of hypothermia is described in the table below.

Frostbite: Local injury resulting from cold is included in the generic term frostbite. There are several degrees of damage. Frostbite can be categorized into:

Frost Nip or Initial Frostbite: (1st degree frostbite) Characterized by blanching or whitening of skin.

Superficial Frostbite: (2nd degree frostbite) Skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient. Blistering and peeling of the frozen skin will follow exposure.

Deep Frostbite: (3rd degree frostbite) Tissues are cold, pale, and solid; extremely serious injury with possible amputation of affected area.

Frostbite can occur without hypothermia when the extremities do not receive sufficient heat. The toes, fingers, cheeks, and ears are the most commonly affected. Frostbite occurs when there is freezing of the fluids around the cells of the affected tissues. The first symptom of frostbite is an uncomfortable sensation of coldness, followed by numbness. There may be tingling, stinging, or cramping. Contact by the skin with tools or other metal objects below 20°F (-7°C) may result in contact frostbite.

Table 8-2: Signs of Cold Stress-Related Illness and Treatment

Condition	Signs/Symptoms	Treatment
Hypothermia **Mild** Body temperature (98° - 90° F)	• Shivering • Lack of coordination • Stumbling, fumbling hands • Slurred speech • Memory loss • Pale, cold skin	• Move to warm area • Stay active • Remove wet clothes and replace with dry clothes or blankets • Cover the head • Drink warm (not hot) sugary drink for hydration
Hypothermia **Moderate** Body temperature (90° - 86° F)	• Shivering stops • Unable to walk or stand • Confused and irrational	• Move to warm area • Stay active • Remove wet clothes and replace with dry clothes or blankets • Cover the head • Drink warm (not hot) sugary drink for hydration • Call for an ambulance • Cover all extremities completely • Place very warm objects, such as hot packs or water bottles on the victim's head, neck, chest and groin
Hypothermia **Severe** Body temperature (86° - 78° F)	• Severe muscle stiffness • Very sleepy or unconscious • Ice cold skin death	• Call for an ambulance • Treat the victim very gently • Do not attempt to re-warm -- the victim should receive treatment in a hospital
Frostbite	• Cold, tingling, stinging or aching feeling in frostbitten area • Numbness • Skin color turns red, then purple, then white or very pale skin, cold to the touch • Blisters in severe cases	• Seek medical attention • Do not rub the area • Wrap in soft cloth • If help is delayed, immerse in warm, not hot, water
Trench Foot	• Tingling, itching or burning sensation • Blisters	• Soak feet in warm water, then wrap with dry cloth bandages • Drink a warm, sugary drink for hydration

SECTION NINE: SITE CONTROL

AECOM personnel will keep the MEARNG informed of RI activities as well as report any suspicious activities noticed during field operations.

9.1 EXCLUSION ZONES

Although not anticipated in the scope of this project, should site conditions require the establishment of site zones (Section 11.4), the Health and safety Officer will coordinate on-site access control. Only essential personnel will be allowed in the EZ during sampling. Site control will be maintained by communication and the following:

- Sampling will cease if nonessential personnel are present within the EZ
- A Site Control Log will be maintained to ensure accountability of all personnel on-site
- Authorized visitors will sign a Site Visitors Log and wear proper PPE
- Authorized visitors will be escorted at all times by the, Health and Safety Officer, or their designee
- A safety briefing will be provided by the Health and Safety Officer to all personnel or visitors to inform them on the potential hazards. All personnel and visitors must acknowledge this briefing via signature.
- Designated safety areas will be established in case of an emergency. The Health and Safety Office will notify the onsite, HSM, and PM if an emergency warrants site evacuation.

9.2 SITE COMMUNICATION, HAND SIGNALS AND EMERGENCY COMMUNICATIONS

A cellular phone will be available on site for emergency use. Emergency numbers will be provided to project personnel and will be available at all times workers are on site. Work will not be conducted on site if there is not access to a telephone, and site personnel will be informed of the nearest available telephone.

Cellular service can be problematic in remote areas. The nearest land line telephone is located at the MEARNG 240th Regional Training Institute at 300 Hildreth Street N, Bangor, ME 04401, immediately north of the MRS.

9.2.1 Emergency Signals

Emergency signals are critical for alerting workers of danger and to maintain site control during an emergency. All field personnel will be trained to recognize the emergency communications and signals described in **Table 9-1**.

Table 9-1: Emergency Communication Signals

Signal	Meaning
One long sound/blast of the emergency alarm signal, air horn, siren, whistle	Emergency situation, face safety watch and watch or listen for directions
Pause; followed by a number of short sounds, 1, 2, 3, or 4	Evacuate to the predestinated emergency meeting place indicated by the number of sounds
Two long blasts of the emergency alarm signal, air horn, siren, whistle	All clear
Point one arm in direction of evacuation, make a large circling motion with the other arm in direction of evacuation	Evacuate the area
Point index finger toward self	I; me
Point index finger toward object	It; them
Point index finger toward person	You; them
Circle index finger at group	We; us; all of us
Pointed finger on extended arm	Look in that direction
Beckon with index finger	Come here
Point with thumb in a particular direction	Move this way; go this way
Hold index finger up near head	Wait
Slowly ease palm face down	Relax; slow down
Put palm over brow	Scout it out; check it out
Move hand far away from body	Stay away
Hands on top of head	Need assistance
Grip partner's wrist or place both hands around partner's arm	Leave area immediately
Thumbs up	OK; I'm all right
Thumbs down	No; negative; bad; not OK
Hand gripping throat	Cannot breathe; out of air
Wave hands over head from side-to-side	Attention; stand-by for the next signal
Swing hand from direction of person receiving signal to directly overhead and through in circle	Come here
Clenched fist of extended arm	Stop motion/hold position
Draw index finger across front of throat	Shut off engine; cut off power; quit
Place palm face down and rotate from side to side	Unsure; cannot decide
Form a circle with thumb and index finer	OK; I understand; agree
Military salute	I understand and will comply

SECTION TEN: EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

When an emergency occurs, decisive action is required. Decisions must often be made immediately and personnel must be ready to respond immediately to an emergency. For this purpose, pre-emergency planning is an essential part of each project's Emergency Response Plan. Pre-emergency planning tasks will be developed and established prior to the start of site work. Pre-emergency planning for the site includes the following tasks:

- Development and approval of this Emergency Response Plan in accordance with SAM-010-PR1), Emergency Response Planning Procedures.
- Review of this Emergency Response Plan with AECOM and AECOM subcontractor personnel prior to starting work.
- Coordination of the Emergency Response Plan with local health and emergency response agencies.
- Training of site personnel in appropriate emergency procedures.
- Maintaining emergency response equipment on site, such as fire extinguishers, first aid supplies, and spill response equipment.
- Performance of an emergency response practice drill during site mobilization and before site activities begin.
- Modification of the Emergency Response Plan, if necessary, as work progresses.

Expected site conditions and operations have been evaluated by the HSM during the preparation of the Emergency Response Plan to formulate a hazard control program for the types of emergencies that may occur. For other events not anticipated, personnel will stop work, secure the site, and follow procedures as directed

If needed, client requirements will be incorporated into this Emergency Response Plan and communicated to all personnel onsite.

10.1 RESPONSE PRIORITIES

Only if it is safe to do so, AECOM personnel may choose to provide only minimal or first line response to all emergencies.

First Priority: Prevent further injury or illness by:

- Protecting response personnel;
- Isolating the scene to authorized personnel only;
- Notifying emergency response personnel; and
- If possible, rescuing any injured parties.

Second Priority: Provide first aid to persons with life-threatening injuries or illnesses.

Third Priority: Alleviate the immediate hazards by:

- Extinguishing incipient-stage fire;
- Reducing chemical releases; and/or
- Containing any spill.

10.2 EVACUATION ROUTES AND PROCEDURES

In a severe emergency such as a large fire, site evacuation may become necessary. **Table 10-1** provides the procedures for site evacuation. The Health and Safety Officer will be responsible for informing site personnel of the anticipated routes of evacuation during the morning safety briefings. The evacuation route and assembly area will correlate to the wind direction, topography, and the nature of the incident. Personnel will be advised to move to an upwind location at least 100 yards from any fires and/or releases, and will be advised to continually monitor wind direction for changes.

If moving upwind is not possible without encountering the incident, personnel will be advised to move crosswind or downwind to a distance out of the path of vapor releases, smoke, odors, or spills. In the event that a site evacuation becomes necessary, the procedures listed in the table below will be used.

Table 10-1: Site Evacuation Procedures

Step	Procedures
1	Site personnel will be notified of an emergency evacuation via horn signal or verbal command. All site personnel will immediately stop work.
2	All site personnel will evacuate the work area as quickly as possible and assemble at a location at least 100 yards upwind of the incident, or as instructed during the morning safety briefing.
3	The Health and Safety Officer will be responsible for roll call.
4	The Health and Safety Officer will contact emergency response personnel as all site personnel are being accounted for during roll call.
5	The Health and Safety Officer will ensure that emergency apparatus have adequate site access.
6	The Health and Safety Officer will ensure that all combustion equipment has been shut down.
7	All site personnel assembled at the designated safe evacuation area will wait for further instructions from emergency response personnel.

10.3 INJURY/ILLNESS TREATMENT

Site personnel will maintain current First Aid/CPR certifications. In the event of any illness or injury, the following steps will be taken:

- Evaluate the extent of injuries or seriousness of illness.
- When employees require urgent medical attention, transport to the hospital or call for emergency assistance. First aid should be administered while awaiting an ambulance or paramedics. All emergency medical treatment, other than first aid, will be administered by the local paramedics. In all cases, critical injuries must be immediately referred for professional medical attention.
- All first aid will be administered by on-site personnel trained and certified in CPR and first aid.
- All vehicles used to transport injured persons to the off-site medical facility will be provided with directions and a map to the medical facility. The Health and Safety Officer or designee will accompany the victim to the hospital.

- For a non-critical injury/illness, provide first-aid treatment and evaluate the need for further treatment.
  - AECOM personnel will utilize the services of AECOM safety staff or the Incident Hotline (1-800-348-5046) to make this evaluation and approve treatment.
  - If further treatment is approved, the HSM will provide the appropriate forms to the occupational medicine clinic. AECOM personnel should seek treatment from an occupational medicine clinic approved by the workers' compensation insurance carrier.
  - Subcontractor personnel will follow their company procedures for medical treatment and case management.

10.4 CHEMICAL EXPOSURE

In the event of a chemical exposure, the guidelines presented in **Table 10-2** will be followed.

Table 10-2: First Aid for Chemical Exposure

Type of Over Exposure	First-Aid Guidelines
Skin Contact	Skin: Wash/rinse the affected area thoroughly with copious amounts of soap and water.
	Eyes: Eyes should be rinsed for at least 15 minutes following chemical contamination.
	Contact emergency response personnel if required, or transport victim to the hospital.
Ingestion	Contact Poison Control Center.
	Contact emergency response personnel, or transport victim to the hospital.

10.5 DECONTAMINATION DURING A MEDICAL EMERGENCY

As previously indicated, few site operations will trigger contamination of any type. For minor medical problems or injuries, regular decontamination procedures will be followed. If emergency, life-saving first aid and/or medical treatment are required, regular decontamination procedures may need to be abbreviated or omitted:

- If the victim has been contaminated with acid, other chemicals, or contaminated soil: immediately wash or rinse the victim with water to rinse off the material.
- Outer garments can be removed if it does not cause a delay, interfere with treatment, or aggravate the problem.
- PPE can be cut away, and respiratory protective equipment must always be removed.
- If contaminated clothing cannot be safely removed, then the victim should be wrapped in a blanket or plastic sheeting to prevent the contamination of the inside of the ambulance and/or emergency response personnel.

The Health and Safety Officer will advise the medical staff of the type of contamination.

10.6 ON-SITE MEDICAL SUPPORT

AECOM field personnel will have current first aid/CPR certification. These personnel will provide initial treatment, while waiting for the local paramedics to arrive. Emergency medical assistance will be coordinated through the appropriate public emergency response resources. Local fire and police departments will respond to 911 calls and provide emergency response to incidents involving AECOM personnel. As appropriate, emergency responders will administer on-site medical treatment beyond initial first aid and will transport AECOM employees to the hospital, as required.

10.7 OFF-SITE MEDICAL SUPPORT

In all cases, critical injuries must be immediately referred for professional medical attention.

When employees require urgent medical attention, transport them to the hospital or call for emergency assistance. First aid should be administered while awaiting an ambulance or paramedics. All emergency medical treatment, other than first aid, will be administered by the local paramedics.

Figure 10-1 and Figure 10-2 provide maps and directions to the nearest hospital and occupational health clinic, respectively. **Table 10-3** lists the emergency telephone numbers for the site. In the event that 911 service is not available at the work site, MEARNG PM Andrew Flint (207-430-5901) should be contacted to direct emergency personnel to the work site.

Table 10-3: Bangor Range Emergency Telephone Numbers

EMERGENCY TELEPHONE NUMBERS	
Ambulance Service:	911
Fire:	911
Police:	911
Hospital: Eastern Maine Medical Center (EMMC) 489 State St. Bangor, Maine 04401	(207)-973-7000
National Spill Response Center	(800) 424-8802
Poison Control Center	(800) 222-1222
Federal OSHA Hot Line	(800) 321-6742
THE FOLLOWING AECOM PEOPLE WILL BE NOTIFIED IF AN INCIDENT HAS OCCURRED:	
AECOM Region SH&E Manager: Tony Indorato	Work: (813) 645-2804 Cell: (757) 298-1563
AECOM HSM & Area SH&E Manager: Alberto Munuera	Cell: (757) 408-4276
Incident Hotline	(800) 348-5046
AECOM Health & Safety Officer: Joe Witte	Work: (301) 820-3267 Cell: (301) 300-9873
AECOM PM: Rosa Gwinn	Work: (301) 820-3123 Cell: (301) 820-3131
ARNG	
ARNG PM/COR: MAJ Julie Hatcher	Work: (703) 601-7608
ARNG ME PM: Andrew Flint	Work: 207-430-5901

Figure 10-1: Hospital Directions

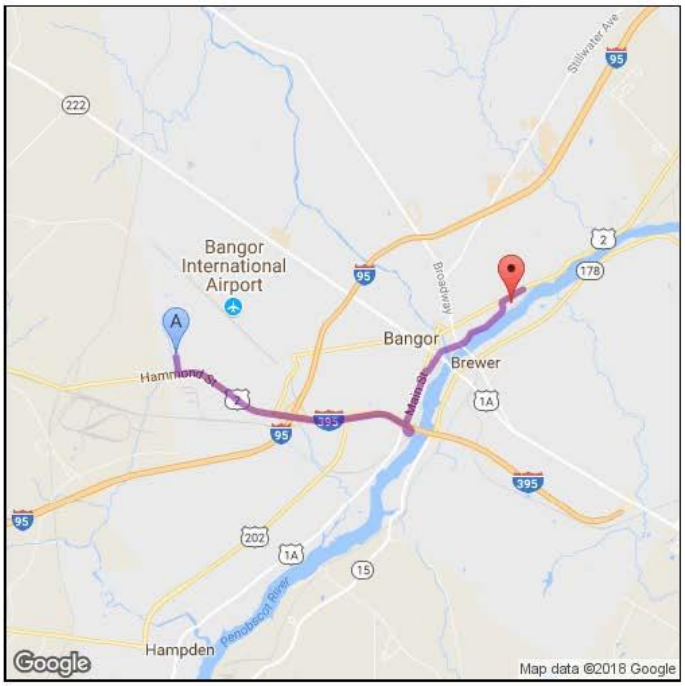
Provider	**Eastern Maine Medical Center**
Address	489 State St Bangor, ME 04401
Specialty	Hospital: Acute Care
National Provider Identifier	1790789147
Phone	207-973-5450, 207-973-7000, 207-973-9500
Fax	207-973-5020, 207-973-7985
Primary Location?	Y
Accepting New WorkComp Patients?	Y
Services	Ambulatory Surgery Center Cardiac Care Unit Cardiovascular Surgery Emergency Department Intensive Care Laboratory Neonatal Intensive Care Unit (NICU) Occupational Medicine Outpatient Facility Outpatient Surgery Prenatal Services Rehabilitation Physical Therapy

TEXT PROVIDER INFO TO MOBILE PHONE

Type a phone number

Send

DRIVING DIRECTIONS



From: Hildreth N Bangor, ME

To: 489 State St Bangor, ME 04401

New Start Address

1.	Head south on Hildreth St N toward Hammond St	0.2 mi
2.	Turn left at the 1st cross street onto Hammond St	1.4 mi
3.	Continue straight onto I-395 E	108 ft
4.	Keep left to stay on I-395 E	1.4 mi
5.	Take exit 3A-3B for US-202 E toward Bangor/Downtown	0.5 mi
6.	Continue onto US-202 E/Main St	0.2 mi
7.	Continue straight onto Main St	0.5 mi
8.	Turn right toward Summer St	148 ft
9.	Turn left onto Summer St	0.3 mi
10.	Continue onto Independent St	344 ft
11.	Continue onto Washington St	0.4 mi
12.	Washington St turns right and becomes Hancock St	0.6 mi
13.	Turn right onto State St	0.3 mi
	Destination will be on the right	
	Estimated driving time: 14 minutes	6.0 mi

Figure 10-2: Clinic Directions

Provider	**Concentra Medical Center**
Address	34 Gilman Road Bangor, ME 04401
Specialty	Occupational Medicine
Language	Arabic, Armenian, Burmese, Cantonese, Chinese, French, German, Haitian Creole, Italian, Japanese, Korean, Mandarin, Polish, Portuguese, Russian, Somali, Spanish, Urdu
National Provider Identifier	1033395033
Phone	207-941-8300
Fax	207-947-3134
Hours	Mon-Fri 7:00 am - 5:00 pm
Language Line	Y
Accepting New WorkComp Patients?	Y

TEXT PROVIDER INFO TO MOBILE PHONE

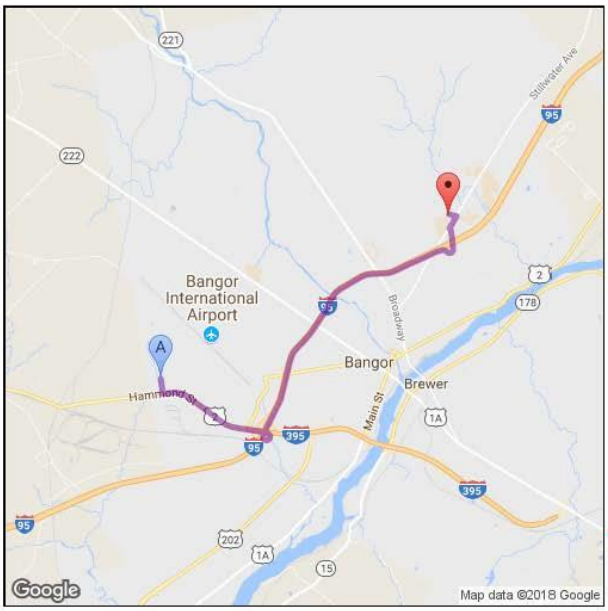
Type a phone number Send

DRIVING DIRECTIONS

From: Hildreth N Bangor, ME New Start Address

To: 34 Gilman Road Bangor, ME 04401

1. Head south on Hildreth St N toward Hammond St 0.2 mi



2. Turn **left** at the 1st cross street onto **Hammond St** 1.4 mi
3. Continue straight onto **I-395 E** 108 ft
4. Keep **left** to stay on **I-395 E** 0.2 mi
5. Take exit **1B** to merge onto **I-95 N** toward **ME-154 N/Orono** 4.1 mi
6. Take exit **186** for **Stillwater Avenue** 0.6 mi
7. Turn **right** onto **Stillwater Ave** 0.2 mi
8. Turn **left** onto **Gilman Rd** 0.1 mi

Destination will be on the left

Estimated driving time: 11 minutes 6.8 mi

☐ TEXT DRIVING DIRECTIONS TO MOBILE PHONE

Type a phone number Send

10.8 MEDICAL SURVEILLANCE

AECOM's SAM-128-PR1, Medical Screening and Surveillance, details the requirements to participate in a medical monitoring program. Medical Surveillance provides a streamlined process to determine if employees meet the physical requirements to perform assigned duties as defined by applicable regulations. It 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

All accidents and potential exposures must be reported immediately to the Health and Safety Officer, HSM, or Area or Region SH&E Manager to arrange for medical exams or tests that may be indicated as part of the medical surveillance program. Depending on the type of incident, it may be critical to perform tests within 24 to 48 hours. Failure to report an injury or incident immediately will result in disciplinary action.

10.9 EMERGENCY RESPONSE PLANS (FIRES)

10.9.1 Small Incident/Fire

A small fire is defined as a fire that can be extinguished with an available 20-pound ABC fire extinguisher. An incipient fire is a fire that is small because it has just started. In the event of a small or incipient fire, the following minimum actions will be taken:

- Evacuate nearby personnel from the area, if possible, to an upwind location, or to an area not affected by smoke or hazardous decomposition products if an upwind location is not feasible.
- Attempt to extinguish fire using portable fire extinguisher or by smothering.
- Contact emergency response personnel, as needed, for any injuries or exposures to hazardous decomposition products.
- After the fire has been extinguished, or emergency response personnel have been contacted, notify the AECOM PM and HSM.

10.9.2 Large Fire/Explosion

An explosion, large fire, or a small fire that cannot be extinguished is beyond the first line response capabilities of AECOM personnel. Professional emergency response personnel would be needed to provide emergency assistance for these types of incidents. In the event of a large fire, explosion, or a small fire that cannot be extinguished, the following minimum actions will be taken:

- Evacuate all personnel from the site, if possible, to an upwind location, or to an area not affected by smoke or hazardous decomposition products if an upwind location is not feasible.
- Perform a quick roll call to account for all site personnel.
- Contact the fire department.

- Contact emergency response personnel, as needed, for any injuries or exposures to hazardous decomposition products.
- After emergency response personnel have been contacted, notify the PM and HSM

10.9.3 Fires Involving Explosives

If a fire occurs in an area containing explosive materials, the Health and Safety Officer will immediately direct site personnel to an upwind location. The Health and Safety Officer will make notifications to the appropriate agencies. At no time will AECOM personnel fight a fire where explosive material is present.

10.9.4 Hazardous Substance Spill or Release

It is not expected that any spills of hazardous materials will occur from AECOM activities on site. In the event that a hazardous substance spill or release occurs, the following steps will be taken:

- Evacuate site personnel, if necessary. Follow the evacuation sequence outlined in Section 10.2.
- Attempt to determine the source of leak or release, the contaminants involved, and the approximate volume of the leaked or released substance.
- After the spill/release has been contained, or emergency response personnel have been contacted, notify the PM.
- A spill or release of a hazardous substance at or above its reportable quantity will require reporting to the National Spill Response Center at (800) 424-8802.

10.9.5 Emergency Equipment and First Aid Requirements

First aid/CPR support will be provided by trained AECOM personnel. In the event that specialized or elevated care is necessary, the AECOM Incident Hotline (800-348-5046) or 911ambulance service will advise or transport the injured person to the appropriate medical facility.

A supply of emergency and first aid PPE and equipment will be maintained in sufficient quantities to ensure an adequate supply for response. All emergency equipment will be fully stocked and readily accessible. American Red Cross First Aid and CPR Instruction Manuals will readily accessible. The following supplies will be available:

- Bloodborne pathogens personal protective equipment kit (minimum requirements are nitrile gloves [2 pairs] and CPR shield)
- Allergy response kit
- Portable, plastic or metal, water-resistant first-aid kit, with handle and manual
- Industrial first-aid kit (one 16-unit kit that complies with American National Standards Institute [ANSI] Z308A for every 25 persons or fewer) with the following supplies:
    - Flashlight/batteries

- Bandage scissors
- Gloves, latex free: 2 pair
- Red bag for biohazard waste disposal
- CPR breathing barrier
- Individually wrapped items:
  - Compress bandages - minimum of six in sizes ranging from 2" to 4"
  - Assorted adhesive bandages (at least 16)
  - Sterile gauze compress pads: 4" x 4"
  - Sterile nonstick gauze pads 3" x 3", minimum of 4 packages
  - Water-soluble burn dressing with gel pad (for minor burns, use after cold water soak), at least 6
  - Occlusive dressings: 4”x4”
  - Butterfly strips (wound closure)
- Tape (hypoallergenic), at least 5 yards of 3/8" wide
- Antiseptic (alcohol prep pads, towelette, or swab), at least 10 individual-use packages (must meet Food and Drug Administration CFR 333 requirements)
- Iodine prep pads (if not allergic to iodine, use after soap and water wash for bloodborne exposure)
- Ice pack or cold pack
- Gauze roller bandages: two 2" x 6 yards and one 4" x 6 yards
- Tweezers (one use, disposable)
- Temperature strips
- Triangular bandage: 40" x 40" x 56"
- Sterile normal saline eye wash, 4-ounce bottle
- Eye covering, at least 2
- Antibiotic - individual use packages only, at least 6
- Insect sting relief wipes or spray
- Aspirin, individually wrapped: at least 2 doses
- Tourniquet with windlass, combat-style: (when power tools in use)

- Spill control/absorption supplies
- Soap or waterless hand cleaner and towels
- Technu or alternative poison ivy wash or wipes
- Fire extinguishers placed in the following locations:
  - In each motor vehicle (10B:C)
  - On site (2A:20B:C)

SECTION ELEVEN: GENERAL PLAN

11.1 GENERAL SITE RULES

- All site personnel will wear PPE as required by the task.
- The buddy system will be observed at all times.
- Entry into exclusion zones not permitted without Health and Safety Officer approval and sign-in.
- All site personnel who wear corrective lenses will provide their own prescription safety glasses.
- Horseplay will not be tolerated.
- Smoking is allowed only in area designated by the Health and Safety Officer.
- Proper site housekeeping (including removal of trash and orderly stacking and removal of materials to reduce slipping, tripping, and fire hazards) will be the responsibility of all site personnel on a daily basis.
- If any unusual site conditions are noted (odors, presence of unknown liquids, suspect biohazards) or any symptoms are experienced, work will be stopped until site hazards can be evaluated.

11.2 SANITATION

Sanitation issues for this site will include the following:

- Drinking/potable water
- Toilets

Employees will not be required to perform work under unsanitary conditions. AECOM will establish and maintain hygienic sanitation provisions at Bangor Range including the following:

- Drinking/potable water (bottled water) will be kept onsite during field activities. This will be replenished, as necessary, to provide adequate supplies of potable water. Soap and water will also be available at the jobsite for washing body parts.
- Containers used for drinking water will be clearly marked and not used for any other purpose.
- Cups must not be shared by employees.
- Outlets for non-potable water (i.e., firefighting purposes) are not to be used by employees for drinking, washing, or cooking purposes.
- Toilet facilities will be available at MEARNG Regional Training Institute, adjacent to the MRS, which are accessible between 0730 and 1600 hours.

- Disposable PPE will eliminate the need for a Personnel Decontamination Station. Used PPE and refuse generated during field activities will be collected in trash bags and disposed of at an approved location.

11.3 CONTAMINATION PREVENTION

One of the most important aspects of decontamination is the prevention of contamination. Good contamination prevention should minimize worker exposure. During the use of hazardous chemicals or when potentially contaminated materials (e.g., soil) are encountered, contamination prevention protocols will be implemented. Procedures for contamination prevention for personnel include:

- Do not walk through areas of obvious or known contamination.
- Do not handle or touch contaminated materials directly.
- Make sure all PPE is free of cuts or tears prior to donning.
- Fasten all closures on suits, covering with tape if necessary.
- Particular care should be taken to protect any skin injuries. If open wounds exist on hands or forearms, handling contaminated materials or samples should be restricted or eliminated.
- Stay upwind of airborne contaminants.
- Do not carry cigarettes, gum, chewing tobacco, cosmetics, etc. into potentially contaminated areas.

Procedures for contamination prevention for equipment include:

- Take care to limit the amount of contamination that comes in contact with heavy equipment.
- If contaminated tools are to be placed on non-contaminated equipment for transport, use plastic to keep non-contaminated surfaces clean.

11.4 SITE ZONES

Although not anticipated in the scope of this project, should site conditions require the establishment of site zones to control the potential spread of contamination, a three-zone system will be implemented. Prior to the start of any activities involving the contaminants of concern, a Support Zone (SZ), a Transition Zone (TZ), and an EZ will be identified.

- *Support Zone* - A non-contaminated area that will be separated from the EZ by the TZ. It contains a center for team communications and emergency response. Appropriate sanitary, safety, and support equipment are also located in this zone. Site operations will be controlled from this location. A log will be kept in the SZ of all personnel entering and exiting the site.

- *Transition Zone* - Established between the EZ and the SZ, the TZ provides for personnel and equipment decontamination. The TZ will be used for EZ entry and exit and for donning and removing PPE.
- *Exclusion Zone* - The areas that contain, or are suspected to contain physical hazards or contaminants of concern are the EZs. Prior to the start of each task, the EZ "hot line," or boundary, will be clearly identified using physical marking systems, which may include stanchions, warning tape, jersey barriers, fencing, or other methods. The Health and Safety Officer will determine the appropriate type of physical marking system at the time of zone establishment. Selection will depend on the activity being conducted within the EZ, as well as the potential for the presence of visitors in the area. All areas that contain, or are suspected to contain, contaminants of concern will be marked as an EZ. Personnel are not allowed in the EZ without:
    - A "buddy"
    - Appropriate PPE
    - Current OSHA medical authorization
    - Current OSHA training certification

Work areas will be clearly marked to alert visitors to the hazards associated with the area. This shall include the placement of appropriate signage and, where necessary, the erection of physical barriers (e.g., barricades). At a minimum, caution tape will be used to mark EZs.

11.5 PERSONNEL DECONTAMINATION

All personnel handling hazardous chemicals will pass through a decontamination station, where conditions necessitate. To reduce the volume of water generated through decontamination, protective clothing will be discarded instead of cleaned and reused. The generation of decontamination water should be minimized whenever possible. The steps outlined in **Table 11-1** will be taken for personnel decontamination when exiting the chemical handling area. The decontamination setup is subject to modification by the Health and Safety Officer.

Equipment and supplies needed for the personnel decontamination station include:

- Plastic buckets and scrub brushes for glove wash and rinse
- Plastic sheeting
- Wash tubs for boot wash and rinse
- Detergent/water solution (non-phosphate detergent)
- Long-handled soft bristle scrub brushes for boot wash

Table 11-1: Personnel Decontamination Procedure

Step	Description
1	Deposit all equipment and tools used in the EZ onto plastic sheeting or into plastic-lined containers.
2	Scrub boots and any soiled PPE thoroughly with a soapy wash solution and a scrub brush. Rinse off boots and PPE.
3	Remove tape from around boots and sleeves and dispose of into a plastic-lined drum.
4	Remove gloves (inside out) and dispose of into a plastic-lined drum.
5	Thoroughly wash prior to eating, drinking, smoking, or using the rest room.

11.6 EQUIPMENT DECONTAMINATION

Hand tools will be decontaminated using phosphate free detergent and distilled water. Wash water is anticipated to be minor in volume and discharged directly at the site of generation. All tools will be cleaned prior to site entry to remove grease, oil, dirt, or any other off-site materials. The Health and Safety Officer will inspect the equipment prior to approving the items for use on site. The Health and Safety Officer will also be responsible for inspecting all items for adequacy of decontamination prior to removal off site. The inspection will be noted in the Health and Safety Officer's logbook. Other site materials will be disposed of as normal trash.

The steps in **Table 11-2** will be taken when decontaminating small equipment:

Table 11-2: Small Equipment Decontamination Procedure

Step	Description
1	Wrap small equipment such as soil probe and hand auger in plastic sheeting.
2	Transport the small equipment from the EZ to the decontamination location.
3	Rinse small equipment with a spray bottle filled with distilled water.
4	Scrub small equipment with soapy water using brushes and a phosphate-free soap.
5	Rinse small equipment with distilled water until free from suds.
6	Place small equipment on clean plastic sheeting and allow it to dry.

11.7 DISPOSAL OF DECONTAMINATION WASTE

PPE that may have come in contact with contaminated media will be decontaminated with phosphate free detergent and rinsed with potable water. The used and decontaminated PPE will be collected in plastic trash bags and disposed of as regular trash. The small volumes of decontamination water will be allowed to infiltrate into the soil.

SECTION TWELVE: REQUIRED DOCUMENTATION

The following documentation must be kept on site or readily accessible:

- Current Hazardous Waste Operation and Emergency Response (HAZWOPER) training certificates (including 8-hour refresher and site supervisor training);
- Current First Aid/CPR certification;
- SDSs for all hazardous chemicals brought on site by AECOM and its subcontractors;
- OSHA-required medical surveillance examination clearance records;
- Field logbook;
- Copies of any Incident Reports such as:
  - AECOM Incident Report; and
- Signed copies of the SSHP Compliance Agreement;
- Site Safety Briefing Form;
- Deficiency Tracking Log
- Completed AHA forms
- Medical Data Sheets for all site personnel;
- Any other permits, training records, or documentation.

12.1 TRAINING LOGS

Training logs will include initial site-specific safety training, daily safety briefings, weekly "toolbox" topic training, and visitor training. A record of the training will be documented on a training log, which will include the following information:

- The date;
- Employee's name;
- Time allocation in training session;
- Training topic(s); and
- Trainer(s) signature.

12.2 FIELD LOG BOOKS

The Health and Safety Officer will maintain a logbook on site in accordance with standard AECOM procedures. Complete and detailed documentation of site activities will be very important. The following information will be recorded on a daily basis:

- Site conditions (e.g., weather);
- Activities being performed;
- Log of photographs taken;
- Personnel on site;
- Site visitors;
- Incidents, accident, and near misses;
- Violations of health and safety procedures; and
- Other significant events.

SECTION THIRTEEN: REFERENCES

Maine Department of Inland Fisheries and Wildlife, 2018. Snakes Webpage. https://www1.maine.gov/ifw/, Accessed January 2018.

U.S. Department of Agriculture Plants Database, http://plants.usda.gov/java/stateSearch, Accessed January 2018.

U.S. Department of Agriculture, Office of Homeland Security & Emergency Coordination Radiation Safety Division. Portable X-Ray Fluorescence Analyzer https://www.dm.usda.gov/ohsec/rsd/xfa.htm. Accessed January 2018.

USACE, 2014. Safety and Health Requirements Manual, EM 385-1-1. 30 November.

Attachment A

AECOM Safety, Health and Environment Policy and Management System

Safety, Health and Environment Policy Statement

Purpose

This policy establishes the framework to attain best-in-class Safety, Health and Environmental (SH&E) performance for AECOM's employees in the global marketplace.

Commitment

AECOM is committed to exceptional levels of performance in safeguarding our people and the environment as one of our Core Values. Keeping our people safe is our most important measure of success. We strive to be the beacon of safety excellence in the industries and global communities in which we work.

To advance our SH&E program, we are committed to:

- Zero work-related injuries to AECOM employees and protection of the environment as a result of our activities.
- Providing a highly effective SH&E management system that drives continual review and improvement.
- Meeting client requirements and properly incorporating all safety, health and environmental rules and regulations at the local, state, provincial and national levels.
- Developing an exceptional safety culture where our people embrace ownership for the safety of themselves and others.
- Advancing our goals of pollution prevention, resource conservation and environmental sustainability.
- Setting and meeting aggressive SH&E performance goals and Core Value Metrics to promote continuous improvement.
- Working with employees and business partners in order to continuously improve SH&E performance.
- Recognizing and celebrating those who contribute to excellent SH&E performance.
- Striving to make AECOM the provider of choice for the safe execution of design, build, finance, operate and maintenance work globally.

The commitment to this policy by the leadership, management and employees of AECOM provides the foundation for a safe workplace, operational excellence and long-term business success.

Expectations

Safety is a core value and a key to our success. We demand continuous improvement in our journey toward a zero incident culture, where everyone is committed to safety, health and environmental excellence.

To that end, we demand:

- Our leaders, managers, supervisors and employees demonstrate their commitment in their actions and decisions to assure that every person goes home safe every day.
- Our employees embrace safety as a core value both on and off the job.
- Each employee is committed to his/her own safety and that of his/her fellow employees.
- We will incorporate AECOM's Life-Preserving Principles into our work planning and execution.
- We proactively and aggressively identify, manage and eliminate hazards in the workplace.
- We train and prepare our people to have the knowledge, skills, competency and equipment required to work safely.
- We stop our employees from working if the work cannot be executed safely or if conditions or behaviors on the work activity are unsafe.
- All employees immediately report safety, health and/or environmental incidents, near-misses, unsafe conditions, and at-risk behaviors to their supervisor; and that we diligently work to correct the problem.

Our SH&E expectations will be accomplished by the demonstrated leadership of management, compliance with regulatory requirements and participation of AECOM personnel.

Communication

This Policy will be reviewed annually to ensure it meets the needs of the company, and will be made available to all persons under the control of the company.

Sincerely:

M. Burke

Michael S. Burke
Chairman and Chief Executive Officer

04 March 2017
Date

Safety for life

Attachment B

Safety Data Sheets

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 **Revision** : 12.10.2015

Trade Name: Alconox

1 Identification of the substance/mixture and of the supplier

1.1 Product identifier

Trade Name: Alconox
Synonyms:
Product number: Alconox

1.2 Application of the substance / the mixture : Cleaning material/Detergent

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer
Alconox, Inc.
30 Glenn Street
White Plains, NY 10603
1-914-948-4040

Supplier
Not Applicable

Emergency telephone number:
ChemTel Inc
North America: 1-800-255-3924
International: 01-813-248-0585

2 Hazards identification

2.1 Classification of the substance or mixture:

In compliance with EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments.

Hazard-determining components of labeling:
Tetrasodium Pyrophosphate
Sodium tripolyphosphate
Sodium Alkylbenzene Sulfonate

2.2 Label elements:

Skin irritation, category 2.
Eye irritation, category 2A.

Hazard pictograms:

Signal word: Warning

Hazard statements:
H315 Causes skin irritation.
H319 Causes serious eye irritation.

Precautionary statements:
P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P321 Specific treatment (see supplemental first aid instructions on this label).
P332+P313 If skin irritation occurs: Get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P501 Dispose of contents and container as instructed in Section 13.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 **Revision** : 12.10.2015

Trade Name: Alconox

Additional information: None.

Hazard description

Hazards Not Otherwise Classified (HNOC): None

Information concerning particular hazards for humans and environment:

The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

Classification system:

The classification is according to EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments, and extended by company and literature data. The classification is in accordance with the latest editions of international substances lists, and is supplemented by information from technical literature and by information provided by the company.

3 Composition/information on ingredients

3.1 Chemical characterization : None

3.2 Description : None

3.3 Hazardous components (percentages by weight)

Identification	Chemical Name	Classification	Wt. %
CAS number: 7758-29-4	Sodium tripolyphosphate	Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	12-28
CAS number: 68081-81-2	Sodium Alkylbenzene Sulfonate	Acute Tox. 4; H303 Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	8-22
CAS number: 7722-88-5	Tetrasodium Pyrophosphate	Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	2-16

3.4 Additional Information : None.

4 First aid measures

4.1 Description of first aid measures

General information: None.

After inhalation:

Maintain an unobstructed airway.
Loosen clothing as necessary and position individual in a comfortable position.

After skin contact:

Wash affected area with soap and water.
Seek medical attention if symptoms develop or persist.

After eye contact:

Rinse/flush exposed eye(s) gently using water for 15-20 minutes.
Remove contact lens(es) if able to do so during rinsing.
Seek medical attention if irritation persists or if concerned.

After swallowing:

Rinse mouth thoroughly.
Seek medical attention if irritation, discomfort, or vomiting persists.

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Effective date: 12.08.2015 **Revision** : 12.10.2015

Trade Name: Alconox

4.2 Most important symptoms and effects, both acute and delayed

None

4.3 Indication of any immediate medical attention and special treatment needed:

No additional information.

5 Firefighting measures

5.1 Extinguishing media

Suitable extinguishing agents:

Use appropriate fire suppression agents for adjacent combustible materials or sources of ignition.

For safety reasons unsuitable extinguishing agents : None

5.2 Special hazards arising from the substance or mixture :

Thermal decomposition can lead to release of irritating gases and vapors.

5.3 Advice for firefighters

Protective equipment:

Wear protective eye wear, gloves and clothing.
Refer to Section 8.

5.4 Additional information :

Avoid inhaling gases, fumes, dust, mist, vapor and aerosols.
Avoid contact with skin, eyes and clothing.

6 Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures :

Ensure adequate ventilation.
Ensure air handling systems are operational.

6.2 Environmental precautions :

Should not be released into the environment.
Prevent from reaching drains, sewer or waterway.

6.3 Methods and material for containment and cleaning up :

Wear protective eye wear, gloves and clothing.

6.4 Reference to other sections : None

7 Handling and storage

7.1 Precautions for safe handling :

Avoid breathing mist or vapor.
Do not eat, drink, smoke or use personal products when handling chemical substances.

7.2 Conditions for safe storage, including any incompatibilities :

Store in a cool, well-ventilated area.

7.3 Specific end use(s):

No additional information.

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Effective date: 12.08.2015 **Revision** : 12.10.2015

Trade Name: Alconox

8 Exposure controls/personal protection

8.1 Control parameters :

7722-88-5, Tetrasodium Pyrophosphate, OSHA TWA 5 mg/m3.

8.2 Exposure controls

Appropriate engineering controls:

Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling.

Respiratory protection:

Not needed under normal conditions.

Protection of skin:

Select glove material impermeable and resistant to the substance.

Eye protection:

Safety goggles or glasses, or appropriate eye protection.

General hygienic measures:

Wash hands before breaks and at the end of work.
Avoid contact with skin, eyes and clothing.

9 Physical and chemical properties

Appearance (physical state, color):	White and cream colored flakes - powder	**Explosion limit lower**: **Explosion limit upper**:	Not determined or not available. Not determined or not available.
Odor:	Not determined or not available.	**Vapor pressure at 20°C**:	Not determined or not available.
Odor threshold:	Not determined or not available.	**Vapor density**:	Not determined or not available.
pH-value:	9.5 (aqueous solution)	**Relative density**:	Not determined or not available.
Melting/Freezing point:	Not determined or not available.	**Solubilities**:	Not determined or not available.
Boiling point/Boiling range:	Not determined or not available.	**Partition coefficient (n-octanol/water)**:	Not determined or not available.
Flash point (closed cup):	Not determined or not available.	**Auto/Self-ignition temperature**:	Not determined or not available.
Evaporation rate:	Not determined or not available.	**Decomposition temperature**:	Not determined or not available.

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Effective date: 12.08.2015 **Revision** : 12.10.2015

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Flammability (solid, gaseous):	Not determined or not available.	**Viscosity**:	a. Kinematic: Not determined or not available. b. Dynamic: Not determined or not available.
Density at 20°C:	Not determined or not available.		

10 Stability and reactivity

10.1 Reactivity : None

10.2 Chemical stability : None

10.3 Possibility hazardous reactions : None

10.4 Conditions to avoid : None

10.5 Incompatible materials : None

10.6 Hazardous decomposition products : None

11 Toxicological information

11.1 Information on toxicological effects :

Acute Toxicity:

Oral:

: LD50 > 5000 mg/kg oral rat - Product .

Chronic Toxicity: No additional information.

Skin corrosion/irritation:

Sodium Alkylbenzene Sulfonate: Causes skin irritation. .

Serious eye damage/irritation:

Sodium Alkylbenzene Sulfonate: Causes serious eye irritation .

Tetrasodium Pyrophosphate: Rabbit - Risk of serious damage to eyes .

Respiratory or skin sensitization: No additional information.

Carcinogenicity: No additional information.

IARC (International Agency for Research on Cancer): None of the ingredients are listed.

NTP (National Toxicology Program): None of the ingredients are listed.

Germ cell mutagenicity: No additional information.

Reproductive toxicity: No additional information.

STOT-single and repeated exposure: No additional information.

Additional toxicological information: No additional information.

12 Ecological information

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12.1 Toxicity:

Sodium Alkylbenzene Sulfonate: Fish, LC50 1.67 mg/l, 96 hours.
Sodium Alkylbenzene Sulfonate: Aquatic invertebrates, EC50 Daphnia 2.4 mg/l, 48 hours.
Sodium Alkylbenzene Sulfonate: Aquatic Plants, EC50 Algae 29 mg/l, 96 hours.
Tetrasodium Pyrophosphate: Fish, LC50 - other fish - 1,380 mg/l - 96 h.
Tetrasodium Pyrophosphate: Aquatic invertebrates, EC50 - Daphnia magna (Water flea) - 391 mg/l - 48 h.

12.2 Persistence and degradability: No additional information.

12.3 Bioaccumulative potential: No additional information.

12.4 Mobility in soil: No additional information.

General notes: No additional information.

12.5 Results of PBT and vPvB assessment:

PBT: No additional information.

vPvB: No additional information.

12.6 Other adverse effects: No additional information.

13 Disposal considerations

13.1 Waste treatment methods (consult local, regional and national authorities for proper disposal)

Relevant Information:

It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities. (US 40CFR262.11).

14 Transport information

14.1 UN Number: None
ADR, ADN, DOT, IMDG, IATA

14.2 UN Proper shipping name: None
ADR, ADN, DOT, IMDG, IATA

14.3 Transport hazard classes:
ADR, ADN, DOT, IMDG, IATA

Class: None
Label: None
LTD. QTY: None

US DOT
Limited Quantity Exception: None

Bulk:
RQ (if applicable): None
Proper shipping Name: None
Hazard Class: None
Packing Group: None
Marine Pollutant (if applicable): No additional information.

Non Bulk:
RQ (if applicable): None
Proper shipping Name: None
Hazard Class: None
Packing Group: None
Marine Pollutant (if applicable): No additional information.

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Effective date: 12.08.2015 **Revision** : 12.10.2015

Trade Name: Alconox

	Comments: None	**Comments:** None
14.4	**Packing group:** ADR, ADN, DOT, IMDG, IATA	None
14.5	**Environmental hazards** :	None
14.6	**Special precautions for user:**	None
	Danger code (Kemler):	None
	EMS number:	None
	Segregation groups:	None
14.7	**Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code:**	Not applicable.
14.8	**Transport/Additional information:**	
	Transport category:	None
	Tunnel restriction code:	None
	UN "Model Regulation":	None

15 Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture.

North American

SARA

Section 313 (specific toxic chemical listings): None of the ingredients are listed.
Section 302 (extremely hazardous substances): None of the ingredients are listed.

CERCLA (Comprehensive Environmental Response, Clean up and Liability Act) Reportable

Spill Quantity: None of the ingredients are listed.

TSCA (Toxic Substances Control Act):

Inventory: All ingredients are listed.
Rules and Orders: Not applicable.

Proposition 65 (California):

Chemicals known to cause cancer: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for females: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for males: None of the ingredients are listed.

Chemicals known to cause developmental toxicity: None of the ingredients are listed.

Canadian

Canadian Domestic Substances List (DSL):
All ingredients are listed.

EU

REACH Article 57 (SVHC): None of the ingredients are listed.

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Trade Name: Alconox

Germany MAK: Not classified.

Asia Pacific

Australia

Australian Inventory of Chemical Substances (AICS): All ingredients are listed.

China

Inventory of Existing Chemical Substances in China (IECSC): All ingredients are listed.

Japan

Inventory of Existing and New Chemical Substances (ENCS): All ingredients are listed.

Korea

Existing Chemicals List (ECL): All ingredients are listed.

New Zealand

New Zealand Inventory of Chemicals (NZOIC): All ingredients are listed.

Philippines

Philippine Inventory of Chemicals and Chemical Substances (PICCS): All ingredients are listed.

Taiwan

Taiwan Chemical Substance Inventory (TSCI): All ingredients are listed.

16 Other information

Abbreviations and Acronyms: None

Summary of Phrases

Hazard statements:

H315 Causes skin irritation.
H319 Causes serious eye irritation.

Precautionary statements:

P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P321 Specific treatment (see supplemental first aid instructions on this label).
P332+P313 If skin irritation occurs: Get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P501 Dispose of contents and container as instructed in Section 13.

Manufacturer Statement:

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

NFPA: 1-0-0

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 **Revision** : 12.10.2015

Trade Name: Alconox

HMIS: 1-0-0

Safety Data Sheet

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

Material Name	:	**Gasoline**
Other Names / Synonyms	:	MOGAS, ULG 95, 88 RON, 90 RON, 91 RON, 92 RON, 93 RON, 95 RON, 97 UNLD, 91 UNLD
Recommended Use / Restrictions of Use	:	Fuel for spark ignition engines designed to run on unleaded fuel.
Supplier	:	**Shell Eastern Trading (PTE) Ltd** 9 North Buona Vista Drive, #07-01, Tower 1, The Metropolis Singapore 138588 Singapore
Telephone	:	+65-6384 8000
Emergency Telephone Number	:	+44 (0) 151 350 4595

2. HAZARDS IDENTIFICATION

GHS Classification	:	Flammable liquids, Category 1 Skin corrosion/irritation, Category 2 Aspiration hazard, Category 1 Toxic to reproduction, Category 2 Germ cell mutagenicity, Category 1B Carcinogenicity, Category 1B Specific target organ toxicity - single exposure, Category 3, Inhalation, Narcotic effects. Acute hazards to the aquatic environment, Category 2 Hazardous to the aquatic environment - Long-term Hazard, Category 2
GHS Label Elements **Symbol(s)**	:	
Signal Words	:	Danger
Hazard Statement	:	PHYSICAL HAZARDS:

H224: Extremely flammable liquid and vapour.

HEALTH HAZARDS:
H304: May be fatal if swallowed and enters airways.
H315: Causes skin irritation.
H336: May cause drowsiness or dizziness.
H340: May cause genetic defects.
H350: May cause cancer.
H361: Suspected of damaging fertility or the unborn child.

ENVIRONMENTAL HAZARDS:
H401: Toxic to aquatic life.
H411: Toxic to aquatic life with long lasting effects.

GHS Precautionary Statements

Prevention : P201: Obtain special instructions before use.
P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P280: Wear protective gloves/protective clothing/eye protection/face protection.

Response : P301+P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.

Storage : P403+P233: Store in a well-ventilated place. Keep container tightly closed.

Disposal: : P501: Dispose of contents and container to appropriate waste site or reclaimer in accordance with local and national regulations.

Other Hazards which do not result in classification : Liquid evaporates quickly and can ignite leading to a flash fire, or an explosion in a confined space. This material is a static accumulator. Even with proper grounding and bonding, this material can still accumulate an electrostatic charge. If sufficient charge is allowed to accumulate, electrostatic discharge and ignition of flammable air-vapour mixtures can occur.
Slightly irritating to respiratory system. This product contains benzene which may cause leukaemia (AML - acute myelogenous leukaemia). May cause MDS (Myelodysplastic Syndrome).

Additional Information : This product is intended for use in closed systems only.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Mixture Description : Complex mixture of hydrocarbons consisting of paraffins, cycloparaffins, aromatic and olefinic hydrocarbons with carbon numbers predominantly in the C4 to C12 range. Includes benzene at 0.1 - 5% v/v. Contains oxygenated hydrocarbons which may include methyl tertiary butyl ether (MTBE) and other ethers. May also contain several additives at <0.1% v/v each.

Synonyms : MOGAS, ULG 95, 88 RON, 90 RON, 91 RON, 92 RON, 93 RON, 95 RON, 97 UNLD, 91 UNLD

Classification of components according to GHS

Chemical Identity	Synonyms	CAS	Hazard Class (category)	Hazard Statement	Conc.
Gasoline, low boiling point naphtha	Gasoline, low boiling point naphtha	86290-81-5	Flam. Liq., 1; Skin Corr., 2; Asp. Tox., 1; Muta., 1B; Carc., 1B; STOT SE, 3; Aquatic Chronic, 2; Aquatic Acute, 2; Repr., 2;	H224; H315; H304; H340; H350; H336; H411; H401; H361;	85.00 - 100.00 %
Ethyl tertiary butyl ether	Ethyl tertiary butyl ether	637-92-3	Flam. Liq., 2; STOT SE, 3; Asp. Tox., 2; Aquatic Acute, 3;	H225; H336; H305; H402;	0.00 - 15.00 %
Methyl tertiary butyl ether	Methyl tertiary butyl ether	1634-04-4	Flam. Liq., 2; Skin Corr., 3; Acute Tox., 5; Asp. Tox., 2;	H225; H316; H303; H305;	0.00 - 15.00 %
Tertiary amyl methyl ether	Tertiary amyl methyl ether	994-05-8	Flam. Liq., 2; Acute Tox., 4; STOT SE, 3;	H225; H302; H336;	0.00 - 15.00 %

Additional Information : Contains Benzene, CAS # 71-43-2. Contains Toluene, CAS # 108-88-3. Contains Ethylbenzene, CAS # 100-41-4. Contains n-Hexane, CAS # 110-54-3. Contains Xylene (Mixed Isomers), CAS # 1330-20-7. Contains Cyclohexane, CAS# 110-82-7. Contains Cumene, CAS# 98-82-8 Contains Tri-methyl-benzene (all isomers), CAS# 25551-13-7.

Contains Naphthalene, CAS # 91-20-3.

The amount of oxygenated components is limited at 2.7 % m/m calculated as oxygen. Alcohols may be present at <0.1%v. Dyes and markers can be used to indicate tax status and prevent fraud. Refer to Ch 16 for full text of H phrases.

Refer to chapter 16 for full text of EC R-phrases.

4. FIRST-AID MEASURES

Inhalation	:	Remove to fresh air. If rapid recovery does not occur, transport to nearest medical facility for additional treatment.
Skin Contact	:	Remove contaminated clothing. Immediately flush skin with large amounts of water for at least 15 minutes, and follow by washing with soap and water if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment. When using high pressure equipment, injection of product under the skin can occur. If high pressure injuries occur, the casualty should be sent immediately to a hospital. Do not wait for symptoms to develop.
Eye Contact	:	Flush eyes with water while holding eyelids open. Rest eyes for 30 minutes. If redness, burning, blurred vision, or swelling persist transport to the nearest medical facility for additional treatment.
Ingestion	:	If swallowed, do not induce vomiting: transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. If any of the following delayed signs and symptoms appear within the next 6 hours, transport to the nearest medical facility: fever greater than 101° F (38.3°C), shortness of breath, chest congestion or continued coughing or wheezing.
Most Important Symptoms/Effects, Acute & Delayed	:	Skin irritation signs and symptoms may include a burning sensation, redness, or swelling. Eye irritation signs and symptoms may include a burning sensation and a temporary redness of the eye. If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. The onset of respiratory symptoms may be delayed for several hours after exposure. Breathing of high vapour concentrations may cause central nervous system (CNS) depression resulting in dizziness, light-headedness, headache, nausea and loss of coordination. Continued inhalation may result in unconsciousness and death. Auditory system effects may include temporary hearing loss and/or ringing in the ears.

Immediate medical attention, special treatment	:	Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Specific hazards arising from Chemicals	:	Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Carbon monoxide may be evolved if incomplete combustion occurs. Unidentified organic and inorganic compounds. The vapour is heavier than air, spreads along the ground and distant ignition is possible. Will float and can be reignited on surface water.
Suitable Extinguishing Media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable Extinguishing Media	:	Do not use direct water jets on the burning product as they could cause a steam explosion and spread of the fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.
Protective Equipment & Precautions for Fire Fighters	:	Proper protective equipment including chemical resistant gloves are to be worn; chemical resistant suit is indicated if large contact with spilled product is expected. Self-Contained Breathing Apparatus must be worn when approaching a fire in a confined space. Select fire fighter's clothing approved to relevant Standards (e.g. Europe: EN469).
Additional Advice	:	Keep adjacent containers cool by spraying with water. If possible remove containers from the danger zone. If the fire cannot be extinguished the only course of action is to evacuate immediately. Contain residual material at affected sites to prevent material from entering drains (sewers), ditches, and waterways.

6. ACCIDENTAL RELEASE MEASURES

Avoid contact with skin, eyes and clothing. Evacuate the area of all non-essential personnel. Ventilate contaminated area thoroughly. If contamination of sites occurs remediation may require specialist advice. Avoid contact with spilled or released material. Immediately remove all contaminated clothing. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. For guidance on disposal of spilled material see Chapter 13 of this Material Safety Data Sheet. Ensure electrical continuity by bonding and grounding (earthing) all equipment. Observe the relevant local and international regulations. Take precautionary measures against static discharges.

Personal Precautions, Protective Equipment and Emergency Procedures	:	Do not breathe fumes, vapour. Do not operate electrical equipment. Shut off leaks, if possible without personal risks. Remove all possible sources of ignition in the surrounding area. Vapour can travel for considerable distances both above and below the ground surface. Underground services (drains, pipelines, cable ducts) can provide preferential flow paths. Evacuate all personnel. Attempt to disperse vapour or to direct its flow to a safe location for example using fog sprays.
Environmental Precautions	:	Take measures to minimise the effects on groundwater. Contain residual material at affected sites to prevent material from entering drains (sewers), ditches, and waterways. Prevent from spreading or entering into drains, ditches or rivers by using sand, earth, or other appropriate barriers.
Methods and Material for Containment and Cleaning Up	:	Take precautionary measures against static discharges. For large liquid spills (> 1 drum), transfer by mechanical means such as vacuum truck to a salvage tank for recovery or safe disposal. Do not flush away residues with water. Retain as contaminated waste. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely. For small liquid spills (< 1 drum), transfer by mechanical means to a labelled, sealable container for product recovery or safe disposal. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely.
Additional Advice	:	Notify authorities if any exposure to the general public or the environment occurs or is likely to occur. Local authorities should be advised if significant spillages cannot be contained. Maritime spillages should be dealt with using a Shipboard Oil Pollution Emergency Plan (SOPEP), as required by MARPOL Annex 1 Regulation 26. To the extent that this product, including its chemical components (e.g. methyl tertiary butyl ether) may impact surface or groundwater, appropriate assessment and remediation (if necessary) should be implemented.

7. HANDLING AND STORAGE

General Precautions	:	Avoid breathing vapours or contact with material. Only use in well ventilated areas. Wash thoroughly after handling. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for

		safe handling, storage and disposal of this material. Air-dry contaminated clothing in a well-ventilated area before laundering. Prevent spillages. Turn off all battery operated portable electronic devices (examples include: cellular phones, pagers and CD players) before operating gasoline pump. Contaminated leather articles including shoes cannot be decontaminated and should be destroyed to prevent reuse. Do not use as a cleaning solvent or other non-motor fuel uses. Vehicle fueling and vehicle workshop areas - Avoid inhalation of vapours and contact with skin, when filling or emptying a vehicle.
Precautions for Safe Handling	:	When using do not eat or drink. Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. Never siphon by mouth. The vapour is heavier than air, spreads along the ground and distant ignition is possible. Avoid exposure. Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires.
Conditions for Safe Storage	:	Drum and small container storage: Keep containers closed when not in use. Drums should be stacked to a maximum of 3 high. Use properly labelled and closeable containers. Packaged product must be kept tightly closed and stored in a diked (bunded) well-ventilated area, away from, ignition sources and other sources of heat. Take suitable precautions when opening sealed containers, as pressure can build up during storage. Tank storage: Tanks must be specifically designed for use with this product. Bulk storage tanks should be diked (bunded). Locate tanks away from heat and other sources of ignition. Cleaning, inspection and maintenance of storage tanks is a specialist operation, which requires the implementation of strict procedures and precautions. Keep in a cool place. Electrostatic charges will be generated during pumping. Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment to reduce the risk. The vapours in the head space of the storage vessel may lie in the flammable/explosive range and hence may be flammable. Refer to section 15 for any additional specific legislation covering the packaging and storage of this product.
Product Transfer	:	Wait 2 minutes after tank filling (for tanks such as those on road tanker vehicles) before opening hatches or manholes. Wait 30 minutes after tank filling (for large storage tanks) before opening hatches or manholes. Even with proper grounding and bonding, this material can still accumulate an electrostatic charge. If sufficient charge is allowed to

		accumulate, electrostatic discharge and ignition of flammable air-vapour mixtures can occur. Be aware of handling operations that may give rise to additional hazards that result from the accumulation of static charges. These include but are not limited to pumping (especially turbulent flow), mixing, filtering, splash filling, cleaning and filling of tanks and containers, sampling, switch loading, gauging, vacuum truck operations, and mechanical movements. These activities may lead to static discharge e.g. spark formation. Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (<= 1 m/s until fill pipe submerged to twice its diameter, then <= 7 m/s). Avoid splash filling. Do NOT use compressed air for filling, discharging, or handling operations.
Recommended Materials	:	For containers, or container linings use mild steel, stainless steel. Aluminium may also be used for applications where it does not present an unnecessary fire hazard. Examples of suitable materials are: high density polyethylene (HDPE), polypropylene (PP), and Viton (FKM), which have been specifically tested for compatibility with this product. For container linings, use amine-adduct cured epoxy paint. For seals and gaskets use: graphite, PTFE, Viton A, Viton B.
Unsuitable Materials	:	Some synthetic materials may be unsuitable for containers or container linings depending on the material specification and intended use. Examples of materials to avoid are: natural rubber (NR), nitrile rubber (NBR), ethylene propylene rubber (EPDM), polymethyl methacrylate (PMMA), polystyrene, polyvinyl chloride (PVC), polyisobutylene. However, some may be suitable for glove materials.
Container Advice	:	Containers, even those that have been emptied, can contain explosive vapours. Do not cut, drill, grind, weld or perform similar operations on or near containers. Gasoline containers must not be used for storage of other products.
Other Advice	:	Ensure that all local regulations regarding handling and storage facilities are followed. See additional references that provide safe handling practices for liquids that are determined to be static accumulators: American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practices on Static Electricity). CENELEC CLC/TR 50404 (Electrostatics – Code of practice for the avoidance of hazards due to static electricity).

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

If the American Conference of Governmental Industrial Hygienists (ACGIH) value is provided on this document, it is provided for information only.

Occupational Exposure Limits

Material	Source	Type	ppm	mg/m3	Notation
Gasoline, low boiling point naphtha	ACGIH	TWA	300 ppm		
	ACGIH	STEL	500 ppm		
	SG OEL	TWA	300 ppm	890 mg/m3	
	SG OEL	STEL	500 ppm	1,480 mg/m3	
Trimethylbenzene, all isomers	ACGIH	TWA	25 ppm		
	SG OEL	TWA	25 ppm	123 mg/m3	
Ethylbenzene	ACGIH	TWA	20 ppm		
	SG OEL	TWA	100 ppm	434 mg/m3	
	SG OEL	STEL	125 ppm	543 mg/m3	
n-hexane	ACGIH	TWA	50 ppm		
	ACGIH	SKIN_DES			Can be absorbed through the skin.
	SG OEL	TWA	50 ppm	176 mg/m3	
Benzene	ACGIH	TWA	0.5 ppm		
	ACGIH	STEL	2.5 ppm		
	ACGIH	SKIN_DES			Can be absorbed through the skin.
	SG OEL	TWA	1 ppm	3.18 mg/m3	

	SHELL IS	TWA	0.5 ppm	1.6 mg/m3	
	SHELL IS	STEL	2.5 ppm	8 mg/m3	
Toluene	ACGIH	TWA	20 ppm		
	SG OEL	TWA	50 ppm	188 mg/m3	
Xylene	ACGIH	TWA	100 ppm		
	ACGIH	STEL	150 ppm		
	SG OEL	TWA	100 ppm	434 mg/m3	
	SG OEL	STEL	150 ppm	651 mg/m3	
Cyclohexane	ACGIH	TWA	100 ppm		
	SG OEL	TWA	300 ppm	1,030 mg/m3	
Naphthalene	ACGIH	TWA	10 ppm		
	ACGIH	STEL	15 ppm		
	ACGIH	SKIN_DES			Can be absorbed through the skin.
	SG OEL	TWA	10 ppm	52 mg/m3	
	SG OEL	STEL	15 ppm	79 mg/m3	
Ethyl tertiary butyl ether	ACGIH	TWA	25 ppm		
Methyl tertiary butyl ether	ACGIH	TWA	50 ppm		
	SG OEL	TWA	40 ppm	144 mg/m3	
Tertiary amyl methyl ether	ACGIH	TWA	20 ppm		
Cumene	ACGIH	TWA	50 ppm		
	SG OEL	TWA	50 ppm	246 mg/m3	

Additional Information : SHELL IS is the Shell Internal Standard. Skin notation means that significant exposure can also occur by absorption of liquid through the skin and of vapour through the eyes or mucous membranes.

Biological Exposure Index (BEI)

Material	Determinant	Sampling Time	BEI	Reference
Benzene	t,t-Muconic acid in Creatinine in urine	Sampling time: End of shift.	500 µg/g	ACGIH BEL (2011)
	S-Phenylmercapturic acid in Creatinine in urine	Sampling time: End of shift.	25 µg/g	ACGIH BEL (2011)
n-hexane	2,5-Hexanedion, without hydrolysis in Urine	Sampling time: End of shift at end of work week.	0.4 mg/l	ACGIH BEL (2011)
Toluene	o-Cresol, with hydrolysis in Creatinine in urine	Sampling time: End of shift.	0.3 mg/g	ACGIH BEL (2011)
	toluene in Blood	Sampling time: Prior to last shift of work week.	0.02 mg/l	ACGIH BEL (2011)
	toluene in Urine	Sampling time: End of shift.	0.03 mg/l	ACGIH BEL (2011)

Ethylbenzene	Sum of mandelic acid and phenylglyoxylic acid in Creatinine in urine	Sampling time: End of shift at end of work week.	0.7 g/g	ACGIH BEL (2011)
	Ethyl benzene in End-exhaled air	Sampling time: Not critical.		ACGIH BEL (2011)
Xylene	Methylhippuric acids in Creatinine in urine	Sampling time: End of shift.	1.5 g/g	ACGIH BEL (2011)
Naphthalene	1-Naphthol, with hydrolysis + 2-Naphthol, with hydrolysis	Sampling time: End of shift.		ACGIH BEL (02 2013)

Appropriate Engineering Controls : The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Use sealed systems as far as possible. Adequate explosion-proof ventilation to control airborne concentrations below the exposure guidelines/limits. Local exhaust ventilation is recommended. Eye washes and showers for emergency use. Always observe good personal hygiene measures, such as washing hands after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping. Define procedures for safe handling and maintenance of controls. Educate and train workers in the hazards and control measures relevant to normal activities associated with this product. Ensure appropriate selection, testing and maintenance of equipment used to control exposure, e.g. personal protective equipment, local exhaust ventilation. Firewater monitors and deluge systems are recommended. Drain down system prior to equipment break-in or maintenance. Retain drain downs in sealed storage pending disposal or for subsequent recycle.

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Individual Protection Measures	:	Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.
Respiratory Protection	:	If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. Where air-filtering respirators are unsuitable (e.g. airborne concentrations are high, risk of oxygen deficiency, confined space) use appropriate positive pressure breathing apparatus. All respiratory protection equipment and use must be in accordance with local regulations. Select a filter suitable for combined particulate/organic gases and vapours [boiling point >65°C(149 °F)].
Hand Protection	:	Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. For continuous contact we recommend gloves with breakthrough time of more than 240 minutes with preference for > 480 minutes where suitable gloves can be identified. For short-term/splash protection we recommend the same, but recognise that suitable gloves offering this level of protection may not be available and in this case a lower breakthrough time may be acceptable so long as appropriate maintenance and replacement regimes are followed. Glove thickness is not a good predictor of glove resistance to a chemical as it is dependent on the exact composition of the glove material. Select gloves tested to a relevant standard (e.g. Europe EN374, US F739). When prolonged or frequent repeated contact occurs, Nitrile gloves may be suitable. (Breakthrough time of > 240 minutes.) For incidental contact/splash protection Neoprene, PVC gloves may be suitable.
Eye Protection	:	Chemical splash goggles (chemical monogoggles). If a local risk assessment deems it so, then chemical splash goggles may not be required and safety glasses may provide adequate eye protection.
Protective Clothing	:	Chemical resistant gloves/gauntlets, boots, and apron (where risk of splashing).
Thermal Hazards	:	Not applicable.

Monitoring Methods	:	Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate. Validated exposure measurement methods should be applied by a competent person and samples analysed by an accredited laboratory. Examples of sources of recommended exposure measurement methods are given below or contact the supplier. Further national methods may be available. National Institute of Occupational Safety and Health (NIOSH), USA: Manual of Analytical Methods http://www.cdc.gov/niosh/ Occupational Safety and Health Administration (OSHA), USA: Sampling and Analytical Methods http://www.osha.gov/
Environmental Exposure Controls	:	Local guidelines on emission limits for volatile substances must be observed for the discharge of exhaust air containing vapour. Take appropriate measures to fulfil the requirements of relevant environmental protection legislation. Avoid contamination of the environment by following advice given in Chapter 6. If necessary, prevent undissolved material from being discharged to waste water. Waste water should be treated in a municipal or industrial waste water treatment plant before discharge to surface water.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Yellow. Clear, bright liquid.
Odour	:	Hydrocarbon
Odour threshold	:	Data not available
pH	:	Data not available
Initial Boiling Point and Boiling Range	:	25 - 220 °C / 77 - 428 °F
Freezing Point	:	Data not available
Flash point	:	-40 °C / -40 °F (Tagliabue Closed Cup)
Upper / lower Flammability or Explosion limits	:	1 - 8 %(V)
Auto-ignition temperature	:	> 250 °C / 482 °F
Vapour pressure	:	Typical 570 hPa at 37.8 °C / 100.0 °F
Relative Density	:	Data not available
Density	:	Typical 0.740 g/cm3 at 15 °C / 59 °F
Water solubility	:	Negligible.
Solubility in other solvents	:	Data not available
n-octanol/water partition	:	2 - 7

coefficient (log Pow)		
Dynamic viscosity	:	Data not available
Kinematic viscosity	:	0.5 - 0.75 mm2/s at 40 °C / 104 °F
Vapour density (air=1)	:	Data not available
Electrical conductivity	:	Low conductivity: < 100 pS/m, The conductivity of this material makes it a static accumulator., A liquid is typically considered nonconductive if its conductivity is below 100 pS/m and is considered semi-conductive if its conductivity is below 10 000 pS/m., Whether a liquid is nonconductive or semi-conductive, the precautions are the same., A number of factors, for example liquid temperature, presence of contaminants, and anti-static additives can greatly influence the conductivity of a liquid.
Evaporation rate (nBuAc=1)	:	Data not available
Decomposition Temperature	:	Data not available
Flammability	:	Extremely flammable.

10. STABILITY AND REACTIVITY

Chemical stability	:	Stable under normal conditions of use.
Possibility of Hazardous Reactions	:	No hazardous reaction is expected when handled and stored according to provisions.
Conditions to Avoid	:	Avoid heat, sparks, open flames and other ignition sources.
Incompatible Materials	:	Strong oxidising agents.
Hazardous Decomposition Products	:	Hazardous decomposition products are not expected to form during normal storage. Thermal decomposition is highly dependent on conditions. A complex mixture of airborne solids, liquids and gases, including carbon monoxide, carbon dioxide and other organic compounds will be evolved when this material undergoes combustion or thermal or oxidative degradation.
Hazardous Polymerisation	:	No
Sensitivity to Mechanical Impact	:	No
Sensitivity to Static Discharge	:	Yes, in certain circumstances product can ignite due to static electricity.

11. TOXICOLOGICAL INFORMATION

Information on Toxicological effects

Basis for Assessment	:	Information given is based on product data, a knowledge of the components and the toxicology of similar products. Unless indicated otherwise, the data presented is representative of the

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product as a whole, rather than for individual component(s).

Likely Routes of Exposure	:	Exposure may occur via inhalation, ingestion, skin absorption, skin or eye contact, and accidental ingestion.
Acute Oral Toxicity	:	Low toxicity: LD50 > 5000 mg/kg
Acute Dermal Toxicity	:	Low toxicity: LD50 >2000 mg/kg , Rabbit
Acute Inhalation Toxicity	:	Low toxicity: LC50 >5 mg/l , 4 h, Rat
Skin corrosion/irritation	:	Irritating to skin.
Serious eye damage/irritation	:	Expected to be slightly irritating.
Respiratory Irritation	:	Based on human experience, breathing of vapours or mists may cause a temporary burning sensation to nose, throat and lungs.
Respiratory or skin sensitisation	:	Not expected to be a sensitiser.
Aspiration Hazard	:	Aspiration into the lungs when swallowed or vomited may cause chemical pneumonitis which can be fatal.
Germ cell mutagenicity	:	May cause heritable genetic damage. (Benzene) Mutagenicity studies on gasoline and gasoline blending streams have shown predominantly negative results.
Carcinogenicity	:	Known human carcinogen. (Benzene) May cause leukaemia (AML - acute myelogenous leukemia). (Benzene) Inhalation exposure to mice causes liver tumours, which are not considered relevant to humans.

Material	:	**Carcinogenicity Classification**
Gasoline, low boiling point naphtha	:	ACGIH Group A3: Confirmed animal carcinogen with unknown relevance to humans.
Gasoline, low boiling point naphtha	:	IARC 2B: Possibly carcinogenic to humans.
Gasoline, low boiling point naphtha	:	GHS / CLP: Carcinogenicity Category 1B
Trimethylbenzene, all isomers	:	GHS / CLP: No carcinogenicity classification
Ethylbenzene	:	IARC 2B: Possibly carcinogenic to humans.
Ethylbenzene	:	GHS / CLP: No carcinogenicity classification
n-hexane	:	GHS / CLP: No carcinogenicity classification

Benzene	:	ACGIH Group A1: Confirmed human carcinogen.
Benzene	:	NTP: Known To Be Human Carcinogen.
Benzene	:	IARC 1: Carcinogenic to humans.
Benzene	:	GHS / CLP: Carcinogenicity Category 1A
Toluene	:	ACGIH Group A4: Not classifiable as a human carcinogen.
Toluene	:	IARC 3: Not classifiable as to carcinogenicity to humans.
Toluene	:	GHS / CLP: No carcinogenicity classification
Xylene	:	ACGIH Group A4: Not classifiable as a human carcinogen.
Xylene	:	IARC 3: Not classifiable as to carcinogenicity to humans.
Xylene	:	GHS / CLP: No carcinogenicity classification
Cyclohexane	:	GHS / CLP: No carcinogenicity classification
Naphthalene	:	ACGIH Group A4: Not classifiable as a human carcinogen.
Naphthalene	:	NTP: Reasonably Anticipated to be a Human Carcinogen.
Naphthalene	:	IARC 2B: Possibly carcinogenic to humans.
Naphthalene	:	GHS / CLP: Carcinogenicity Category 2
Ethyl tertiary butyl ether	:	ACGIH Group A4: Not classifiable as a human carcinogen.
Ethyl tertiary butyl ether	:	GHS / CLP: No carcinogenicity classification
Methyl tertiary butyl ether	:	IARC 3: Not classifiable as to carcinogenicity to humans.
Methyl tertiary butyl ether	:	GHS / CLP: No carcinogenicity classification
Tertiary amyl methyl ether	:	GHS / CLP: No carcinogenicity classification
Cumene	:	IARC 2B: Possibly carcinogenic to humans.
Cumene	:	GHS / CLP: No carcinogenicity classification

Reproductive and Developmental Toxicity : Causes foetotoxicity at doses which are maternally toxic. (Toluene)
May impair fertility at doses which produce other toxic effects. (n-hexane)
Many case studies involving abuse during pregnancy indicate that toluene can cause birth defects, growth retardation and learning difficulties. (Toluene)
Inhalation of high concentrations of gasoline vapour containing Methyl tertiary butyl ether produced a very low incidence of rare birth defects (ventral midline closure failure) in mice.

Specific target organ toxicity - single exposure : High concentrations may cause central nervous system depression resulting in headaches, dizziness and nausea; continued inhalation may result in unconsciousness and/or death.

Specific target organ toxicity - repeated exposure : Kidney: caused kidney effects in male rats which are not considered relevant to humans

Blood-forming organs: repeated exposure affects the bone

marrow.

Additional Information : Prolonged and repeated exposures to high concentrations have resulted in hearing loss in rats. Solvent abuse and noise interaction in the work environment may cause hearing loss. (Toluene)

Abuse of vapours has been associated with organ damage and death. (Toluene)

Exposure to very high concentrations of similar materials has been associated with irregular heart rhythms and cardiac arrest.

May cause MDS (Myelodysplastic Syndrome). (Benzene)

Classifications by other authorities under varying regulatory frameworks may exist.

12. ECOLOGICAL INFORMATION

Basis for Assessment : Fuels are typically made from blending several refinery streams. Ecotoxicological studies have been carried out on a variety of hydrocarbon blends and streams but not those containing additives. Information given is based on a knowledge of the components and the ecotoxicology of similar products. Unless indicated otherwise, the data presented is representative of the product as a whole, rather than for individual component(s).

Acute Toxicity : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l (to aquatic organisms) LL/EL50 expressed as the nominal amount of product required to prepare aqueous test extract.

Fish : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l

Aquatic crustacea : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l

Algae/aquatic plants : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l

Microorganisms : Expected to be harmful: LL/EL/IL50 >10 <= 100 mg/l

Chronic Toxicity

Fish : NOEC/NOEL expected to be > 1.0 - <= 10 mg/l

Aquatic crustacea : NOEC/NOEL expected to be > 1.0 - <= 10 mg/l

Mobility : Evaporates within a day from water or soil surfaces. Large volumes may penetrate soil and could contaminate groundwater. Toxic to aquatic organisms; may cause long-term adverse effects in the aquatic environment. Ether oxygenates are significantly more water soluble and less biodegradable

		than benzene, toluene, ethyl benzene and xylenes (BTEX). Consequently ether oxygenates have the potential to migrate relatively longer distances than BTEX in groundwater. Contains volatile components. Floats on water. Methyl tertiary butyl ether degradation may result in the formation of tert-butyl alcohol (TBA).
Persistence/degradability	:	Major constituents are expected to be inherently biodegradable, but the product contains components that may persist in the environment. The volatile constituents will oxidize rapidly by photochemical reactions in air. While biodegradation of Methyl tertiary butyl ether has been documented, it is generally less biodegradable than many petroleum hydrocarbons and has a potential to migrate relatively longer distances in groundwater.
Bioaccumulative Potential	:	Contains constituents with the potential to bioaccumulate. Log Kow > =4
Other Adverse Effects	:	Films formed on water may affect oxygen transfer and damage organisms.

13. DISPOSAL CONSIDERATIONS

Material Disposal	:	Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Waste arising from a spillage or tank cleaning should be disposed of in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand. Do not dispose into the environment, in drains or in water courses. Do not dispose of tank water bottoms by allowing them to drain into the ground. This will result in soil and groundwater contamination.
Container Disposal	:	Drain container thoroughly. After draining, vent in a safe place away from sparks and fire. Residues may cause an explosion hazard. Do not puncture, cut, or weld uncleaned drums. Send to drum recoverer or metal reclaimer. Do not pollute the soil, water or environment with the waste container.
Local Legislation	:	Disposal should be in accordance with applicable regional, national, and local laws and regulations. Local regulations may be more stringent than regional or national requirements and must be in compliance.

14. TRANSPORT INFORMATION

Land (as per ADR classification): Regulated

Class	:	3
Packing group	:	II
Hazard indentification no.	:	33
UN number	:	1203
Danger label (primary risk)	:	3
Proper shipping name	:	GASOLINE (UNLEADED)
Environmentally Hazardous	:	Yes

IMDG

Identification number	UN 1203
Proper shipping name	GASOLINE
Technical name	(UNLEADED)
Class / Division	3
Packing group	II
Environmental hazards:	Yes

IATA (Country variations may apply)

UN number	:	1203
Proper shipping name	:	Gasoline
Technical name	:	(UNLEADED)
Class / Division	:	3
Packing group	:	II

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Pollution Category	**:**	Not applicable.
Ship Type	**:**	Not applicable.
Product Name	**:**	Not applicable.
Special Precaution	**:**	Not applicable.
Additional Information	**:**	MARPOL Annex 1 rules apply for bulk shipments by sea.

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

Local Regulations

Workplace Safety and Health Act & Workplace	:	This product is subject to the requirement in the Act/ Regulations.

Safety and Health (General Provision) Regulations		
Environmental Protection and Management Act and Environmental Protection and Management (Hazardous Substances) Regulations	:	This product is subject to the requirement in the Act/ Regulations.
Maritime and Port Authority of Singapore (Dangerous Goods, Petroleum and Explosives) Regulations	:	This product is subject to the requirement in the Act/ Regulations.
Fire Safety Act and Fire Safety (Petroleum & Flammable Materials) Regulations	:	This product is subject to the requirement in the Act/ Regulations.
Classification triggering components	:	Contains gasoline, low boiling point naphtha, unspecified.

16. OTHER INFORMATION

Hazard Statement

H224	Extremely flammable liquid and vapour.
H225	Highly flammable liquid and vapour.
H302	Harmful if swallowed.
H303	May be harmful if swallowed.
H304	May be fatal if swallowed and enters airways.
H305	May be harmful if swallowed and enters airways.
H315	Causes skin irritation.
H316	Causes mild skin irritation.
H336	May cause drowsiness or dizziness.
H340	May cause genetic defects.
H350	May cause cancer.
H361	Suspected of damaging fertility or the unborn child.
H401	Toxic to aquatic life.
H402	Harmful to aquatic life.
H411	Toxic to aquatic life with long lasting effects.

Additional Information	:	This document contains important information to ensure the safe storage, handling and use of this product. The information in this document should be brought to the attention of the person in your organisation responsible for advising on safety matters.
SDS Version Number	:	1.0
SDS Effective Date	:	10.03.2014

Safety Data Sheet

SDS Revisions	:	A vertical bar (|) in the left margin indicates an amendment from the previous version.
Uses and Restrictions	:	This product must not be used in applications other than those recommended in Section 1, without first seeking the advice of the supplier. This product is not to be used as a solvent or cleaning agent; for lighting or brightening fires; as a skin cleanser. This product is designed only to suit automotive applications and no provision is made for the requirements of aviation applications.
SDS Distribution	:	The information in this document should be made available to all who may handle the product.
Key/Legend to Abbrevations used in this SDS	:	The standard abbreviations and acronyms used in this document can be looked up in reference literature (e.g. scientific dictionaries) and/or websites.

Flam. Liq.	Flammable liquids
Asp. Tox.	Aspiration hazard
Muta.	Germ cell mutagenicity
Carc.	Carcinogenicity
Skin Corr.	Skin corrosion/irritation
STOT SE	Specific target organ toxicity - single exposure
	Toxic for Reproduction

Key Literature References	:	The quoted data are from, but not limited to, one or more sources of information (e.g. toxicological data from Shell Health Services, material suppliers' data, CONCAWE, EU IUCLID date base, EC 1272 regulation, etc).
Disclaimer	:	This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

SAFETY DATA SHEET

1. Identification

Product identifier	**Insect Repellent**
Other means of identification	
Product code	14011
Registration number	EPA: 51147-13-55809
Recommended use	Insect repellent
Recommended restrictions	None known.

Manufacturer/Importer/Supplier/Distributor information

Manufactured or sold by:

Company name	CRC Industries, Inc.
Address	885 Louis Dr. Warminster, PA 18974 US
Telephone	
General Information	215-674-4300
Technical Assistance	800-521-3168
Customer Service	800-272-4620
24-Hour Emergency (CHEMTREC)	800-424-9300 (US) 703-527-3887 (International)
Website	www.crcindustries.com

2. Hazard(s) identification

Physical hazards	Flammable aerosols	Category 1
	Gases under pressure	Liquefied gas
Health hazards	Acute toxicity, oral	Category 4
	Acute toxicity, dermal	Category 4
	Skin corrosion/irritation	Category 2
	Serious eye damage/eye irritation	Category 2
	Sensitization, skin	Category 1
	Specific target organ toxicity, single exposure	Category 3 narcotic effects
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 2
	Hazardous to the aquatic environment, long-term hazard	Category 3

OSHA defined hazards Not classified.

Label elements

Signal word	Danger
Hazard statement	Extremely flammable aerosol. Contains gas under pressure; may explode if heated. Harmful if swallowed. Harmful in contact with skin. Causes skin irritation. May cause an allergic skin reaction. Causes serious eye irritation. May cause drowsiness or dizziness. Toxic to aquatic life. Harmful to aquatic life with long lasting effects.

Precautionary statement

Prevention	Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Do not spray on an open flame or other ignition source. Pressurized container: Do not pierce or burn, even after use. Do not apply while equipment is energized. Extinguish all flames, pilot lights and heaters. Vapors will accumulate readily and may ignite. Use only with adequate ventilation; maintain ventilation during use and until all vapors are gone. Open doors and windows or use other means to ensure a fresh air supply during use and while product is drying. If you experience any symptoms listed on this label, increase ventilation or leave the area. Avoid breathing mist or vapor. Do not eat, drink or smoke when using this product. Contaminated work clothing must not be allowed out of the workplace. Wear eye/face protection. Wear protective gloves/protective clothing. Wash thoroughly after handling. Avoid release to the environment.
Response	If swallowed: Call a poison center/doctor if you feel unwell. Rinse mouth. If on skin: Wash with plenty of water. If skin irritation or rash occurs: Get medical attention. Take off contaminated clothing and wash before reuse. If inhaled: Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor if you feel unwell. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.
Storage	Store in a well-ventilated place. Store locked up. Protect from sunlight. Do not expose to temperatures exceeding 50°C/122°F. Exposure to high temperature may cause can to burst.
Disposal	Dispose of contents/container in accordance with local/regional/national regulations.
Hazard(s) not otherwise classified (HNOC)	Static accumulating flammable liquid can become electrostatically charged even in bonded and grounded equipment. Sparks may ignite liquid and vapor. May cause flash fire or explosion.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
isopropyl alcohol		67-63-0	30 - 40
liquefied petroleum gas		68476-86-8	20 - 30
N,N-diethyl-m-toluamide (DEET)		134-62-3	25
N-octyl bicycloheptene dicarboximide		113-48-4	5
di-n-propyl isocinchomeronate		136-45-8	2.5
acetone		67-64-1	1 - 3
propylene glycol		57-55-6	1 - 3

Specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. First-aid measures

Inhalation	Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.
Skin contact	Remove contaminated clothing immediately and wash skin with soap and water. In case of eczema or other skin disorders: Seek medical attention and take along these instructions. Wash contaminated clothing before reuse.
Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Get medical advice/attention if you feel unwell.
Most important symptoms/effects, acute and delayed	May cause drowsiness and dizziness. Headache. Nausea, vomiting. Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Skin irritation. May cause redness and pain. May cause an allergic skin reaction. Dermatitis. Rash.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Keep victim warm. Keep victim under observation. Symptoms may be delayed.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance. Wash contaminated clothing before reuse.

5. Fire-fighting measures

Suitable extinguishing media	Alcohol resistant foam. Water fog. Carbon dioxide (CO2). Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.

Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	Contents under pressure. Pressurized container may rupture when exposed to heat or flame. This product is a poor conductor of electricity and can become electrostatically charged. If sufficient charge is accumulated, ignition of flammable mixtures can occur. Static electricity accumulation may be significantly increased by the presence of small quantities of water or other contaminants. Material will float and may ignite on surface of water. During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.
Fire-fighting equipment/instructions	In case of fire: Stop leak if safe to do so. Move containers from fire area if you can do so without risk. Containers should be cooled with water to prevent vapor pressure build up.
General fire hazards	Extremely flammable aerosol. Contents under pressure. Pressurized container may rupture when exposed to heat or flame.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Keep out of low areas. Remove all possible sources of ignition in the surrounding area. Many vapors are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks). Wear appropriate protective equipment and clothing during clean-up. Avoid breathing mist or vapor. Emergency personnel need self-contained breathing equipment. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ventilate closed spaces before entering them. Use appropriate containment to avoid environmental contamination. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Keep combustibles (wood, paper, oil, etc.) away from spilled material. The product is immiscible with water and will spread on the water surface. Stop the flow of material, if this is without risk. Prevent product from entering drains. Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid release to the environment. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground. Inform appropriate managerial or supervisory personnel of all environmental releases. Use appropriate containment to avoid environmental contamination.

7. Handling and storage

Precautions for safe handling	Minimize fire risks from flammable and combustible materials (including combustible dust and static accumulating liquids) or dangerous reactions with incompatible materials. Pressurized container: Do not pierce or burn, even after use. Do not use if spray button is missing or defective. Do not spray on a naked flame or any other incandescent material. Do not smoke while using or until sprayed surface is thoroughly dry. Do not cut, weld, solder, drill, grind, or expose containers to heat, flame, sparks, or other sources of ignition. Use caution around energized equipment. The metal container will conduct electricity if it contacts a live source. This may result in injury to the user from electrical shock and/or flash fire. Avoid breathing mist or vapor. Avoid contact with eyes, skin, and clothing. Do not taste or swallow. When using, do not eat, drink or smoke. Use only in well-ventilated areas. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Observe good industrial hygiene practices. Avoid release to the environment. Wash contaminated clothing before reuse. For product usage instructions, please see the product label.
Conditions for safe storage, including any incompatibilities	Level 3 Aerosol. Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50°C/122 °F. Do not puncture, incinerate or crush. Do not handle or store near an open flame, heat or other sources of ignition. This material can accumulate static charge which may cause spark and become an ignition source. Avoid spark promoters. These alone may be insufficient to remove static electricity. Store in a well-ventilated place. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
acetone (CAS 67-64-1)	PEL	2400 mg/m3 1000 ppm

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
isopropyl alcohol (CAS 67-63-0)	PEL	980 mg/m3
		400 ppm

US. ACGIH Threshold Limit Values

Components	Type	Value
acetone (CAS 67-64-1)	STEL	500 ppm
	TWA	250 ppm
isopropyl alcohol (CAS 67-63-0)	STEL	400 ppm
	TWA	200 ppm

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value
acetone (CAS 67-64-1)	TWA	590 mg/m3
		250 ppm
isopropyl alcohol (CAS 67-63-0)	STEL	1225 mg/m3
		500 ppm
	TWA	980 mg/m3
		400 ppm

US. AIHA Workplace Environmental Exposure Level (WEEL) Guides

Components	Type	Value	Form
propylene glycol (CAS 57-55-6)	TWA	10 mg/m3	Aerosol.

Biological limit values

ACGIH Biological Exposure Indices

Components	Value	Determinant	Specimen	Sampling Time
acetone (CAS 67-64-1)	25 mg/l	Acetone	Urine	*
isopropyl alcohol (CAS 67-63-0)	40 mg/l	Acetone	Urine	*

* - For sampling details, please see the source document.

Appropriate engineering controls

Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower should be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection

Wear safety glasses with side shields (or goggles).

Skin protection

Hand protection

Wear protective gloves such as: Nitrile. Viton®.

Other

Wear appropriate chemical resistant clothing. Use of an impervious apron is recommended.

Respiratory protection

If engineering controls are not feasible or if exposure exceeds the applicable exposure limits, use a NIOSH-approved cartridge respirator with an organic vapor cartridge. Use a self-contained breathing apparatus in confined spaces and for emergencies. Air monitoring is needed to determine actual employee exposure levels.

Thermal hazards

Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations

When using do not smoke. Keep away from food and drink. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Contaminated work clothing should not be allowed out of the workplace.

9. Physical and chemical properties

Appearance

Physical state	Liquid.
Form	Aerosol.
Color	Clear. Colorless.
Odor	Mild. Alcoholic.
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	-138.5 °F (-94.7 °C) estimated
Initial boiling point and boiling range	132.9 °F (56.1 °C) estimated
Flash point	75 °F (23.9 °C) Tag Closed Cup
Evaporation rate	Moderate.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	2 % estimated
Flammability limit - upper (%)	12.8 % estimated
Vapor pressure	1255.3 hPa estimated
Vapor density	> 1 (air = 1)
Relative density	0.8 estimated
Solubility (water)	Immiscible.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	700 °F (371.1 °C) estimated
Decomposition temperature	Not available.
Viscosity (kinematic)	Not available.
Percent volatile	67.5 % estimated

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Heat, flames and sparks. Contact with incompatible materials.
Incompatible materials	Acids. Strong oxidizing agents. Isocyanates. Chlorine.
Hazardous decomposition products	Carbon oxides. Nitrogen oxides (NOx).

11. Toxicological information

Information on likely routes of exposure

Inhalation	May cause drowsiness and dizziness. Headache. Nausea, vomiting.
Skin contact	Harmful in contact with skin. Causes skin irritation. May cause an allergic skin reaction.
Eye contact	Causes serious eye irritation.
Ingestion	Harmful if swallowed.
Symptoms related to the physical, chemical and toxicological characteristics	Headache. May cause drowsiness and dizziness. Nausea, vomiting. Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Skin irritation. May cause redness and pain. May cause an allergic skin reaction. Dermatitis. Rash.

Information on toxicological effects

Acute toxicity	In high concentrations, vapors are anesthetic and may cause headache, fatigue, dizziness and central nervous system effects. Harmful in contact with skin. Harmful if swallowed. Narcotic effects. May cause an allergic skin reaction.

Product	Species	Test Results
Insect Repellent		
Acute		
Dermal		
LD50	Rabbit	1388 mg/kg estimated
Inhalation		
LC50	Rat	41224 ppm, 4 hours estimated
Oral		
LD50	Rat	1747 mg/kg estimated
TDL0	Human	117 g/kg estimated

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation Causes skin irritation.

Serious eye damage/eye irritation Causes serious eye irritation.

Respiratory sensitization Not a respiratory sensitizer.

Skin sensitization May cause an allergic skin reaction.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

US. National Toxicology Program (NTP) Report on Carcinogens

Not listed.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Reproductive toxicity This product is not expected to cause reproductive or developmental effects.

Specific target organ toxicity - single exposure May cause drowsiness and dizziness.

Specific target organ toxicity - repeated exposure Not classified.

Aspiration hazard Not an aspiration hazard.

12. Ecological information

Ecotoxicity Toxic to aquatic life. Harmful to aquatic life with long lasting effects.

Components		Species	Test Results
acetone (CAS 67-64-1)			
Aquatic			
Crustacea	EC50	Water flea (Daphnia magna)	10294 - 17704 mg/l, 48 hours
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	4740 - 6330 mg/l, 96 hours
isopropyl alcohol (CAS 67-63-0)			
Aquatic			
Acute			
Crustacea	EC50	Water flea (Daphnia magna)	7550 - 13299 mg/l, 48 hours
Fish	LC50	Fathead minnow (Pimephales promelas)	9640 mg/l, 96 hours
N,N-diethyl-m-toluamide (DEET) (CAS 134-62-3)			
Aquatic			
Fish	LC50	Fathead minnow (Pimephales promelas)	106 - 114 mg/l, 96 hours
propylene glycol (CAS 57-55-6)			
Aquatic			
Fish	LC50	Fathead minnow (Pimephales promelas)	710 mg/l, 96 hours

Components		Species	Test Results
Acute			
Crustacea	EC50	Water flea (Daphnia magna)	4850 - 34000 mg/l, 48 hours

* Estimates for product may be based on additional component data not shown.

Persistence and degradability No data is available on the degradability of this product.

Bioaccumulative potential

Partition coefficient n-octanol / water (log Kow)

acetone	-0.24
isopropyl alcohol	0.05
N,N-diethyl-m-toluamide (DEET)	2.02
propylene glycol	-0.92

Bioconcentration factor (BCF)

isopropyl alcohol	3.16

Mobility in soil No data available.

Other adverse effects No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal of waste from residues / unused products If discarded, this product is considered a RCRA ignitable waste, D001. Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Contents under pressure. Do not puncture, incinerate or crush. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose in accordance with all applicable regulations.

Hazardous waste code D001: Waste Flammable material with a flash point <140 F

Contaminated packaging Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

UN number	UN1950
UN proper shipping name	Aerosols, flammable, Limited Quantity
Transport hazard class(es)	
Class	2.1
Subsidiary risk	-
Label(s)	2.1
Packing group	Not applicable.
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	N82
Packaging exceptions	306
Packaging non bulk	None
Packaging bulk	None

IATA

UN number	UN1950
UN proper shipping name	Aerosols, flammable, Limited Quantity
Transport hazard class(es)	
Class	2.1
Subsidiary risk	-
Packing group	Not applicable.
ERG Code	10L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Other information	
Passenger and cargo aircraft	Allowed with restrictions.
Cargo aircraft only	Allowed with restrictions.

IMDG

UN number	UN1950
UN proper shipping name	AEROSOLS, LIMITED QUANTITY

Transport hazard class(es)

Class	2
Subsidiary risk	-
Packing group	Not applicable.
Environmental hazards	
Marine pollutant	No.
EmS	Not available.
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

SARA 304 Emergency release notification

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: Listed substance

di-n-propyl isocinchomeronate (CAS 136-45-8)

CERCLA Hazardous Substance List (40 CFR 302.4)

acetone (CAS 67-64-1) Listed.

CERCLA Hazardous Substances: Reportable quantity

acetone (CAS 67-64-1) 5000 LBS

Spills or releases resulting in the loss of any ingredient at or above its RQ require immediate notification to the National Response Center (800-424-8802) and to your Local Emergency Planning Committee.

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

Drug Enforcement Administration (DEA). List 2, Essential Chemicals (21 CFR 1310.02(b) and 1310.04(f)(2) and Chemical Code Number

acetone (CAS 67-64-1) 6532

Drug Enforcement Administration (DEA). List 1 & 2 Exempt Chemical Mixtures (21 CFR 1310.12(c))

acetone (CAS 67-64-1) 35 %WV

DEA Exempt Chemical Mixtures Code Number

acetone (CAS 67-64-1) 6532

FEMA Priority Substances Respiratory Health and Safety in the Flavor Manufacturing Workplace

acetone (CAS 67-64-1) Low priority
isopropyl alcohol (CAS 67-63-0) Low priority

Food and Drug Administration (FDA) Not regulated.

US EPA Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

FIFRA Information	This chemical is a pesticide product registered by the United States Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets (SDS), and for workplace labels of non-pesticide chemicals. The hazard information required on the pesticide label is reproduced below. The pesticide label also includes other important information, including directions for use.
Signal word	Warning.
Hazard statement	Harmful if swallowed. Causes substantial but temporary eye injury. This product is registered in all 50 United States and Puerto Rico. This product is not registered outside of the United States and Puerto Rico.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Section 311/312 Hazard categories	Immediate Hazard - Yes Delayed Hazard - No Fire Hazard - Yes Pressure Hazard - Yes Reactivity Hazard - No
SARA 302 Extremely hazardous substance	No

US state regulations

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

acetone (CAS 67-64-1)
di-n-propyl isocinchomeronate (CAS 136-45-8)
isopropyl alcohol (CAS 67-63-0)
liquefied petroleum gas (CAS 68476-86-8)

US. California Controlled Substances. CA Department of Justice (California Health and Safety Code Section 11100)

Not listed.

US. New Jersey Worker and Community Right-to-Know Act

acetone (CAS 67-64-1)
propylene glycol (CAS 57-55-6)
di-n-propyl isocinchomeronate (CAS 136-45-8)
isopropyl alcohol (CAS 67-63-0)

US. Massachusetts RTK - Substance List

acetone (CAS 67-64-1)
isopropyl alcohol (CAS 67-63-0)

US. Pennsylvania Worker and Community Right-to-Know Law

acetone (CAS 67-64-1)
isopropyl alcohol (CAS 67-63-0)
propylene glycol (CAS 57-55-6)

US. Rhode Island RTK

acetone (CAS 67-64-1)
di-n-propyl isocinchomeronate (CAS 136-45-8)

US. California Proposition 65

WARNING: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

benzene (CAS 71-43-2)	Listed: February 27, 1987
cumene (CAS 98-82-8)	Listed: April 6, 2010
di-n-propyl isocinchomeronate (CAS 136-45-8)	Listed: May 1, 1996
ethanal (CAS 75-07-0)	Listed: April 1, 1988

US - California Proposition 65 - CRT: Listed date/Developmental toxin

benzene (CAS 71-43-2)	Listed: December 26, 1997
toluene (CAS 108-88-3)	Listed: January 1, 1991

US - California Proposition 65 - CRT: Listed date/Male reproductive toxin

benzene (CAS 71-43-2)	Listed: December 26, 1997

Volatile organic compounds (VOC) regulations

EPA

VOC content (40 CFR 51.100(s))	64.9 %
Consumer products (40 CFR 59, Subpt. C)	Not regulated

State

Consumer products	This product is regulated as an Insect Repellent. This product is compliant for use in all 50 states.
VOC content (CA)	64.9 %
VOC content (OTC)	64.9 %

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	No
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 05-21-2015

Revision date 06-29-2016

Prepared by Allison Cho

Version # 02

Further information CRC # 926

HMIS® ratings
Health: 1
Flammability: 3
Physical hazard: 0
Personal protection: B

NFPA ratings
Health: 1
Flammability: 3
Instability: 0

NFPA ratings

Disclaimer
The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. This information is accurate to the best of CRC Industries' knowledge or obtained from sources believed by CRC to be accurate. Before using any product, read all warnings and directions on the label. For further clarification of any information contained on this (M)SDS consult your supervisor, a health & safety professional, or CRC Industries.

Revision Information
Hazard(s) identification: Supplemental label information
Composition / Information on Ingredients: Ingredients
Fire-fighting measures: Suitable extinguishing media
Exposure controls/personal protection: Appropriate engineering controls
Physical & Chemical Properties: Multiple Properties
Toxicological Information: Toxicological Data
Ecological Information: Ecotoxicity
Disposal considerations: Hazardous waste code
Transport Information: Agency Name, Packaging Type, and Transport Mode Selection
Regulatory Information: United States
GHS: Classification

Attachment C

Resumes

Resume

Alberto Munuera
alberto.munuera@aecom.com

Alberto Munuera

Sr. SH&E Manager, DCSA, Southeast

I am currently an Occupational Safety and Health professional responsible for managing the AECOM Americas Southeast Region.

From 2006-2016 I worked as SH&E manager in AECOM Spain, OHSAS 18001 certified.

From 2012 to 2016 I was responsible for International SH&E management systems that included system development, implementation, monitoring and improvement.

I worked in the Soil and Groundwater Department as geologist for 8 years until 2012, when I became involved in environmental projects and civil works, responsible for contaminated site investigation, remediation and industrial plant decommissioning and demolition.

Proffessional history

Sr. DCSA SH&E Manager, DCSA Southeast
AECOM (June 2016 to Present)

Spain SH&E Manager
AECOM (2006 to June 2016)

Int. Client EMAAP SH&E Manager
AECOM-URS (2009 to present)

Geologist - Environmental Consultant
Legacy URS (2003 to 2012)

Education and Training

Master's Degree in Occupational Health and Safety. 2015 (Universidad San Pablo CEU, Madrid, Spain). Project (Hons): Development and implementation of SH&E Management system according to OHSAS 18001

Graduated in Geological Sciences. 1998-2004 (Universidad Complutense de Madrid, Spain)

40h Construction Safety Hazard Awarness EM-385-1-1 USACE (The Safety Company, 2016)

ATSSA Advanced Traffic Control Design Specialist, 2017

Nebosh International General Certificate in Occupational Health and Safety (Workplacelaw, 2013)

OHSAS 18001 Auditor and OHS Systems Auditor (2015)

OSHA Outreach Training for General Industry and Construction Works. 30h+30h courses (University of South Florida – OTIEC, 2014-15)

High Technician Certificate in Occupational Health and safety – Specialities of Ergonomy and applied psycosociology, Safety in the workplace and industrial hygiene 2007 (IMF) – 1200h

Certified Health & Safety trainer for HAZWOPER training, OSHA 29 CFR 1910.120 (URS, 2009)

Essential Navigation & Seamanship Training (Avante, 2014) – Including Safety and Emergency Response on powerboats

First Aids, AED and CPR Training (MedicFirstAid, 2016).

Hazardous Waste Materials Management Expert (Ambientum, 2010)

Management of SH&E System

I managed the implementation of the AECOM SH&E management system both in the office and field with the objective of reducing accidents, illnesses and property damage rate by promoting a safe environment, safety culture and employee healthy habits. This includes worksites risk assessments and implementation of control measures, ergonomics, industrial hygiene, social psychology and environment protection.

As part of my responsibilities I provide among others, the following:

- SH&E annual action plan development, management, follow up and continuous improvement
- Training plan development, management and follow up (>2000 employees and 19 offices)
- Trainer in OSHA Hazardous waste operations and emergency response (Hazwoper 24h) and Limnology courses.
- Management of internal (AECOM employees) and external (subcontractors, clients and third parties) communication on SH&E matters
- Key Performance Indicators definition and control (leading and lagging indicators)
- Safe Work and Emegercy Plans preparation and review
- Office and Field audits and follow up of non conformities (all types of industrial sites, demolition works, landfills, work over water, airport activities, etc)
- Management and support on reporting tools and Data evaluation in a monthly basis from 2006.
- Evaluation of incident reports (>35.000) at corporate level (2015)
- Accident and Incident investigation and implementation of appropriate control measures. Sharing Lessons Learned.
- Providing support in Industrial Hygiene program development, coordination and implementation
- OHSAS 18001 implementation and continuous safety improvement
- Encouraging leaders to commit to safety and employees to participate in SH&E to include safety in their daily activity, projects design, work and life.
- SH&E advising for national and international projects
- Business impact evaluation of SH&E events and measures
- Maintaining adequate records of pertinent data

Alberto Munuera
alberto.munuera@aecom.com

Affiliations and proffessional associations

International Ambassador in IOSH Education Committee

Graduate IOSH (International Occupational Safety and Health)

Safety Trained Supervisor (STS), BCSP

Certified Site Safety and Health Officer (CSSHO)

Awards

2017 US Excellenece Awards: Safety for Life Winner

2017 Annual Government Award for good practices at work and prevention of accidentabiliy (Spain)

2016 CE Excellenece Awards: Safety for Life Winner

2016 AECOM Coins Awards: implementation of Wellness Program in Spain

2014 Finalist in the AECOM-URS EMI Safety For Life Annual Awards

OHSAS 18001 certification implementation in URS Spain. April 2014.

2012 through 2015: URS Spain #1 Ranked in unified H&S system of top 6 Oil and Gas companies (Retail) in Spain

2011 BP HSSE Award in recognition of 5 consecutive years of incident-free work in Europe (URS-BP Iberia SH&E Manager)

URS quarterly award 1st Q 2010 (Work over water Training development)

BP Excellence award 2006

Languages

English and Spanish (spoken and written):
Bilingual – Spanish native

Portuguese (spoken and written): medium-high.

French (spoken and written): medium

Other Information

Member of the Innovation and Collaboration Excellence Committee in Safety, Health and Environment within AECOM (2015-2016)

Management of SH&E for International Clients

I have been involved in the development and follow up of several SH&E management systems within AECOM for International Clients with strong safety cultures.

Especially I have developed and implemented a client specific SH&E Management system at an EMAAP Region level. This system focuses, among others, on the following elements:

- A consistent culture evolution work plan (Key Performance Indicators to follow up)
- Internal and external communication plan development and implementation, especially client fluid communication plan.
- Leadership commitment, including site audits and visits plan
- Training sessions and specific training requirements set up
- Incidents management and investigation
- Establishing joint safety expectations
- Recognition and rewards program
- Ensure site Safe Work Plan consistency across the region
- Subcontractor management
- Site specific safety program development and implementation.

Management of SH&E in Field Operations

I have managed SH&E in field projects from 2003, developing worksite risk assessments, implementing preventitive and control measures and supervising the compliance of legislation and client and AECOM specific procedures. Some of the field projects I have worked on are:

- SH&E management and environmental investigation of the subsoil in petrol stations and industrial plants.
- SH&E management during installation and monitoring of remediation systems at sites contaminated with many different chemical compounds.
- Monitoring, control and management of SH&E in large excavations and refineries.
- Develop, implement and manage SH&E on a lindane landfill monitoring and remediation project
- SH&E audits in several industrial plants and petrol stations.
- Supervisor and SH&E manager of dismantling and demolition works of an oil and gas storage terminal.
- Environmental audit, SH&E management and site assessment during works in a cruise motors factory.
- Management of health and safety, decommissioning, demolition and soil remediation of an industrial complex to be developed as a residential area
- Derelict industrial building SH&E studies
- Fertilizers distributor industrial site demolition environmental audit and risks assessment.
- Detailed Dam Emergency Plan development.
- SH&E Management of construction works in airports.

Joseph Witte
Environmental Scientist

Professional History

09/2013 - Present, AECOM
Environmental Scientist

Education

BS, Environmental Science & Policy, University of Maryland, 2013

Years of Experience

With AECOM: 3.5
With Other Firms: 0
With URS: 1

Training

OSHA 8-Hour Site Supervisor Training
OSHA 40-Hour HAZWOPER Training
American Heart Association – First Aid, CPR, and AED Certification
Shell Life Saving Rules
Smith System Defensive Driving Training
SHA MD DOT Temporary Traffic Control Manager's Training
DOT HAZMAT Shipping for Environmental Professionals Training

Mr. Witte is an environmental scientist with remediation team in the Germantown office working both in office and in the field. He has direct project experience across multiple disciplines as the project Health and Safety Officer, field coordinator, field technician, data manager and analyst, and office task leader. Mr. Witte has lead and participated in numerous projects with both state and federal government agencies as well as private clients such as Motiva, Shell Oil, WMATA, Dover AFB, the Army National Guard, and the US Army Corps of Engineers (USACE). Mr. Witte is trained by the SHA MD DOT as a Temporary Traffic Control Manager. Mr. Witte assists in preparing work plans, quality assurance project plans, health and safety plans, and remedial investigation reports for a variety of private and federal clients.

Experience

Army National Guard (ARNG), Remedial Investigation through Decision Document for Five and Six Army National Guard Munitions Response Sites, Multiple U.S. Locations, Deputy Project Manager/Field Task Leader, September 2016 – Ongoing. Manage project activities related to conducting Remedial Investigation of multiple former small arms ranges at Non-Department of Defense, Non-Operational Defense Sites (NDNODS) located with CONUS. Technical lead on implementation of incremental sampling methodology (ISM) technologies to assess the risks of metals contamination in target berm soils. Act as team lead and health and safety officer for field operations. Author RI Work Plans and UFP-QAPPs and assess the fate and transport of site related contaminants.

Army National Guard (ARNG), Preliminary Assessments and Site Inspections for Perfluoroctane-Sulfonic Acid and Perfluoroctanoic Acid Impacted Sites, ARNG Installations-Nationwide, Field Task Leader, August 2017 – Ongoing. Manage project activities related to conducting Preliminary Assessment site visits of ARNG installations nationwide. Project site lead on drafting Preliminary Assessments to assess the presence or absence of perfluorinated compound release areas at ARNG installations. Act as team lead and health and safety officer for field operations. Author Preliminary Assessments and assess the fate and transport of site related contaminants.

US National Guard Bureau - US Property and Fiscal Office, Ravenna Army Ammunition Plant Solid Waste Disposal Sites, Ravenna, Ohio. Act as team lead and health and safety officer for field operations including intrusive investigations of solid waste sites. Author Solid Waste Management Plan to be used as a tool by the OHARNG. Contributed as an integral team member in composing the former Ravenna Army Ammunition Plant/Camp Ravenna Joint Military

Training Center visual assessment survey report for the evaluation, identification, and management of potential solid waste disposal sites.

US Naval Facilities Engineering Command Pacific, Multiple Award Environmental Services - Small Business Remediation Action Contra, Baltimore, Maryland. Performed incremental groundwater and sediment sampling using ISCO equipment, escorted by UXO technicians, on an active army base. Field work included in-stream sampling of surface water and sediment, maneuvering through Florida forest and swamp land.

Washington Metropolitan Area Transit Authority, Bladensburg Heavy Overhaul Maintenance Terminal Industrial Hygiene Assessment, Washington, District of Columbia. Performed industrial hygiene assessment consisting of indoor area sampling for diesel particulate matter, mercaptans, NO, NO2, SO2, formaldehyde, acrolein, methane, VOCs, compressed natural gases and fungal spores using a variety of equipment including SKC air pumps, passive sampling badges, SUMMA canister 1-liter minicans, and Landtec landfill gas meters. Co-wrote deliverable report on findings to client.

Washington Metropolitan Area Transit Authority, TO 15-03 QRT [1], Washington, District of Columbia. Obtains DDOT construction and occupancy permits to perform drilling and installation of monitoring wells onsite, as well as trimesterly groundwater sampling in active roadways. Acted as a traffic control manager onsite during well installation on active roadways. Performed groundwater sampling onsite and groundwater monitoring well redevelopment, while acting as traffic control manager during thru-way tasks.

Shell Oil Company, Site Assessment, Various Locations. Assisted in numerous office and field work tasks and worked in the field at over 25 unique sites and performed office work associated with many more. Field work tasks include groundwater gauging and sampling, product bailing and absorbent sock administering, soil sampling soil vapor sampling, operations and maintenance with a senior field technician, subcontractor oversight of drum pickups, field screening various indoor areas using a photoionization detector, excavation oversight, and system demo oversight across states including Maryland, Massachusetts, New Jersey, Pennsylvania, South Carolina and Washington DC. Acted as a direct contact for laboratories in arranging for appropriate equipment and laboratory glassware for scheduled field work. Also acted as a liaison with previous consultant in the transferal of field notes, data, work orders, and site safety information. Prepared numerous health and safety plans for the newly acquired sites using information disseminated by previous firm and independent research.

Shell Oil Company, Pennzoil-Quaker State - Active Third-Party Owned Terminal Time and Materials Contract, Charleston, South Carolina. Coordinated groundwater sampling events onsite, participated in surfactant extractions and injections, composed biannual site reports, and ordered lab bottleware and equipment. Spearheaded a group of three as the only current Shell-trained technician to ensure all Shell safety standards were met. Created the field operations manual prior to this work for use in the field by all field staff. The former PQS site is a 20-year remediation project

and the current and past site activities include periodic monitoring and sampling of site monitoring wells; LNAPL removal activities consisting of periodic aggressive fluid vapor recovery (AFVR) events and passive recovery methods such as manual bailing and absorbent socks; and aggressive LNAPL recovery program that includes targeted excavations and surfactant injections and extractions.

Shell Chemical Holdings Inc, 2015 Groundwater Investigation and Soil Delineation, East Hanover, New Jersey. Performed groundwater sampling as a field team lead in March 2015 and composed following groundwater sampling report. Participated as a field team member in soil sampling as part of the offsite PCB delineation in November and December 2016 under client and third party consultant supervision. Performed various office tasks associated with facilitating field work operations.

Motiva Enterprises, LLC, Site #137675 - 15541 New Hampshire Avenue, Silver Spring, Maryland. Performed site manager and field work duties including quarterly groundwater sampling, weekly coordination of operation and maintenance events, placing field equipment and lab bottleware requests, and report writing. Additionally, developed and maintained a trusted relationship with residents in the surrounding neighborhood to perform potable well sampling in their homes and manage bottled water deliveries to their homes in lieu of municipally supplied water.

Petroleum Marketing Group, Site #2007-317 (VDEQ), Woodbridge, Virginia. Site manager performing duties including monthly groundwater gauging, quarterly groundwater sampling, quarterly soil vapor point sampling using SUMMA 1-liter canisters, coordination of field events, ordering lab bottleware and equipment, performing Mann-Kendall statistical analysis to present a case for no further action to Virginia Department of Environmental Quality, and writing quarterly status reports to be submitted to VDEQ.

Travel Centers of America, Stormwater Management, Richmond, Virginia and Ashland, Virginia. Performed managerial site duties including report writing, field event coordinating, and permit application updating.

Shell Oil Company, Service Station #136431, Washington, District of Columbia. Site manager performing duties including quarterly groundwater sampling, coordinating field events, ordering lab bottleware and equipment, and writing quarterly status reports to be submitted to the District Department of the Environment.

Shell Oil Products US, Site #58141 - Fairfax Terminal, Fairfax, Virginia. Performed monthly groundwater gauging, biannual groundwater sampling, pond outfall sampling to meet VPDES permit requirements, coordination of field events, equipment ordering, and composition of biannual status reports. Acted as team lead during field events associated with the site.

Shell Oil Company, Service Station #136440, Washington, District of Columbia. Site manager performing duties including groundwater sampling, coordinating field events, ordering lab bottleware and equipment, and writing status reports.

Chahel 252 Inc., Service Station #10 (VDEQ), Vienna, Virginia. Site manager performing duties including coordination of operations and maintenance activities onsite, ordering bottleware and equipment, and writing quarterly status reports to be submitted to Virginia Department of Environmental Quality.

Baltimore County Game & Fish Protective Association, Small Arms Range Environmental Stewardship Plan, Portland, Oregon. Aided in a site visit at the Baltimore County Game & Fish Protective Association Small Arms Range to assess bullet containment, vegetative ground cover and erosion, soil pH, and volume control. Created an environmental stewardship plan following site visit on behalf of the BCGF.

Wood Group Mustang, Inc., Sunrise Gas Development, Various Locations, Pennsylvania. Participated in a geophysical seismic refraction survey to delineate the Sunrise Pipeline route across rural landscapes in Lancaster, PA.

Confidential Client, 2013 Long Term Monitoring, Dover AFB, Delaware. Assisted in field activities performing injection events onsite to stimulate the growth of microbes to promote bioremediation.

Shell Oil Company, Rouseville Parcel 07-019-001, Rouseville, Pennsylvania. Participated in completing a site investigation of the large, wooded property. During inspection, the team took photographs, detailed descriptions, and GPS locations of any items relating to the prior storage of crude oil including steel vessels, tank pads, wooden barrels, piping, steel drums, and Pennzoil-branded items. Contaminants of concern included, volatile organic compounds, semi-volatile organic compounds, and RCRA metals. Contributed to a report containing a summary of investigation results and recommendations for future remedial activities.

Shell Oil Company, Former Rouseville Refinery Plant I AST Farm, Rouseville, Pennsylvania. Participated in a lmited Phase II ESA, which included over 160 soil borings advanced via hand-auger excavation at items discovered during the November investigation. Also contributed to the field operations manual used during the Phase II ESA and a report containing a summary of soil sampling results and recommendations for future remedial activities.

Shell Oil Company, Former Rouseville Refinery Plant II AST Farm, Rouseville, Pennsylvania. Participated in oversight of the excavation of a suspected drum pit estimated to extend to 285 feet by 130 feet. Contaminants of concern included volatile organic compounds, semi-volatile organic compounds, and RCRA metals. Present for tree clearing, grading, temporary road construction, onsite job trailer establishment, soil staging area construction, and soil logging associated with the excavation. Also conducted product bailing onsite and oversaw repairs to a sump associated with the site.

Certificate of Completion

This is to certify that

Joe Witte

Has completed the

Radiation Safety for X-ray Tube Based Instruments

Online training course

On

10/13/2017

Supervisor signature

Erin Poitras, RSO Thermo Fisher Scientific
Portable Analytical Instruments

Attachment D

AECOM Safety Forms

SAFETY COMPLIANCE AGREEMENT AND
DOCUMENTATION OF SITE SAFETY BRIEFING
Bangor Range, ME
Contract/Delivery Order: W9133L-14-D-0001/ 0006

DATE AND TIME: _____ PROJECT NAME AND NUMBER: _____

SITE LOCATION: _____ SITE SAFETY OFFICER: _____

NAME AND EFFECTIVE DATE OF SITE HEALTH AND SAFETY PLAN: _____

TOPICS COVERED DURING BRIEFING:

___ Extent and Concentration of Chemical Hazards on Site
___ Monitoring Procedures
___ Health Effects of Chemical Hazards
___ Action Levels
___ Physical Hazards on Site
___ Decontamination Procedures
___ Levels of Protection Required
___ Location of Emergency Numbers
___ Route to the Hospital
___ Location of Emergency Equipment (e.g., first-aid kit, fire extinguishers)
___ Verification That Health and Safety Plan Has Been Received and Read
___ Other:_____

I, the undersigned, have received a copy of the safety plan for the referenced project. I have read the plan, understand it, and agree to comply with all of the health and safety requirements. I understand that I may be prohibited from working on the project for violating any of the requirements. In addition, I have been verbally briefed on the topics noted above.

Name (print): _____

(Signature):_____

Company:_____

AECOM

Americas

Daily Tailgate Meeting

S3AM-209-FM5

Job Location:		Date:	
AECOM Site Supervisor:		Person Conducting Tailgate Meeting:	
AECOM Site Supervisor Phone:		AECOM Safety Officer Name & Phone:	

List activities to be performed today:	

Muster Point:		Spill Kit Location:	
First Aid Kit Location:		Fire Extinguisher Location:	

Have all personnel reviewed and understand the site-specific safety plan?	☐ Yes ☐ No*
Are current Pre-Job Hazard Assessments in place for each of the tasks to be performed today and understood by all?	☐ Yes ☐ No*
Does each subcontractor have hazard assessments (e.g., THA, JSA, JHA) for their activities?	☐ Yes ☐ No* ☐ N/A
Are any required permits in place for the applicable tasks to be performed today and understood by all? Identify required permits and permit #s:	☐ Yes ☐ No* ☐ N/A
Have all members of the work team confirmed understanding of the work, hazards, and controls/ mitigation?	☐ Yes ☐ No*
Have work areas been properly cordoned-off to protect workers, site staff, and the public?	☐ Yes ☐ No* ☐ N/A
Have equipment checks been completed, documented, and reviewed?	☐ Yes ☐ No* ☐ N/A
Do all site workers understand injury/ intervention reporting requirements including immediately notifying the AECOM Site Supervisor of any injury near miss, unsafe condition or hazard observation?	☐ Yes ☐ No*

** if No, then work cannot be performed until corrective action is completed and documented.*

Topics covered in today's tailgate meeting:	

Other Items Discussed Today:	**Stop Work Authority & Obligation**
	* All employees will stop the job any time anyone is concerned or uncertain about safety. * All employees will stop the job if anyone identifies a hazard or additional mitigation not recorded on the THA. * All employees will be alerted to any changes in personnel or conditions at the worksite. * All employees will stop the job and reassess a task, hazards, and mitigations, and then amend the THA as needed.

SITE WORKERS (including AECOM Contractors and Subcontractors): By signing here, you are stating the following:

* You have been involved in reviewing the THAs and understand the hazards and control measures associated with each task you are about to perform.
* You understand the permit to work requirements applicable to the work you are about to perform (if it includes permitted activities).
* You are aware that no tasks or work (that is not risk-assessed) is to be performed.
* You are aware of your authority and obligation to 'Stop Work'.

I arrived and departed fit for duty:

* You are physically and mentally fit for duty.
* You are not under the influence of any type of medication, drugs, or alcohol that could affect your ability to work safely.
* You are aware of your responsibility to immediately report any illness, injury (regardless of where or when it occurred), or fatigue issue you may have to the AECOM Supervisor.
* You signed-out uninjured unless you have otherwise informed the AECOM Supervisor.

Print Name & Company	Signature	Initials & Sign In Time	Initials & Sign Out Time
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit

(Attach additional Site Worker sign-in/out sheets if needed)

SITE VISITOR / SITE REPRESENTATIVE

Name	Company Name	Arrival Time	Departure Time	Signature

To be completed once activities for the day have been concluded:

Were there any Incidents, Near Misses or Observations?	☐ Yes ☐ No	If yes, details:
Were there any 'Stop Work' interventions?	☐ Yes ☐ No	If yes, details:
Were there any areas for improvement noted?	☐ Yes ☐ No	If yes, details:
At the conclusion of the day, the job site is being left in a safe condition and there were no reports of injury or first aid.	☐ Yes ☐ No	AECOM Supervisor Signature:

AECOM

Americas

Task Hazard Assessment

S3AM-209-FM6

Customer	**Permit No.**
Location	**Job No.**
Description of Task	**Date**

Basic Task Steps (explain how the task will be carried out)	**Hazards** (identify all hazards and potential hazards)	**Risk** (initial)	**Precautions** (describe how that hazard will be controlled)	**Risk** (final)	**Initials**
			Highest Risk Index		

Review and attach to Tailgate Meeting as required. Number and attach additional pages if necessary.

Worker/Visitor acknowledgement and review of this content on back of this document.

Risk Matrix on Reverse

Originator _____ (Print Name) _____ (Signature)

Supervisor _____ (Print Name) _____ (Signature)

THIS FORM IS TO BE KEPT ON JOB SITE.

AECOM

WORKER SIGN ON

NAME (Please Print) SIGNATURE

I participated in the development and understand the content of this Task Hazard Assessment.

VISITOR SIGN ON

NAME (Please Print) SIGNATURE TIME

Risk Rating Matrix

Probability	Severity				
	5 - Catastrophic	4 – Critical	3 – Major	2 – Moderate	1 - Minor
5 – Frequent	25	20	15	10	5
4 – Probable	20	16	12	8	4
3 – Occasional	15	12	9	6	3
2 – Remote	10	8	6	4	2
1 - Improbable	5	4	3	2	1

Risk Rating (Probability x Severity)	Risk Acceptance Authority
1 to 4 (Low)	Risk is tolerable, manage at local level
5 to 9 (Medium)	Risk requires approval by Operations Lead/Supervisor & Safety Manager
10 to 25 (High)	Risk requires the approval of the Operations Manager & Safety Director

Severity – Potential Consequences				
	People	Property Damage	Environmental Impact	Public Image/Reputation
Catastrophic	Fatality, Multiple Major Incidents	>$1M USD, Structural collapse	Offsite impact requiring remediation	Government intervention
Critical	Permanent impairment, Long term injury/illness	>$250K to $1M USD	Onsite impact requiring remediation	Media intervention
Major	Lost/Restricted Work	> $10K to $250K USD	Release at/above reportable limit	Owner intervention
Moderate	Medical Treatment	> $1K to $10K USD	Release below reportable limit	Community or local attention
Minor	First Aid	</=$1K USD	Small chemical release contained onsite	Individual complaint

Probability		
Frequent	Expected to occur during task/activity	9/10
Probable	Likely to occur during task/activity	1/10
Occasional	May occur during the task/activity	1/100
Remote	Unlikely to occur during task/activity	1/1,000
Improbable	Highly unlikely to occur, but possible during task/activity	1/10,000

Task Hazard Assessment Follow-Up/Review.

First Break **Initial**

Lunch Break **Initial**

Second Break **Initial**

Emergency Meeting / Assembly Area

Emergency Contact #

Emergency Radio Channel

Area is safe and housekeeping completed at the end of task/shift.

Supervisor (print name)

Signature

Americas

Driving

S3NA-005-PR1

1.0 Purpose and Scope

1.1 The purpose of this document is to establish policies and procedures for operation of AECOM-owned, rented, or leased vehicles, client or customer-owned vehicles, and personal vehicles used by AECOM employees.

1.2 This procedure applies to all AECOM Americas-based employees and operations. Policies and procedures related to the operation of commercial motor vehicles are in addition to this procedure; refer to *S3NA-320-PR1 Commercial Motor Vehicles.*

2.0 Terms and Definitions

2.1 **AECOM Business** – Any activity that is performed in the name of AECOM. This includes, but is not limited to, vehicle travel between work locations, client sites, meeting locations as well as driving performed as a part of work-related travel (e.g., driving to and from airports, hotels, train stations). AECOM business does not include driving that is a part of a daily routine commute from home to an AECOM location.

2.2 **Authorized Driver** – AECOM employees who receive manager approval following evaluation of driver criteria to drive and maintain an AECOM-owned, leased or rented vehicle, a client or customer-owned vehicle, or a personal vehicle operated in the course of conducing AECOM business. Authorized Drivers shall maintain a current driver's license with full privileges applicable to the vehicle to be operated. There are three categories of Authorized Drivers;

- Professional (AECOM employee who operates a commercial motor vehicle. Please refer to *S3NA-320-PR1 Commercial Motor Vehicles*).
- Hired (Employee's specific AECOM role is to drive employees in a normal street vehicle, which may or may not require commercial licensing by the applicable authorities. This category does not include busses or vans with a capacity of more than 12 people.).
- General (Driving is required as a part of the employee's job duties. This includes driving AECOM-owned, leased, or rented vehicles, client or customer-owned vehicles, or personal vehicles on AECOM business).

2.3 **Collision** – Any incident in which a motor vehicle that (whether in motion, temporarily stopped, or parked) makes contact with another vehicle or pedestrian, or results in property damage and/or bodily injury, regardless of who was injured, what property was damaged, or who was responsible.

2.4 **Commercial Motor Vehicle (CMV)** – Any self-propelled or towed motor vehicle used for AECOM business (e.g., to transport passengers or property) when the vehicle is one of the following:

- Has a gross vehicle weight rating (GVWR) or gross combination weight rating, of ≥ 10,001 pounds (4,536 kilograms); or
- Is designed or used to transport more than eight passengers, including the driver, for compensation; or
- Is designed or used to transport more than 15 passengers, including the driver, and is not used to transport passengers for compensation; or
- Is used in transporting hazardous material in quantities ≥ 1,001 pounds (454 kilograms) combined total weight at any time.
- Refer to *S3NA-320-PR1 Commercial Motor Vehicles* for additional information.

2.5 **Distracted Driving** – An activity that takes the driver's attention away from the primary task of driving.

2.6 **Driving Under the Influence (DUI)/Driving While Intoxicated (DWI)** – The operation of a vehicle while 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 the substances produces impairment in violation of the applicable governmental laws.

2.7 **Fatigue** – A general term used to describe the experience of being "sleepy", "tired" or "exhausted". The effect of fatigue is both physiological and psychological and can severely impair a driver's judgement. Fatigue can cause lapses in concentration which could prove fatal. Fatigue is not just a problem for drivers on long trips, as drivers can also suffer from fatigue on short trips.

2.8 **Incident** – For the purposes of this procedure, a vehicle collision or other event where personal injury or property damage occurs, or where a citation is issued while the employee is on AECOM business. This may also include acts of theft, vandalism, and criminal mischief.

2.9 **Journey Management** – A process for planning and executing necessary journeys safely.

2.10 **Local Laws** – Signs, postings, laws, regulations, ordinances and codes applicable for the jurisdiction in which the motor vehicle is being operated.

2.11 **Motor Vehicle Report (MVR) / Driver's Abstract** – A listing of the tickets (violations), incidents collision for an individual driver over a period of time (e.g., 3 years, 5 years) provided by a state or provincial authority such as the Department of Motor Vehicles.

2.12 **Personal Vehicle** – A motorized vehicle owned or leased by an employee.

2.13 **Portable Electronic Device** – A 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 Communication Devices (MCD)
  - Mobile/Cellular phones
  - Two-way Radios
- Personal Data Assistant (PDA)
- iPads, iPods, or other tablet models
- Computers
- Global Positioning System (GPS) receivers

2.14 **Spotters –** Extra personnel that may provide guidance when maneuvering in close and/or complex situations in order to avoid the occurrence of an incident.

2.15 **Task Hazard Analysis (THA)** – A tool for evaluating work activities for the purpose of:

- Identifying the SH&E hazards and risks associated with the activity being performed;
- Identifying and implementing control measures to eliminate or reduce hazards and risks; and,
- Evaluating the effectiveness of control measures and making modifications as needed.

3.0 References

3.1 AECOM Global Travel Policy

3.2 RS2-001-PR Firearms Standard

3.3 S3NA-003-PR1 SH&E Training

3.4 S3NA-004-PR1 Incident Reporting, Notifications & Investigation

3.5 S3NA-009-PR1 Fatigue Management

3.6 S3NA-010-PR1 Emergency Response Planning

3.7 S3NA-209-PR1 Risk Assessment & Management

3.8 S3NA-314-PR1 Working Alone

3.9 S3NA-319-PR1 All-Terrain Vehicles

3.10 S3NA-320-PR1 Commercial Motor Vehicles

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Manager / Supervisor**

- Confirming employees are informed of the provisions of this procedure and related vehicle procedures.
- Providing a copy of this procedure to an employee who will be driving an AECOM-owned, leased or personal vehicle for AECOM business.
- Allowing employees to designate time to complete required driving safety training, vehicle inspections and related activities.
- Assigning driving tasks to authorized employees only.
- Selecting and providing vehicles for use by authorized employees that are appropriate for the planned working conditions and environment.
- Supporting employees in the reporting of vehicle incidents per *S3NA-004-PR1 Incident Reporting, Notifications & Investigations,* including the entry of the incident into the on-line incident management system (e.g., IndustrySafe).
- Confirm notification of AECOM Human Resources and Counsel upon receipt by an employee of a legal summons associated with a moving violation related to the use of a company vehicle.

4.1.2 **Employee**

- Follow this procedure and applicable laws while operating a vehicle.
- Complete assigned driver safety training based on the training matrix and any additional training assessments developed at the business group. Refer to *S3NA-003-PR1 SH&E Training, including S3NA-003-FM1 SH&E Training Matrix.*
- Report to the Manager / Supervisor if the vehicle selected is not appropriate for the working conditions and environment.
- Report to the Manager / Supervisor if the employee is inexperienced in operating the type of vehicle assigned.
- Report to the Manager / Supervisor if the employee is inexperienced in driving in the type of working conditions and environment assigned.
- Review the completed Task Hazard Assessment and complete journey management. If required, document the Journey Management Plan using *S3NA-005-FM1 Journey Management Plan* or equivalent.
- Immediately report vehicle incidents per *S3NA-004-PR1 Incident Reporting, Notifications & Investigations*, including the entry of the incident into the on-line incident management system (e.g., IndustrySafe).
- Notify the appropriate Manager / Supervisor and SH&E Manager upon receipt of a legal summons associated with a moving violation related to the use of a company vehicle.
- Immediately report a change or limitation(s) to his/her Driver's License to the appropriate AECOM Human Resources representative or his/her Manager / Supervisor.

- Conducting a pre-operational inspection of the vehicle for damage or deficiencies and reporting discovered deficiencies affecting the safe operation of the motor vehicle to the appropriate authority (e.g., supervisor, rental car agency, etc.).

4.1.3 **SH&E Manager**

- Maintaining and updating training resources for vehicle and driver safety.
- Providing guidance.
- Assisting operational leaders with determining the risk incurred by the use of motor vehicles.
- Assist in the incident investigation and review process.

4.2 General Procedures and Practices

4.2.1 Only Authorized Drivers are to operate a motor vehicle (rental, personal, client or customer-owned, or AECOM-owned/leased) while on AECOM business.

4.2.2 Drivers must comply with *AECOM's Global Travel Policy* and applicable laws, and employ safe driving practices. (NOTE: *Individual state, provincial, and local laws vary*.) Refer to *S3NA-005-ATT1 Authorized Driver Safety Practices*.

4.2.3 Authorized Drivers shall confirm their operating license is on their person, and valid registration and insurance is maintained with the respective vehicle prior to operation.

4.2.4 All local laws including, signs, postings, regulations, ordinances, and codes applicable for the jurisdiction in which the motor vehicle is being operated shall be adhered to.

4.2.5 At-risk driving behavior by AECOM employees shall be identified and managed accordingly.

4.2.6 Authorized Drivers must be at least 18 years of age (noncommercial license) or 21 years of age (commercial license) and have a current driver's license for the appropriate class of vehicle (unless more stringent requirements are established by the leasing/renting agency). Employees with conditional licenses are prohibited from operating vehicles on AECOM business.

4.2.7 If an Authorized Driver receives a citation resulting in their license being suspended, has his/her driver's license revoked, or is otherwise unauthorized to drive, he/she shall notify the appropriate AECOM Human Resources representative or his/her Manager prior to start of the following work day. Failure to do this may result in disciplinary action up to and including termination.

4.2.8 The office to which the vehicles are registered is liable for any damages to the vehicle being operated by an Authorized Driver.

4.2.9 Seat belts are to be worn by the occupants. The number of passengers shall not exceed the manufacturer's specifications for the vehicle.

4.2.10 The vehicle may not move until all passengers have fastened their restraints in the proper manner (e.g., lap belt secured and shoulder harness placed over the shoulder). Vehicles are not to be operated or used by AECOM employees if seatbelts are not included as part of the vehicle's safety equipment.

4.2.11 The vehicle's engine is to be turned off during refueling. Smoking or cellular phone use is not allowed while refueling.

4.2.12 Motorcycles may not be operated on AECOM business unless:

- Specific approval is provided by the Supervisor with concurrence from the SH&E Manager.
- A hazard analysis is completed.
- Required training and license is in place.
- Headlights or daytime running lights will be used when the vehicle is in operation.
- A Class 2 or 3 safety vest and appropriate helmet shall be worn while operating a motorcycle.

4.2.13 When practical, drivers should travel during daylight hours and avoid driving during adverse weather conditions. Drivers should also inform colleagues of their travel itinerary including destination and anticipated departure and arrival times.

4.2.14 Fire arms and weapons are not permitted in AECOM-owned, leased or rented vehicles insured by AECOM. Firearms and weapons in personal vehicles are subject to the laws and regulations of the respective local, provincial, state, territory, federal and region and/or country. Refer to the *RS2-001-PR1 Firearms Standard*.

- Exceptions to this standard may exist where there is a credible and demonstrated risk to AECOM employees or assets, or when knives or weapons are required as part of the work activity. Under such circumstances, the exception must be approved by the Chief Resilience Officer, and must strictly adhere to the procedures set forth by the Global Resilience Group.

4.2.15 Vehicles are to be selected based on the nature of planned use. In some working conditions, specialized vehicles, such as four-wheel drive and higher clearance vehicle, may be required to confirm safe travel. These specialized vehicle requirements/specifications shall be identified in the project specific SH&E Plan and/or THA.

4.2.16 Vehicles are to be maintained according to manufacturer's specifications and the applicable environmental and operating factors (e.g. winterized with appropriate fluids, winter tires installed, appropriate coolant for hot climates, etc.).

4.2.17 Vehicles are to be outfitted with the appropriate support equipment based on the THA or client vehicle specifications. Support equipment may include, but is not limited to, cones, rotating warning lights, warning flags, vehicle identification (magnetic door signs or similar), wheel chocks, cargo nets, and rollover protection.

4.2.18 Drivers are to operate vehicles in a manner that avoids situations where backing is necessary. Whenever possible and as permitted, reverse parking of all vehicles while on business is required. A spotter shall be used when backing of trucks and heavy equipment presents a risk of collision.

4.2.19 Non-AECOM drivers (subcontractors, joint venture partners, clients) are prohibited from operating an AECOM company owned, leased or rented vehicle unless the activity is specifically agreed to in the applicable contract and only if the use of the vehicle is consistent with the terms of the contract.

4.2.20 Authorized drivers required to operate vehicles with special hazards (e.g., trucks carrying fuel cells, vehicles used to tow trailers, vehicles with limited visibility, etc.) will be thoroughly briefed on the hazards and control measures necessary for safe operation of the vehicle. The local AECOM operation will maintain documentation of the briefing.

4.2.21 Define specific vehicle travel routes and parking areas at field sites through the use of fencing, cones, or other markings.

4.3 Distracted Driving

4.3.1 Distractions while driving are a major cause of incidents. Distractions include the use of cellular phones (including texting), eating, drinking, smoking, and engaging in intense conversations. AECOM Authorized Drivers must exercise proper control of the vehicle at all times, including the management of possibly distracting actions and behaviors.

4.3.2 The use of portable electronic devices that may distract the driver while driving is prohibited. This includes cell phones, two-way radios and other items whether hand-held or hands-free. Electronic devices include, but are not limited to, all mobile phones pagers, iPods, MP3s, GPS DVD players, tablets laptops and other portable electronic devices that can cause driver distraction.

- Employees shall not use a personal or company mobile communication devices (MCD) while driving any vehicle on AECOM business.
- Employees shall not use a company MCD while driving a personal vehicle.
- Driving includes the time spent in traffic or while stopped at red lights or stop signs.

4.3.3 GPS units and devices (e.g., smart phones, tablets) used for navigation may only be used if factory installed or secured to the vehicle with a bracket that allows the driver to view the image without having to take their eyes off the road.

4.3.4 Electronic devices shall be setup for operation prior to commencing driving activities and shall not be changed by the driver while driving.

4.4 Impairment

4.4.1 Impairment can take many forms ranging from fatigue, to the use of prescription medication or alcohol (even small amounts), to the abuse use of illegal and legal drugs and alcohol. AECOM employees shall not drive in an impaired condition.

4.4.2 AECOM employees are prohibited from being under the influence of alcohol or drugs or improperly using medication in a way that could diminish, or raise questions concerning, an employee's ability to perform at his or her best while performing services for or on behalf of AECOM. Operation of vehicles while under the influence may void insurance coverage.

4.4.3 Drivers/operators will not drive or operate vehicles while under the influence of medications when told by a physician, another healthcare provider, or the manufacturer (e.g., instructions on the label) the medication could render the activity unsafe.

4.4.4 AECOM employees are prohibited from operating a vehicle if they are experiencing signs and symptoms of fatigue. Employees should stop work and rest before driving. No employee should operate a vehicle if they have worked 14 consecutive hours within a 24 hour period. Refer to *S3NA-009-PR1 Fatigue Management*.

4.5 Journey Management

4.5.1 When practical, alternatives to road travel should be evaluated including teleconferencing/video conferencing, the use of public transportation or carpooling.

4.5.2 Journey management is a process for planning and executing necessary journeys safely and may or may not be documented. Review the completed THA and complete the journey management process. If required, document a Journey Management Plan (JMP) using *S3NA-005-FM1 Journey Management Plan* or equivalent. The journey management process includes the following steps:

- Determining if the trip is necessary.
- Evaluating alternative safer modes of transport.
- Evaluating the potential to combine journeys with others.
- Planning the trip.
- Select the safest and most efficient route. Confirm compliance with any site specific specified routes, route rules, or restrictions.
- Confirm route planning factors in fatigue management. Refer to *S3NA-009-PR1 Fatigue Management*.
- Review road conditions and potential hazards associated with the route.
- Review weather conditions and forecast.
- If applicable, review *S3NA-314-PR1 Working Alone*.
- Confirm Emergency Response Plan includes procedures to be taken in the event of a collision or vehicle incident.
- Allow for adequate travel time.
- Inform others of destination, estimated time of arrival and routing.

4.5.3 Drivers who are to undertake trips in excess of 250 miles (400 km) each way, drive in remote or hazardous areas, or when otherwise deemed necessary, shall develop and document a JMP. This plan typically includes the route, location of route hazards, timing, rest periods and locations, communications, emergency response and security arrangements.

4.5.4 Drivers are responsible for developing the JMP and coordinating with the applicable parties identified in the plan.

4.6 Driver Safety Training

Authorized drivers shall have a current driver's license for the appropriate class of vehicle (unless more stringent requirements are established by the leasing/renting agency).

Driver safety training is to be assigned based on the risks posed with the work environment, driver type and vehicle type, using the training matrix and any additional training assessments developed at the business group level. Refer to *S3NA-003-PR1 SH&E Training, including S3NA-003-FM1 SH&E Training Matrix*. A determination of training type is at the discretion of the Manager / Supervisor, with the following guidance applied.

4.6.1 All Authorized Drivers (Professional, Hired, and General Drivers) shall be trained in this procedure; *S3NA-005-PR1 Driving*.

4.6.2 All Authorized Professional Drivers shall be trained in *S3NA-320-PR1 Commercial Motor Vehicles.*

4.6.3 Vehicle Safety (online) Training

- Recommended for all employees who drive on behalf of AECOM (Professional, Hired and General Drivers).
- Shall be completed within 1 month of the Authorized Driver's hire date.

4.6.4 Defensive Driver (online) Training

- Recommended for all Authorized Drivers (Professional, Hired, and General Drivers) who are assigned an AECOM company owned, leased or rented vehicle for a significant period of time with the expectation that the employee utilizes the vehicle on a regular basis for AECOM business.
- It is recommended that authorized drivers who have completed web-based defensive driver training or equivalent also complete a refresher every three years.
- Defensive Driver training is provided online through AECOM University or one of the following AECOM-approved training resources:
  - The National Safety Council
  - Alert Driving

4.6.5 Defensive Driver (hands-on) Training

- Recommended for all Authorized Professional Drivers and Authorized Hired Drivers.
- Recommended for Authorized General Drivers who drive in remote locations, hazardous environments (such as refineries, ports, terminals etc.), at-risk drivers, and when required by clients.
- Defensive Driver hands-on training is provided through an AECOM-approved training resource, such as Smith Systems.
- Hands on defensive driver training may be required as a result of an incident or negative Motor Vehicle Report.

4.6.6 Driver Retraining

- Drivers involved in repeated motor vehicle incidents, incidents of sufficient severity or concern, or drivers identified as at-risk through review of their Motor Vehicle Report/Driver Abstract may be retrained or, as applicable, subject to disciplinary action and refused the right to drive on behalf of AECOM.
- Retraining programs will be implemented at the discretion of the Supervisor and SH&E Manager.

- Employees eligible to continue driving shall be subject to a driver retraining program that may include any of the above programs or other training programs appropriate for the type of driving the employees performs.

4.6.7 Special Vehicles and Driving Conditions

- Vehicles such as All-Terrain Vehicles (ATVs), four wheel drive vehicles, motorized carts, snowmobiles, box vans and trailers (towing) require specialized training and supervision. For ATVs, Refer to *S3NA-319-PR1 All-Terrain Vehicles* for additional information.
- Use of these types of vehicles is limited to AECOM projects, therefore training and qualification programs for drivers will be project specific. The Manager shall work with the SH&E Manager to tailor training to the specific needs of the project.

4.7 Personal Vehicles (additional requirements)

4.7.1 The requirements of this procedure apply to the use of a personal vehicle for AECOM business. Additional requirements are set forth in the *AECOM Global Travel Policy*.

4.7.2 Personal vehicles driven by Authorized Drivers for business use must satisfy the jurisdiction's registration and inspection requirements and may not be modified beyond manufacturer's specifications.

4.8 Rental Vehicles (additional requirements)

4.8.1 The requirements of this procedure apply to the use of a rental vehicle for AECOM business. Additional requirements are set forth in the *AECOM Global Travel Policy*.

4.9 Requirements for Authorized Drivers

4.9.1 Review the *S3NA-005-ATT1 Authorized Driver Safety Practices* for specifics.

4.9.2 Drivers are not to permit unauthorized persons to operate an AECOM-owned/leased/rented vehicle.

4.9.3 All Authorized Drivers shall perform a walk-around inspection of the vehicle prior to operation.

4.9.4 Pre-operation vehicle inspections shall be performed and documented by all Authorized Professional Drivers and all Authorized Hired Drivers. A sample vehicle inspection checklist is provided in *S3NA-005-FM2 Vehicle Inspection Checklist*.

4.9.5 Vehicles with deficiencies that affect or could potentially affect the safe operation of the vehicle shall be removed from service and promptly repaired as necessary to permit safe vehicle operation.

4.9.6 As applicable, arrange for and/or coordinate with appropriate AECOM personnel to facilitate preventive maintenance services for the vehicle. Maintain it in sound mechanical condition, as per the manufacturer's recommendations provided in the owner's manual.

4.9.7 Do not operate the vehicle if unsafe maintenance conditions exist that would likely result in vehicle damage or personal injury. This applies to vehicles owned or leased by AECOM and to personally-owned vehicles used for AECOM business. Escalate other maintenance issues for correction to appropriate authority (e.g., manager, rental car agency, supervisor, etc.).

4.9.8 Transport only persons on AECOM related business or those persons receiving transportation as a prescribed service. Only drive vehicles in conditions for which the driver has the appropriate training and experience.

4.9.9 AECOM-owned, rented, or leased vehicles are for official business use only and are not to be used for personal activities. Exceptions to this requirement can be made only with the specific written approval of the Manager of the office or location the vehicle is registered to.

4.9.10 Smoking (including the use of e-cigarettes) and chewing tobacco is not permitted in AECOM-owned, leased or rented vehicles.

4.9.11 Drivers are responsible for damage caused by abuse of the vehicle.

4.9.12 Secure the vehicle when left unattended.

4.9.13 Securing loads in the inside and outside compartments of the vehicle.

- Do not rely on weight/shape of load alone. Always use a cargo net, straps, containers or other mechanical device when necessary to confirm load is secure.
- Mark loads that extend the beyond the end of truck, trailer or similar edge with a red warning flag of at least 16 square inches.
- Red lights will be utilized at night to mark loads that extend the beyond the end of truck, trailer or similar edge.

4.9.14 Do not modify existing equipment (warning sounds, backing alarms etc.) or install aftermarket equipment including toolboxes, truck caps, specialty lights, or towing equipment) without approval from the Manager of the office or location the vehicle is registered to and AECOM Procurement Department.

4.10 Emergency Preparedness

4.10.1 AECOM-owned or leased vehicles are to have a “Safety Kit” that contains a first-aid kit, portable fire extinguisher, safety triangle, and two reflective safety vests. If not available, contact the Manager / Supervisor of SH&E Manager to determine how to obtain a kit.

4.10.2 The following suggested items should be kept in vehicles used for AECOM business in remote project locations:

- First aid kit, appropriate to the work and crew size, or per regulations.
- Fire extinguisher, safety triangle, and safety vest.
- Emergency equipment (e.g., flares, flashlight, blanket, drinking water, etc.) based on conditions.
- Means of communication (cell phone, radio or satellite phone), extra batteries or a charger.

4.10.3 To the extent possible, employees should refrain from changing tires or making repairs to vehicles in the field. A road side assistance service should be identified for vehicles used for AECOM business in advance travel.

4.10.4 Specific emergency procedures are to be identified in the applicable Emergency Response Plan, JMP or the THA. Refer to *S3NA-010-PR1 Emergency Response Planning*.

4.11 Vehicle Incidents

4.11.1 Vehicle incidents are to be managed in accordance with *S3NA-004-PR1 Incident Reporting, Notifications and Investigation* regardless of how minor the incident might be.

4.11.2 The Employee(s) involved in a collision shall follow the below guidelines:

- Assess the situation to confirm everyone is safe, and remove any vehicle occupants from harm’s way. Call, or have someone else call 911 immediately, if necessary.
- As appropriate, remain at the scene of a collision to contact the police. Ask another motorist to call the police if necessary; never leave the scene of a collision.
- As applicable, provide (if requested) to police and the other driver(s) the liability insurance information. Obtain the officer’s jurisdiction, name, and badge number and a copy of the police report.
- As applicable, consider moving the vehicle out of the traffic flow if it is safe to do so, the vehicle is operational, and/or no further damage to the vehicle can occur.
- Do 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.
- Turn on the vehicle’s flashers to warn other motorists.
- Obtain:

- Names, phone numbers, and addresses of owner(s), driver(s), and occupants of the other car(s) involved.
- Other party's insurance company's name, address, phone number, policy number, and insurance agent.
- Names, phone numbers, and addresses of all witnesses.
- Photographs of the accident scene when safe to do so.

- Cooperate with AECOM Counsel if the incident results in unresolved risks or third party claims, or if the employee receives a summons, complaint or other legal documents relating to a traffic incident.
- DO NOT ADMIT LIABILITY, AGREE TO PAY FOR DAMAGE OR SIGN A DOCUMENT RELATED TO AN INCIDENT EXCEPT AS REQUIRED BY LAW.
  - Statements made in haste or anger may be legally damaging.
  - If contacted by a third party, do not answer any questions. Immediately report this contact to the Manager / Supervisor and/or Legal Counsel
- Employees shall report the incident to AECOM's Global Travel Department. If the incident involved a third party, the driver is responsible for obtaining a copy of the police report and providing to global travel

4.11.3 Employees must cooperate with the incident investigation team during any investigation of an incident meeting the investigation protocol.

4.11.4 Vehicle repairs shall be conducted at the authorization of the Manager / Supervisor.

4.12 Drug and Alcohol Testing

4.12.1 Testing for Alcohol and/or Drugs procedures shall be administered in accordance with the applicable policy and procedures.

4.12.2 In the event that a police/regulatory officer responding to a vehicle incident administers field and/or laboratory impairment testing AECOM reserves the right, as permitted, to obtain copies of such testing results for inclusion in the incident report and consideration in a subsequent incident investigation.

4.13 Driving Privileges, Citations and Violations

4.13.1 A violation of this vehicle safety standard is subject review by the appropriate AECOM Human Resources representative and may be subject to disciplinary action, up to and including termination. The applicable Manager / Supervisor will review all incidents involving AECOM-owned, rented, or leased vehicles.

4.13.2 Citations and violations which occur while driving for AECOM business are to be reported as a vehicle incident in accordance with *S3NA-004-PR1 Incident Reporting, Notification & Investigation* within 24-hours.

4.13.3 The AECOM Manager responsible for the employee, in consultation with the appropriate AECOM Human Resources representative, may suspend the privilege to operate vehicles on AECOM business due to noncompliance with the AECOM Vehicle and Driver Safety Program, involvement in a motor vehicle incident, or resulting citations or other legal actions associated with motor vehicle violations.

4.13.4 The employee's driving privileges will be suspended for any of the following:

- Accidents or legal action involving alcohol or drug use (e.g., driving under the influence).
- Driving without a license.
- Hit-and-run driving or leaving the scene of an accident.
- Unauthorized use of AECOM vehicles (e.g., using an AECOM vehicle for moving personal items, carrying passengers who are not associated with work activities, etc.).

4.13.5 The employee's driving privileges may be suspended for any of the following:

- Two or more at-fault accidents involving the same Authorized Driver within a 12-month period.
- Multiple complaints from other employees or members of the public about driving performance.
- Any accident caused by an AECOM Authorized Driver where damages exceed $2,500.
- Failure to comply with the distracted driving requirements.
- Gross misconduct or violation of policy.

4.13.6 An Authorized Driver's driving privileges may be reinstated as follows:

- For any suspension resulting from law enforcement agency legal action involving drugs and alcohol on the part of the former Authorized Driver, driving privileges may be reinstated only by concurrent agreement of the Vice President of SH&E for the applicable Business Group and Human Resources Manager.
- For those Authorized Driver's privilege suspensions that are not related to driving under the influence of drugs or alcohol, privileges may be reinstated with concurrent agreement by the AECOM Manager, the SH&E Manager, and Human Resources Manager upon completion of required remedial training.

4.13.7 Disciplinary action may include the following:

- Loss of AECOM driving privileges.
- Disciplinary warning.
- Termination.

4.13.8 The employee is personally responsible for payment of fines for moving violations and parking citations incurred while driving a vehicle on AECOM business and for reporting such incidents to his/her Manager / Supervisor. The Manager is responsible for notifying Counsel.

4.13.9 If an Authorized Driver receives a citation resulting in the license being suspended from driving or has his/her driver's license revoked, he/she is required to notify his/her Manager / Supervisor prior to start of the following work day. Failure to do so may result in disciplinary action up to and including termination.

5.0 Records

5.1 Documentation of employee training completed shall be retained in accordance with *S3NA-003-PR1 SH&E Training*.

5.2 As applicable, completed *S3NA-005-FM2 Vehicle Inspection Checklists* and/or *S3NA-005-FM1 Journey Management Plans* shall be retained in project files.

6.0 Attachments

6.1 S3NA-005-ATT1 Authorized Driver Safety Practices

6.2 S3NA-005-FM1 Journey Management Plan

6.3 S3NA-005-FM2 Vehicle Inspection Checklist

Americas

Vehicle Inspection Checklist

S3NA-005-FM2

Vehicle Tag No:	Mileage:	Date:	Time:	Driver Name:	Location:

Inspection Checklist: This Pre-Trip Vehicle Inspection Checklist is intended to be completed by the vehicle driver prior to departing on a trip. Checking boxes means that item is present and functioning. Deficiencies that affect or could potentially affect the safe operation of the vehicle shall be repaired or corrected prior to departure. This checklist should only be used in addition to an on-going vehicle maintenance program.

Item	Yes	No	N/A
1. General			
1-1 Proof of insurance and registration available and current?	☐	☐	☐
1-2 Is the date of the last regular maintenance known, or is the mileage/date of next scheduled maintenance known?	☐	☐	☐
1-3 Is the overall condition of the vehicle good (no body damage, unusual sounds, leaks, odors, etc.)?	☐	☐	☐
2. Tires			
2-1 Do all tires have sufficient tread for driving conditions? Legal limit: 2/32” (for rain/snow: > 4/32”)	☐	☐	☐
2-2 Are tires sufficiently inflated for driving conditions?	☐	☐	☐
2-3 Are the lug nuts and stem caps present and tight for each tire?	☐	☐	☐
2-4 Is the spare tire and jack present and in good condition?	☐	☐	☐
3. Vehicle Interior			
3-1 Are the brake and accelerator pedal pads in good condition?	☐	☐	☐
3-2 Are the floor mats in good condition and not interfering with the brake or accelerator pedals?	☐	☐	☐
3-3 Is the seat properly adjusted (including the headrest)?	☐	☐	☐
3-4 Is the seatbelt in good condition?	☐	☐	☐
3-5 Are the mirrors in good condition (not broken, dirty)?	☐	☐	☐
3-6 Are the dashboard/instrument lights working?	☐	☐	☐
3-7 Is the dashboard free of warning lights and do the gauges appear to work when the car is started?	☐	☐	☐
3-8 Does the horn work?	☐	☐	☐
3-9 Are distractions such as cell phones and GPS units secured so they do not encourage use?	☐	☐	☐
4. Lights and Signals			
4-1 Do the headlights and high beams work?	☐	☐	☐
4-2 Do the tail lights function properly?	☐	☐	☐
4-3 Do the turn signals work (front and rear)?	☐	☐	☐
4-4 Do the brake lights work (including high light in the rear window if applicable)?	☐	☐	☐
4-5 Do the hazard lights (emergency flashers) work?	☐	☐	☐
4-6 Do back up / reverse lights work?	☐	☐	☐
4-7 If equipped with a back-up alarm can it be heard clearly?	☐	☐	☐
5. Mechanical			
5-1 Do the brakes work and feel solid (not soft)?	☐	☐	☐
5-2 Does the parking/emergency brake work?	☐	☐	☐
5-3 Is the steering in good working condition (not loose)?	☐	☐	☐
5-4 Is the engine oil level full or in the operating zone?	☐	☐	☐
5-5 Excessive vehicle bounce going over bumps reported (possible sign of worn shock absorbers)?	☐	☐	☐

Item	Yes	No	N/A
6. Windows and Windshield			
6-1 Is the windshield clean and unbroken?	☐	☐	☐
6-2 Are the wiper blades in good condition (front and rear)?	☐	☐	☐
6-3 Are all the windows clean and unbroken and windshield fluid available and operational?	☐	☐	☐
7. Emergency Equipment (as needed per conditions/project requirements)			
7-1 Is there a “Safety Kit” (fire extinguisher, first aid, safety triangle and 2 reflective vests)?	☐	☐	☐
7-2 Is there a first aid kit, has it been inspected recently?	☐	☐	☐
7-3 Is survival gear and equipment available (blanket, water, heat source, flashlight, etc.)?	☐	☐	☐
7-4 Is a means for emergency communication available?	☐	☐	☐
8. Other Equipment (as needed per conditions/project requirements)			
8-1 Is there a means to secured loads (cargo next, container)?	☐	☐	☐
8-2 Are cones or other warning devices available?	☐	☐	☐
8-3 Is weather specific equipment (snow chains, tired etc.)?	☐	☐	☐
8-4 Does the vehicle have a snow brush/ice scraper?	☐	☐	☐
8-5 Does the vehicle have a fire extinguisher?	☐	☐	☐
9. Comments			

Inspector Name:	Signature:	Date:

Americas

Housekeeping

S3NA-013-PR1

1.0 Purpose and Scope

1.1 This procedure provides AECOM's basic housekeeping requirements for offices and work sites, as well as establishes personal hygiene and sanitation standards for housekeeping.

1.2 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

2.1 None

3.0 References

3.1 S3NA-208-PR1 Personal Protective Equipment

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Managers / Supervisors**

- Implementation of this procedure at all AECOM sites and offices.
- Confirm inspections are performed at appropriate intervals.
- Confirm the building Property Manager maintains leased facilities effectively.

4.1.2 **SH&E Managers**

- Monitor, assess, and report on housekeeping when visiting AECOM sites.

4.1.3 **Employees**

- Report any areas of concern to their Manager / Supervisor for prompt resolution.
- Maintain office locations that are free from debris, clutter, and slipping or tripping hazards.

4.2 General Housekeeping

4.2.1 All aisles, emergency exits, fire extinguishers, etc., will be kept clear (a minimum of three feet / 0.9 meters of either side) of material storage (temporary and permanent) at all times.

4.2.2 Areas in front of electrical panels will be kept clear and free of debris and materials storage for a minimum distance of 36 inches, or approximately 0.9 meters.

4.2.3 All work areas shall be kept clean to the extent that the nature of the work allows.

4.2.4 Spills shall be promptly cleaned up and resulting waste will be disposed of properly.

4.2.5 Storage areas will be maintained in an orderly manner at all times. When supplies are received, the supplies will be stored properly.

4.2.6 At all times, work areas will be kept free of debris and unused materials, tools and equipment that may affect the safety of employees and visitors.

4.2.7 All sharps, and sharp objects, shall be stored and/or guarded in a manner that prevents injury.

4.2.8 Recyclable material, debris and trash will be collected and stored in appropriate containers (e.g., recycle bins, plastic trash bags, garbage cans, roll-off bins) prior to disposal or recycling.

4.2.9 Containers maintained outdoors shall be provided with lids that are kept closed. Contents shall be removed at appropriate intervals (e.g. garbage weekly, garbage daily in areas with wildlife, monthly recyclable cardboard, etc.).

4.2.10 Take positive control measures for protection against vermin, insects, and rodents.

4.3 Smoking, Eating, and Drinking

4.3.1 Eating and drinking will be permitted in designated areas. These areas shall be located away from the work zone.

4.3.2 Operate and maintain food dispensing facilities established by AECOM in compliance with applicable health and sanitation regulations.

4.3.3 Buildings housing food dispensing facilities shall be floored completely, painted, well lighted, heated, ventilated, fly proof, and sanitary. Equip doors and windows with screens.

4.3.4 Microwave ovens shall be used for food only.

4.3.5 Use refrigerators designated for food storage for food only (i.e., no chemical or samples storage).

4.3.6 Hand washing stations shall be available nearby for employees entering the eating and smoking areas.

4.3.7 Smoking will be permitted only in areas:

- Designated in compliance with applicable local laws, regulations, legislation and ordinances;
- Not in the immediate vicinity of work-related activities or designated eating and drinking areas.
- Free of fire hazard;
- That will not contaminate indoor areas and HVAC systems. Specifically, there shall be no smoking within 5 metres (16 feet) around doorways, windows, air vents, and HVAC intakes and equipment; and
- Supervisors will designate each smoking area giving primary consideration to those employees who do not smoke.

4.3.8 Employees 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).

4.3.9 Site employees will first wash hands and face after completing work activities which involve potential exposure or contact with hazardous substances and prior to eating or drinking.

4.4 Water Supply

4.4.1 Water will be available for use on all AECOM sites and will comply with the following requirements:

- Potable Water:
  - An adequate supply of drinking water will be available for site staff consumption.
  - Potable water can be provided in the form of approved well or city water, bottled water, or drinking fountains.
  - Water coolers and water dispensers shall be maintained in a sanitary condition and filled only with potable water.
  - Where drinking fountains are not available, individual use cups will be provided as well as adequate disposal containers. Do not use common drinking cups.
  - Potable water containers will be properly identified in order to distinguish them from non-potable water sources.
  - Laboratory-test drinking water obtained from streams, wells, or other temporary sources in accordance with applicable regulations, or often enough to ensure it is suitable for consumption. Maintain records of testing reports and results

- Non-potable Water:
  - Non-potable water will not be used for drinking purposes.
  - Non-potable 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 non-potable water used will be properly identified and labelled as such.

4.5 Toilet Facilities

4.5.1 Clean and sanitary toilet facilities in good repair will be available for site and office staff and visitors. For locations without flush toilets readily available, one of the following shall be provided:

- Chemical toilets.
- Combustion toilets.
- Recirculation toilets.

4.5.2 A minimum of one toilet will be provided for every 20 site staff, with separate toilets maintained for each sex, except where there are less than five total staff on site or in an office.

4.5.3 Where toilet facilities will not be used by women, urinals may be provided instead of water closets in accordance with jurisdictional regulations.

4.5.4 Provisions for toilet facilities shall be considered as being met when mobile crews or employees working at normally unattended work locations have transportation immediately available (within 4 minutes travel time) to nearby toilet facilities.

4.5.5 Toilets shall be constructed so that the interior is lighted, by artificial or natural light, adequate ventilation is provided, and all windows and vents are screened.

4.5.6 A means for washing hands shall be provided next to or near toilet areas.

4.5.7 Release sanitary sewage into sanitary sewer lines or to other proper disposal channels.

4.6 Washing Facilities

4.6.1 Hand and Face: Site staff will wash hands and face after completing work activities and prior to breaks, lunch, or completion of workday.

4.6.2 Personal Cleaning Supplies: Cleaning supplies at all AECOM sites will consist of soap, water, and disposable paper towels or items of equal use/application (e.g., anti-bacterial gels, wipes, etc.).

4.7 Work Areas

4.7.1 Worksites which store chemical or environmental samples in refrigerators will clearly label the refrigerators that no food or beverages permitted and will locate refrigerators and sample coolers used for temporary sample storage, away from any food areas.

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 creates the risk of slips, trips, falls, and puncture wounds. Employees shall eliminate slip, trip, and fall hazards where reasonably practicable.

4.7.4 At no time will debris or trash be intermingled with waste PPE or contaminated materials.

4.8 Break Areas and Lunchrooms

Site staff will observe the following requirements when using break areas and lunchrooms at AECOM sites:

4.8.1 All food and drink items will be properly stored when not in use.

4.8.2 Food items will not be stored in personal lockers for extended periods in order to prevent the potential for vermin infestation.

4.8.3 Perishable foods will be refrigerated whenever possible.

4.8.4 All waste food containers will be discarded in trash receptacles.

4.8.5 All tables, chairs, counters, sinks, and similar surfaces will be kept clean and free of dirt, waste food, and food containers at all times.

4.8.6 All ice dispensing machines for beverages shall be hands free/touchless design to prevent bacterial contamination (no ice scoops or ice bins permitted, closed beverage containers can be stored in portable ice coolers but the ice may not be used in the beverage).

4.8.7 Refrigerators used to store food items will be maintained at 40 degrees Fahrenheit (4 degrees Celsius) and emptied of all unclaimed food items weekly. Refrigerators used to store food will be labelled as such so that only food and drinks are stored within the refrigerator.

4.8.8 Routine cleaning of refrigerators will also be performed on a regular basis.

4.9 Change Rooms and Sleeping Facilities

4.9.1 Heated and ventilated change rooms shall be provided for changing, hanging, and/or drying clothing for operations subjecting employees to prolonged wetting or contact with hazardous materials.

4.9.2 Temporary sleeping quarters shall be heated, ventilated, lighted, and clean with all doors and windows screened.

4.9.3 Keep clean and sanitary, and periodically disinfect bunkhouses, bedding, and furniture.

4.10 Office Areas

Office areas are to be kept neat and orderly. The following general rules apply to prevent injuries and to maintain a professional workplace appearance.

4.10.1 All waste receptacles shall be lined with a plastic trash bag to avoid direct contact with waste during disposal. Employees shall use gloves when handling waste and may use a compaction bar to compress waste when necessary.

4.10.2 Keep file and desk drawers closed when not in use to avoid injuries. Open only one file drawer at a time to prevent tipping of file cabinets. Nothing should be stored on top of high filing cabinets without adequate support.

4.10.3 Telephone cords, electrical cords, wastebaskets, open file cabinets, and other ground-level hazards shall be managed in a manner that protects employees from tripping and obstruction hazards.

- Electrical cords and computer/phone cables will be bundled and stored.
- Cord covers should be used to protect temporary extension cords (used for presentations etc.) where they could be a tripping hazard.
- Small electrical appliances shall not be plugged into portable extension cords.
- Multiple appliances amperage should not exceed the circuit load limits.

4.10.4 Electrical appliances shall not be used in wet areas unless the circuit is equipped with ground fault circuit interrupters (GFCI).

4.10.5 File cabinets, desk drawers, safes, and other doors shall be fitted with handles or other hardware to protect employees from pinch points.

4.10.6 All materials shall be stored in a manner that prevents tipping of storage furniture (e.g. book shelves, file cabinets) and inadvertent falling of overhead material.

4.10.7 Do not stack excessive amounts of papers or other material on shelves to reduce possibility of shelf overload or falling items.

4.10.8 Workstations should be tidied, as a minimum, at the end of each day.

- Paperwork that is not currently needed should be filed appropriately
- Refrain from storing items on the floor as they may become falling or tripping hazards.

4.10.9 In public areas of the office:

- Maintain chairs in good repair.
- Keep rugs clean, in good repair, and free of tripping hazards.
- Clean up spills immediately.
- Pick up objects that may have been left on the floor by others.
- Report loose carpeting, damaged flooring, or other obstructions that are present in walkways.

4.10.10 Broken or damaged office furniture and equipment shall be removed from service. Office equipment shall be repaired and serviced by qualified personnel or contractors.

5.0 Records

5.1 None

6.0 Attachments

6.1 S3NA-013-FM1 Housekeeping Inspection

Americas

Housekeeping Inspection

S3NA-013-FM1

Building or Location: _____

Inspection Conducted by: _____ **Date:** _____

Check Yes, No, or NA for Not Applicable.

General Site Housekeeping

1.	Exits, emergency equipment, and electrical panels unblocked?	☐ Yes	☐ No	☐ NA
2.	Equipment, materials, supplies properly stored and, as applicable, secured (e.g. chocked)?	☐ Yes	☐ No	☐ NA
3.	Drawers closed when not in use?	☐ Yes	☐ No	☐ NA
4.	Equipment, including desks and chairs, in good repair?	☐ Yes	☐ No	☐ NA
5.	Storage areas free from the accumulation of materials that constitute trip hazards?	☐ Yes	☐ No	☐ NA
6.	Recyclable material, debris and trash collected and stored in appropriate containers?	☐ Yes	☐ No	☐ NA
7.	Scrap materials and other debris from removed from work area?	☐ Yes	☐ No	☐ NA
8.	Combustible scrap and debris removed by safe means at regular intervals?	☐ Yes	☐ No	☐ NA
9.	Oily rags removed at the end of the day and stored in metal cans with tight fitting lids?	☐ Yes	☐ No	☐ NA

Visibility

10.	Worksite and, as applicable, halls, stairways and walkways are well lit?	☐ Yes	☐ No	☐ NA
11.	Well-designed light switches are present in areas where walkways are not always lighted?	☐ Yes	☐ No	☐ NA
12.	Dust, smoke or steam does not create poor visibility?	☐ Yes	☐ No	☐ NA
13.	Glare from floodlights or windows does not create poor visibility in work areas?	☐ Yes	☐ No	☐ NA

Stairs

14.	Handrails are tight and at the proper level?	☐ Yes	☐ No	☐ NA
15.	Handrails extend past the top and bottom step?	☐ Yes	☐ No	☐ NA
16.	White or yellow strips are painted on the first and last step for better visibility? (recommendation only).	☐ Yes	☐ No	☐ NA
17.	Steps are not rough or defective?	☐ Yes	☐ No	☐ NA
18.	Stair treads are wide enough and risers consistently spaced?	☐ Yes	☐ No	☐ NA
19.	Stairs are free of obstructions?	☐ Yes	☐ No	☐ NA

Floor Conditions

20.	Floors of every workroom are clean, and so far as possible, in a dry condition?	☐ Yes	☐ No	☐ NA
21.	Floors are not oily, overly waxed, or polished.	☐ Yes	☐ No	☐ NA
22.	Where wet floors or processes are present, proper drainage and false floors, mats, or other dry standing places are provided?	☐ Yes	☐ No	☐ NA
23.	Floor surfaces finished with non-slip coatings where spills are likely?	☐ Yes	☐ No	☐ NA
24.	Floors and passageways are free from protruding nails, splinters, holes, or loose boards?	☐ Yes	☐ No	☐ NA
25.	Floors are free of holes and depressions?	☐ Yes	☐ No	☐ NA
26.	Aisles or pathways are wide enough for easy passage and for carrying objects (48 inches is recommended)?	☐ Yes	☐ No	☐ NA
27.	Ramps are covered with non-slip surfaces or matting?	☐ Yes	☐ No	☐ NA

28.	Carpets or rugs free from loose or frayed edges that may catch boots or shoes?	☐ Yes	☐ No	☐ NA
29.	Extension cords, air hoses and cables removed from walkways, or otherwise managed to prevent trip hazards?	☐ Yes	☐ No	☐ NA
30.	Pathways free from boxes, containers, machine parts, or other tripping hazards?	☐ Yes	☐ No	☐ NA
	Ground Conditions			
31.	Trip hazards are not present?	☐ Yes	☐ No	☐ NA
32.	Fall hazards are not present?	☐ Yes	☐ No	☐ NA
33.	Holes or changes in ground elevation are either filled or guarded?	☐ Yes	☐ No	☐ NA
34.	Muddy or icy walkways are provided with traction material (e.g. sand, gravel) to reduce slipping?	☐ Yes	☐ No	☐ NA
	Equipment			
35.	Vehicle steps are free from debris or obstructions and of adequate size, and surface placement for safe dismounting?	☐ Yes	☐ No	☐ NA
36.	Hand grips or ladders are free from debris or obstructions and adequate for getting into and out of equipment?	☐ Yes	☐ No	☐ NA
37.	Ladders have been checked for damage and removed from service if found unsafe?	☐ Yes	☐ No	☐ NA
	Chemicals			
38.	Chemicals are properly stored to minimize a potential spill?	☐ Yes	☐ No	☐ NA
39.	Spill cleanup materials are available and appropriate for the type of potential spill?	☐ Yes	☐ No	☐ NA
	Smoking, Eating and Drinking			
40.	Smoking permitted in designated areas only?	☐ Yes	☐ No	☐ NA
41.	Designated smoking area appropriately placed?	☐ Yes	☐ No	☐ NA
42.	Appropriate and clean eating and drinking areas designated away from work areas?	☐ Yes	☐ No	☐ NA
43.	Food and drink items properly stored?			
44.	Potable water identified and readily available?	☐ Yes	☐ No	☐ NA
	Sanitation			
45.	Appropriate cleaning supplies available and properly stored?	☐ Yes	☐ No	☐ NA
46.	Hand and face washing facilities available and maintained with adequate supplies?	☐ Yes	☐ No	☐ NA
47.	Adequate toilet facilities available and maintained with sufficient supplies?	☐ Yes	☐ No	☐ NA

Identify areas that need attention and describe the corrective actions to be implemented:

_____

_____

_____

_____

_____

I certify that the above inspection was performed to the best of my knowledge and ability, based on the conditions present.

_____ _____

Signature Date

Americas

First Aid

S3NA-012-PR1

1.0 Purpose and Scope

1.1 The purpose of this procedure is to ensure employee accessibility to first aid personnel and supplies commensurate with the hazards of the workplace**.**

1.2 This procedure applies to all AECOM Americas employees and operations, except where legislation is more stringent.

2.0 Terms and Definitions

2.1 **Automated External Defibrillator (AED)** – 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 **Cardiopulmonary Resuscitation (CPR) –** An emergency procedure in which the heart and lungs are made to work by:

- Manually compressing the chest overlying the heart, or
- Both manually compressing the chest and performing rescue breaths that force air into the lungs.

CPR is applied to a victim in respiratory distress and/or to maintain circulation when the heart stops pumping (cardiac arrest), which may be due to heart tissue damage (heart attack), disease, electrical shock, drug overdose, drowning, suffocation, stroke or trauma.

2.3 **First Aid Provider –** Is a First Aid, CPR, and AED trained employee who provides emergency first aid or treatment (including performing CPR and applying an AED) to someone who is injured or suddenly ill, before emergency medical services (EMS) arrives. This is a voluntary action and not an occupational duty assigned by AECOM. They may use a limited amount of equipment to perform initial assessment and provide immediate life support and care while awaiting arrival of emergency medical services.

2.4 **High Risk Task(s) –** For the purpose of this procedure, a work related task with the potential to cause traumatic injury/illness or immediate life threatening conditions.

2.5 **Occupational Exposure –** 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 precautions specified for the project.

3.0 References

3.1 S3NA-003-PR1 SH&E Training

3.2 S3NA-004-PR1 Incident Reporting, Notifications & Investigation

3.3 S3NA-010-PR1 Emergency Response Planning

3.4 S3NA-018-PR1 Injury & Claims Management

3.5 S3NA-111-PR1 Bloodborne Pathogens

3.6 S3NA-208-PR1 Personal Protective Equipment

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 SH&E Manager

- Supporting the assessment of employees in the need for first aid, CPR and/or AED training and making training available to required employees.
- Assisting Managers with the assessment of each office or project site for adequate response time and availability of Emergency Medical Services (EMS).
- Assisting Managers with the development of the location specific emergency response plan. Refer to *S3NA-010-PR1 Emergency Response Planning*.
- Coordinating first aid/adult cardiopulmonary resuscitation (CPR) and automated external defibrillator (AED) training with the Manager.

4.1.2 Managers

- Ensure location specific emergency response plans are developed. Refer to *S3NA-010-PR1 Emergency Response Planning*.
- Coordinating weekly / monthly inspections of first aid kits and AEDs.
- Coordinating replacement supplies to re-stock first aid kits and AEDs.
- Ensuring debriefing and availability of counselling for any Employees, including First Aid Providers, who responded to the event, as well as any bystanders and co-workers who witnessed the event.
- Ensuring the appropriate investigations of incidents are conducted.
- Ensuring jurisdictional requirements, such as appropriate notifications, oversight and specific protocols are in place as necessary (e.g., requirements associated with Good Samaritan protection).

4.1.3 Employees

- Notifying supervisors of any injuries.
- Complying with emergency response procedures.
- Reporting all work related injuries in accordance with *S3NA-004-PR1 Incident Reporting, Notifications & Investigation*.

4.1.4 AECOM First Aid Providers

- Maintaining all required First Aid, CPR, and AED training.
- Providing emergency first aid or treatment if they so choose (including performing CPR and applying an AED) in accordance with training.

4.1.5 Designated Individual

- Ensuring First Aid Providers have been trained and maintain valid certificates in First Aid, CPR, and AED.
- Ensuring appropriate maintenance, testing and inspections of emergency equipment and supplies are completed as identified by this procedure and manufacturer requirements.
- Coordinating replacement supplies to re-stock first aid kits and AEDs.
- Ensuring appropriate documentation and reporting is completed as identified by this procedure and manufacturer requirements.

4.2 Requirements

4.2.1 An assessment shall be made by the Manager for each office or work site for first aid and medical requirements. The following factors should be considered:

- Types of incidents that could reasonably occur.
- Location of local clinics and hospitals.
- Response time for external emergency services (EMS).
  - Consult applicable legislation for minimum response time required as determined by hazards and distance to medical facilities.
- Corrosive or hazardous materials that may be used.
- Industry specific requirements.
- Types of training for Employees and First Aid Providers.
- First aid supplies required to be available.

4.2.2 A location specific emergency response plan must be developed and communicated to all affected personnel. Refer to *S3NA-010-PR1 Emergency Response Planning*.

4.2.3 The responsible Manager shall ensure adequate first aid supplies are available and an adequate number of trained First Aid Providers (but not less than one) are available during hours of normal operation or while performing work if either of these conditions cannot be met or relied on:

- High Risk Tasks: In workplaces locations where life-threatening injuries can reasonably be expected, emergency medical services must be available within 3-4 minutes. This generally means that community emergency medical services cannot be relied on since their response time is usually greater than 3 minutes.
- Remote Potential for Serious Injury: If no life-threatening work-related injuries can reasonably be expected, the response time for trained personnel is extended to 15 minutes.

4.2.4 The number of First Aid Providers and the type and quantity of first aid supplies will vary depending upon the number of workers, location of the office or project site, associated site hazards and legislation.

4.2.5 The trained First Aid Providers should be designated so that the other employees know who they are and how to contact them. Location specific emergency response plans shall include emergency contact lists that identify and provide contact information for the designated First Aid Providers. Refer to *S3NA-010-PR1 Emergency Response Planning*.

4.2.6 All on-site personnel must be aware of the First Aid Room (if applicable), First Aid Provider's location and contact information.

4.2.7 For certain long-term, heavily staffed, or high hazard projects, AECOM may opt to establish a first aid station on site. It should be staffed with a person who is a nurse, Emergency Medical Technician (EMT), or Emergency Medical Technician Paramedic (EMT-P) who may practice limited treatment under the direction of a physician.

4.3 First Aid Rooms

4.3.1 Where required by the applicable federal, provincial, or territorial legislation, every first aid room will:

- Be located in an area that is easily accessible to workers at all times;
- 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;

- Have adequate lighting, ventilation, and heating and be covered by a floor made of non-porous material;
- Be of an adequate size to accommodate all supplies;
- Be equipped with
- An appropriately sized First Aid Kit;
- 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;
- A stretcher.
- During working hours, be supervised by a first aid provider, who is readily available to provide first aid; and
- Be kept clean and sanitary.

4.4 First Aid Supplies

4.4.1 It is required that all AECOM locations maintain an adequate amount of first aid supplies in an easily identifiable and accessible location (this may by a vehicle in vehicle-based operations in remote locations). All locations (including vehicles) must be equipped with a complete first aid kit appropriate to the number of staff, location of work, and site hazards, as dictated by the applicable legislation and regulation.

4.4.2 First aid kits must be inspected to ensure contents meet jurisdictional requirements given the number of staff, work location, and potential hazards prior to being placed in the determined location or sent to site and, as a minimum, monthly thereafter.

- For construction operations, first aid kits shall be checked before being sent out to each job and at least weekly thereafter.
- An inventory (listing required and approved items) and weekly / monthly inspection form shall be included with each first aid kit. Any items not listed on the inventory (listed as required or approved for the kit) will be removed during the weekly / monthly inspection unless specifically approved by a health care professional for inclusion and added to the inventory. Refer to *S3NA-012-FM1 First Aid Kit / AED Inventory and Inspection* form.
- At no time will over-the-counter medications such as antacids, aspirin, cold or cough drops, or other sundry items be stored in the kits without the prior approval of a health care professional (where permitted by local legislation) and inclusion in the kit's listed inventory. Over-the-counter medications may be provided to employees with work-related injuries if recommended by a medical professional and/or a SH&E Manager.
- First aid kit content usage shall periodically be assessed for demand and supply inventory increased accordingly.

4.4.3 The Designated Individual identified on each individual project / location will be responsible for ensuring the weekly / monthly documented inspection of first aid kits for their assigned projects or locations, including all vehicles.

4.4.4 Each item in first aid kits shall be individually sealed to protect the contents from contamination. The first aid equipment and supplies shall 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.

4.5 First Aid Response

4.5.1 Any Employee who recognizes a medical emergency immediately initiates an emergency response in accordance with the location-specific Emergency Response Plan. Refer to *S3NA-010-PR1 Emergency Response Planning.*

4.5.2 First Aid Providers assess the emergency scene to determine and initiate the appropriate course of action based on their observations, the victim's condition, their training and according the location-specific Emergency Response Plan.

4.5.3 As is applicable to the victim's condition, First Aid Providers arrange for an escort to a suitable medical provider.

- For work related non-critical injuries and illnesses, Employees must follow procedures outlined in *S3NA-004-PR1 Incident Reporting, Notifications & Investigation*.
- Contact shall be made with their Manager, Supervisor or SH&E Manager prior to seeking any medical treatment for non-critical injuries/illnesses. Refer to *S3NA-018-PR1 Injury & Claims Management.*

4.5.4 As is applicable to the victim's condition, First Aid Providers transfer the victim's care to the EMS agency for appropriate advanced medical treatment and provides a report including: The initial time of the event.

- The initial time of the event.
- Any care given prior to the First Aid Provider's arrival.
- Victim's condition upon the First Aid Provider's arrival.
- Treatment rendered to the victim by the First Aid Provider.
- Available medical information about the victim.

4.5.5 If an AED was used, leave the defibrillator attached to the victim until instructed to remove it by EMS personnel or higher medical authority.

4.5.6 Reporting shall be completed in accordance with *S3NA-004-PR1 Incident Reporting, Notifications & Investigation* and *S3NA-018-PR1 Injury & Claims Management.*

4.6 Automated External Defibrillator (AED)

4.6.1 While locations are not mandated to acquire AEDs, an AED should be considered based on the number of employees, response time of local Emergency Medical Services (EMS), and access to other AED units (e.g., those provided by the office building management).

4.6.2 The selection of AED equipment will be based on the most current listing of approved AED manufacturers as provided by the American Heart Association, Heart and Stroke Foundation of Canada or country equivalent.

4.6.3 Many jurisdictions require Emergency Medical Services (EMS) notification as a requirement for placing an AED.

- This allows the servicing or responding agency to know that an AED is at a particular location. In some instances the 911 dispatcher will have that information and can advise callers as to its location.
- To meet this requirement, each location purchasing an AED will contact the local Emergency Response Services (EMS) or fire department to determine where notification(s) need to be sent.
- Some jurisdictions also require registration of AEDs. The Heart and Stroke Foundation, Department of Health or Office of Emergency Medical Services of the applicable jurisdiction may be helpful in this determination.

- Once it has been determined who must be notified, notification(s) will be made via certified mail, and records of notification will be delivered to the Designated Individual and maintained in the applicable project/ location files.
- Notification requirements shall be provided in AED procedures included in the location specific emergency response plan.

4.6.4 AEDs should be placed in a location that optimizes the fastest response time an individual walking at a rapid pace would incur to reach the victim. A general rule of thumb by the American Heart Association is that it should take no longer than 3 minutes to retrieve an AED and return to the victim. The AED should be in an easily accessible position with the location well-communicated to all staff.

4.6.5 In order to ensure readiness for use and integrity of the device, AEDs shall be inspected after use and on a monthly basis, and maintained, cleaned and tested according to manufacturer's specifications.

- Check equipment, supplies, accessories and spares for quantities, performance, expiration dates and defects. Additional items that should be stored and accessible with the AED:
  - Simplified written directions for CPR and the use of the AED.
  - Non-latex protective gloves (several pairs in various sizes).
  - Breathing barrier (CPR)
  - Disposable razor to shave chest hair if necessary.
  - Biohazard clean-up kit with two biohazard disposal bags.
  - Absorbent towels.
- AEDs shall be serviced according the manufacturer's specifications.
- After-use maintenance shall be performed according to manufacturer's specifications before it is returned to service.
- Inspections, cleaning, maintenance, tests and results shall be documented on *S3NA-012-FM1 First Aid Kit / AED Inventory and Inspection* form.
- All documentation (e.g. inspections, service records, etc.) will be delivered to the Designated Individual and maintained in the applicable project/ location files.

4.6.6 AEDs shall only be used by individuals with current and proper training.

4.6.7 Each location that has an AED will incorporate AED procedures into its location specific emergency response plan. Refer to *S3NA-010-PR1 Emergency Response Planning.*

4.6.8 AEDs shall be used in conjunction with CPR according to training and the equipment's operator directions when a victim is unresponsive and not breathing.

4.6.9 AEDs shall be applied to a victim and operated by a First Aid Provider in accordance with training and the equipment's instructions.

- Once the AED is turned on, it coaches the user through the steps for use. AEDs are completely safe. The device gives its users step-by-step instructions on what to do in an emergency situation and will only deliver a shock if the heart rhythm can be corrected by defibrillation.

4.6.10 Once an AED has been applied to a victim, it shall not be removed or turned off even if the device advises 'No Shock'. The AED will continue background monitoring of the victim's heart rhythm and alert the First Aid Provider(s) if a shock is required. The AED shall only be turned off or removed upon direction of the device itself, EMS personnel or higher medical authority.

4.6.11 When an AED has been used and has been detached from the victim, the First Aid Provider shall deliver the equipment as soon as possible to the Designated Individual who will download the data from its internal memory and, as necessary, subsequently erase the AEDs memory (ensures adequate memory space for future data).

4.6.12 Ensure any additional reporting or notifications required as per jurisdictional or client requirements is completed. Note: Jurisdictional requirements may specify additional actions, reports or notifications necessary in order for Good Samaritan protections to apply.

4.7 Eyewash and Body Flush (Shower) Facilities

4.7.1 If corrosive, irritating or otherwise hazardous materials are used, review applicable safety data sheets to assist in determining whether eyewash and body flush (shower) facilities must be provided.

4.7.2 Employees who may be exposed to corrosive, irritating or otherwise hazardous materials will be instructed in the location and proper use of emergency eyewash units and body flush (shower) facilities.

4.7.3 Eyewash and body flush (shower) facilities will be assembled and installed in accordance with the manufacturer's instructions.

4.7.4 These facilities should highly visible, clearly identified and, if possible, within 10 seconds of the hazard. The water source / flushing fluid must be tepid, pressure controlled, and maintained to prevent freezing and contamination of the fluid.

4.7.5 Eyewash facilities must be capable of flushing both eyes simultaneously and providing at least 15 minutes of potable water flow at a velocity low enough so as not to cause injury to the user (not less than 0.4 gallons per minute (gpm), or 1.5 liters per minute (lpm)).This generally requires between 7 and 15 gallons depending on flow.

4.7.6 Plumbed eyewash and body flush (shower) equipment will be activated weekly to verify operation and ensure that flushing fluid is available. Self-contained eyewash and body flush (shower) equipment will be visually checked regularly to determine whether the flushing fluid needs to be changed or supplemented.

4.7.7 Body flush (shower) facilities will be capable of delivering flushing fluid at a rate of not less than 20 gpm (75.7lpm) for 15 minutes.

4.7.8 Eye/face wash facilities will meet all the criteria outlined for facewash facilities, except the equipment will be capable of delivering flushing fluid at a rate of not less than 3.0 gpm (11.4 lpm) for 15 minutes.

4.7.9 All eyewash and body flush (shower) equipment will be included in site inspections as well as inspected annually for compliance with this procedure.

4.8 Training

4.8.1 First Aid Provider(s) shall possess a valid certificate in First Aid, CPR, and AED training from an approved provider for the applicable jurisdiction (e.g., the U.S. Bureau of Mines, the American Red Cross, St. John Ambulance, etc.), that can be verified by documentary evidence. Refer to *S3NA-003-PR1 Training.*

4.8.2 First Aid, CPR, and AED training will be renewed 30 days before expiration. 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.

4.8.3 If there is potential for occupational exposure to bloodborne pathogens, requirements of *S3NA-111-PR1 Bloodborne Pathogens* will be followed (where regulatory required).

4.9 Providing Assistance to Injured Employees

4.9.1 In the case of an emergency, the First Aid Provider may provide injured workers with a level of care within the scope of the their training, objectively record observed or reported signs and symptoms of injuries and exposures to contaminants, and refer workers with injuries considered to be serious or beyond the scope of the provider's training to medical personnel.

4.10 Program Review

4.10.1 This program will be evaluated at least annually.

5.0 Records

5.1 Documented inspections shall be maintained in the office / location / project files.

5.2 Records associated with treatment will be filed and maintained with strict confidentiality.

5.3 Downloaded AED data shall be stored in a secure location.

6.0 Attachments

6.1 S3NA-012-FM1 First Aid Kit / AED Inventory and Inspection

Americas

First Aid Kit / AED Inventory and Inspection

S3NA-012-FM1

This form is to be used to record the required contents of the first aid kit as well as document monthly First Aid Kit / AED inspections. The column '**Quantity**' is to be completed according to jurisdictional requirements and/or approval prior to the first aid kit being delivered to its intended location and at the beginning of each calendar year thereafter. Any listed items that are not required by the given jurisdiction or approved to be included in the first aid kit shall have '**N/A**' entered in the corresponding '**Quantity**' box. If an AED is not on location, or inspection is included on another *S3NA-012-FM1 First Aid Kit / AED Inventory and Inspection* form, mark the AED content in this form with 'N/A'.

Project/Location/ Office Name:		**Address:**	
First Aid Kit Type:		**Kit Location:**	
First Aid Kit ID #:		**AED Location:**	
AED ID #:		**Date:**	

Monthly inspections require the inspector to record the actual quantity of required items in the corresponding monthly column. Items deficient in number must be restocked. Unapproved items shall be removed from the First Aid Kit.

Item (Year)	Quantity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
First Aid Manual *(current)*													
Adhesive Bandage													
Elastic Adhesive Bandage													
Gauze Roller Bandage													
Triangular Bandage													
Conforming Bandage													
Tensor Bandage													
Safety Pins													
Adhesive Tape													
Antiseptic *(solution/swabs)*													
Burn Treatment													
Medical Exam Gloves													
Dressing *(Sterile Pad)* Sz/ Type													
Dressing *(Sterile Pad)* Sz/ Type													
Dressing *(Sterile Pad)* Sz/ Type													
Dressing *(Sterile Pad)* Sz/ Type													
Dressing *(self-adherent roller)*													
Eye Pad *(with Shield / Tape)*													
Breathing Barrier *(CPR use)*													
Bandage Scissors													
Soap													

Item (Year)	Quantity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cold Compress													
Splinter Forceps													
Waterless Hand Cleaner													
Waterproof Waste Bag													
Eye Wash													
Tweezers													

AED inspected according to manufacturer specifications. Use '✓' as acceptable condition and 'x' as deficient. Deficiencies, corrective actions taken, and whether inspection was an 'After-Use' inspection recorded in monthly comments below.

AED Condition													
AED Tested													
AED Pads													
AED Battery													
AED Supplies *(razor, manual)*													
AED Other													

Inspector for the given month shall record his/her name, record any comments regarding the inspection (including items replaced) and initial once complete.

MONTH	Inspector Name	Comments	Initials
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
January			
December			

Americas

Personal Protective Equipment

S3NA-208-PR1

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 Americas-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 **ANSI** – American National Standards Institute

2.2 **CSA** – Canadian Standards Association

2.3 **PPE** – Personal Protective Equipment

2.4 **SDS** – Safety Data Sheets

2.5 **THA –** Task Hazard Assessment

3.0 References

3.1 S3NA-123-PR1 Respiratory Protection

3.2 S3NA-209-PR1 Risk Assessment & Management

3.3 S3NA-301-PR1 Confined Spaces

3.4 S3NA-304-PR1 Fall Protection

3.5 S3NA-315-PR1 Working On & Near Water

3.6 S3NA-317-PR1 Hand Safety

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Managers** or **Supervisors**

- Confirm the location specific SH&E Plan documents required hazard controls.
- Confirm Task Hazard Assessments (THAs) are conducted and hazards identified are eliminated through substitution, engineering, or administrative controls first before assigning PPE for hazard mitigation.
- Confirm appropriate subject matter experts, manufacturer's specifications, and regulatory requirements are consulted as necessary to assist with proper PPE selection.
- Match the appropriate PPE to those hazards that cannot be eliminated; support employees in exercising Stop Work Authority if the task is too hazardous to be mitigated
- Provide and document employee training on use and care of PPE.
- Determine which staff requires employee-issued PPE.

- If applicable, manage medical monitoring of employees using PPE (e.g. respirators, hearing protection, radiation, etc.).
- Approve the purchase of company-issued PPE.
- Confirm that appropriate PPE is utilized by employees when required or necessary. This may periodically be documented using *S3NA-208-FM2 Personal Protective Equipment Inspection*.
- Exercise Stop Work Authority if PPE is inadequate to address hazards

4.1.2 **SH&E Managers**

- Provide guidance to Managers, Supervisors, and staff on the assessment of hazards and the selection of PPE.
- Provide training materials to Managers and Supervisors for employee training

4.1.3 **Employee**

- Review all relevant SH&E Plans, THAs and applicable SDS prior to commencing work.
- Exercise Stop Work Authority if the task is too hazardous.
- In accordance with training and instructions, utilize appropriate PPE that has been issued when required or necessary.
- Inspect PPE prior to and after use to confirm that it is functional, and maintain PPE in a clean and functional condition.
- Follow instructions and manufacturers' guidance on the care, use, and storage of PPE.
- Replace PPE when worn out, expired or damaged.
- 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

4.2.1 The location specific SH&E plan and THA shall assess the hazards and identify the necessary control measures. Refer to *S3NA-209-PR1Risk Assessment & Management.*

4.2.2 These control measures shall include direction and guidance concerning the appropriate PPE required as the last line of defense to the anticipated hazards of the specific operations and tasks. A PPE specific assessment may assist in identifying PPE requirements. *S3NA-208-FM1 Personal Protective Equipment Assessment* may be completed and included in the SH&E Plan.

4.2.3 Various tasks and operations, including but not limited to, demolition, remediation, spill response, asbestos abatement, and lead removal, may require additional direction concerning selection, use, care, and disposal of PPE from a subject matter expert (e.g. protector manufacturer, industrial hygienist, asbestos professional, etc.).

- Obtained direction shall be included in the SH&E Plan.
- Consultation with subject matters may be limited to the planning phase or they may be retained to provide technical assistance for a portion of or duration of the project.

4.3 Training

4.3.1 All employees shall be informed of their right to Stop Work if the task is too hazardous to mitigate through use of elimination, substitution, engineering controls, administrative controls, and PPE.

4.3.2 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.

4.3.3 Staff are responsible for confirming that they have reviewed the operation manual/instructions for the PPE before work commences.

4.3.4 All staff will receive a location specific orientation to the hazards on the job site as well as appropriate PPE requirements.

4.4 Determining the Need for PPE

4.4.1 Prior to beginning work, the SH&E plan shall be consulted and THAs developed to identify the PPE requirements.

4.4.2 After the hazard assessments have been completed, the manager and/or employee shall select the appropriate PPE for each job category or task, as necessary. PPE will be provided to each employee appropriate for the hazards present. All PPE selected, purchased and used by AECOM will meet or exceed the appropriate ANSI/CSA standards or other standards as determined by federal, provincial, territorial, or state legislation

4.4.3 If the hazard can be mitigated through using appropriate PPE shall:

- Properly fit the employee's body.
- Be selected and used in accordance with recognized standards and provide effective protection.
- Not in itself create a hazard to the wearer (e.g., scratched safety glasses which could cause impaired vision should be replaced with clear safety glasses).
- Be compatible so that one item of PPE does not interfere with other PPE.
- Be maintained in good working order and in a sanitary condition.
- Not be altered in any way.

4.4.4 Prior to entering any controlled or restricted work area, employees shall review the SH&E plan and corresponding THA(s) to confirm that they are equipped with the applicable ANSI/CSA-approved PPE, appropriate to the specific work area's hazards.

4.5 Eye and Face Protection

4.5.1 AECOM employees shall use appropriate eye and face protection when eye or face hazards are present or potential from flying particles, molten metal, liquid chemicals, acid and caustic liquids, chemical gases or vapors, or injurious light radiation.

4.5.2 Safety glasses with side protection is the minimum eye protection requirement. Additional eye protection shall be suitable to the anticipated hazards (e.g. goggles, safety glasses with a face-shield, welder's helmet, etc.). Refer to *SN3NA-208-ATT1 Eye & Face Protection*.

4.6 Head Protection

4.6.1 Appropriate protective hardhats are required when employees are working in areas where there is any potential for injury to the head.

4.6.2 Head protection shall be suitable to the anticipated hazards (e.g. working near exposed electrical conductors requires hardhats designed to reduce electrical shock). Refer to *S3NA-208-ATT2 Head Protection.*

4.7 Foot Protection

4.7.1 AECOM employees shall use appropriate foot protection when hazards to feet are present or potential; including impact, puncture, cut, electrical, thermal or chemical hazards.

4.7.2 Refer to *S3NA-208-ATT3 Foot Protection.*

4.8 Hand Protection

4.8.1 Appropriate hand protection is required when employee's hands are exposed to hazards such as those from skin absorption of harmful substances, cuts and lacerations, abrasions, punctures, chemical burns, thermal burns, electricity, or harmful temperature extremes.

4.8.2 Refer to *S3NA-208-ATT4 Hand Protection* and *S3NA-317-PR1 Hand Safety*.

4.9 Chemically Resistant Clothing

4.9.1 Chemically resistant clothing is required when there is significant potential for the employee to come in direct contact with the chemicals being handled. Tasks that involve chemical handling will be evaluated for potential splashing or spilling. Refer to *S3NA-208-ATT5 Limb & Body Protection*.

4.9.2 The process for selecting chemical resistant clothing will be similar for the selection of chemical resistant gloves (refer to *S3NA-208-ATT4-Hand Protection* and *S3NA-317-PR1 Hand Safety*).

4.10 High-Visibility Apparel

4.10.1 “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 ANSI/CSA standards. Refer to *S3NA-208-ATT6 High Visibility Safety Apparel.*

4.10.2 Color of apparel (orange or lime) may be client/project-specific. 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).

4.10.3 Work conducted at night may require that the minimum level of apparel worn be, at minimum, ANSI/CSA Class III, and in accordance with the governing legislation.

4.11 Personal Clothing

4.11.1 Employees on a project site shall wear full length trousers and shirts that cover shoulders.

4.11.2 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; or
- Torn or ragged clothing.
- Jewelry (e.g. rings, bracelets, neck chains) when working with moving parts or there is a risk or entanglement.

4.11.3 Long hair shall be tied back or otherwise confined when working with moving parts or there is a risk of entanglement.

4.11.4 Clothing made of synthetic fibers can be readily ignited and melted by electric flash or extreme heat sources. Cotton or wool fabrics are recommended for general use.

4.11.5 Footwear shall be suitable for the site conditions and task requirements. No athletic shoes, sandals, flip flops, permitted on active job sites.

4.11.6 It is recommended to use clothing with sun protection properties when working in high sun uv exposure

4.12 Specialized PPE

4.12.1 In addition to basic PPE, additional specialized PPE may be required to provide appropriate protection to the employee. Refer to applicable legislation and related SH&E procedures for additional information on PPE requirements.

- Fall Protection – Only full-body harnesses with shock-absorbing lanyards will be used for personal fall arrest. Refer to *S3NA-304-PR1 Fall Protection*.
- Respiratory Protection – Respiratory protection shall be selected based on the contaminant and concentration to which the employee will be exposed. Refer to *S3NA-123 PR1 Respiratory Protection*, the task- or project-specific hazard assessments and the applicable SDSs for specific requirements.
- Fire Resistant Clothing (FRC) – Approved fire-resistant outer clothing may be required at work locations with flammable or explosive materials or environments. Refer to *S3NA-208-ATT5 Limb & Body Protection.*
- Other Head Protection – Operators and passengers (if trained and permitted) of all-terrain vehicles and snowmobiles will wear approved helmets. Refer to *S3NA-208-ATT2 Head Protection.*
- Protection from Drowning – Appropriate personal floatation devices shall be worn when work working over and near water. Refer to *S3NA-315 Working On & Near Water*.
- Temperature Extremes – Work in cold environments may require additional layers and insulated clothing, gloves, boots and accessories such as balaclavas, hardhat liners. Confirm these items are approved and do not introduce additional unacceptable hazards (e.g. insufficient visibility, conductivity, etc.).
- Hearing Protection – Noise levels in the work environment that cannot be eliminated or reduced to acceptable levels requires worker be protected from exposure. Refer to *S3NA-118-PR1 Hearing Conservation.*
- Traction Devices – Traction devices applied to the base of work boots may be necessary if the employee may be walking on icy surfaces. Refer to *S3NA-208-ATT3 Foot Protection*.
- Rescue – Confined spaces hazards may necessitate the use of specific harnesses attached to retrieval lines to facilitate rescue. Refer to *S3NA-301-PR1 Confined Spaces*.

4.13 Maintaining PPE Supplies

4.13.1 Employees shall inspect their required PPE prior to use. Defective equipment shall be removed from service and replaced.

4.13.2 Each AECOM location will maintain a supply of safety equipment of appropriate types and sizes, including hard hats, high visibility vests, safety glasses, gloves, hearing protection and chemically resistant clothing based on the nature of their field activities. The Manager or designee will be responsible for maintaining this inventory.

4.13.3 Use of PPE by employees and adequacy of protection should be evaluated on a routine basis. This may periodically be documented using *S3NA-208-FM2 Personal Protective Equipment Inspection.*

4.13.4 At a minimum, locations will review their PPE program annually.

4.14 Obtaining Personalized Safety Gear

4.14.1 Employees are not expected to provide their own general PPE. Most basic PPE will be provided to the employee at no charge (e.g. safety glasses, hard hat, gloves, hearing protection, etc.) with the exception of the below personalized safety equipment (prescription safety glasses, safety-toed boots, any washable coveralls).

4.14.2 Certain personalized safety gear such as prescription safety glasses, safety-toed (capped) boots, and any washable coveralls will be ordered and sized specifically by the user. A partial cost reimbursement to the employee may be made if their location provides a specialized PPE purchase program.

4.14.3 All specialized PPE (e.g. fall protection equipment, respirators, helmets, etc.) will be provided by AECOM for employee use at no charge to the employee, with the exception of the above personalized safety equipment (prescription safety glasses, safety-toed boots, any washable coveralls).

5.0 Records

5.1 Completed SH&E plans, THAs documenting PPE requirements, and as applicable, PPE assessments and PPE inspections, will be maintained in the location's safety files.

6.0 Attachments

6.1	S3NA-208-ATT1	Eye & Face Protection
6.2	S3NA-208-ATT2	Head Protection
6.3	S3NA-208-ATT3	Foot Protection
6.4	S3NA-208-ATT4	Hand Protection
6.5	S3NA-208-ATT5	Limb & Body Protection
6.6	S3NA-208-ATT6	High Visibility Safety Apparel
6.7	S3NA-208-FM1	Personal Protective Equipment Assessment
6.8	S3NA-208-FM2	Personal Protective Equipment Inspection

Americas

Competent Person Designation

S3NA-202-PR1

1.0 Purpose and Scope

1.1 Outlines the process and minimum requirements necessary for classifying an AECOM employee as a "Competent Person" to oversee and/or self-perform activities involved with tasks listed in this procedure. Employee competency to perform work activities is addressed elsewhere.

1.2 This procedure applies to all AECOM Americas-based employees and operations where AECOM is self-performing the identified activities and where AECOM controls projects performing 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 Assessment, SH&E Plan, etc.).

1.3 It is recognized that local regulations and legislation may contain alternate definitions for Competent Person and it will be the responsibility of the manager responsible for the work (e.g. Manager, Superintendent) in conjunction with the local SH&E 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 Manager in coordination with their SH&E Manager may designate an appropriately qualified and trained Contractor employee as the Competent Person for the AECOM operations.

2.0 Terms and Definitions

2.1 **Competent Person –** An employee, through education, training and experience who has knowledge of applicable regulatory requirements, is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

3.0 References

3.1 S3-NA-213-PR1 Subcontractor Management

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 M**anager**

- Confirm that all assigned personnel, including personnel utilized from other offices to support their operations, comply with the requirements of this procedure. The manager responsible for the work shall:
  - Identify the need for a designated Competent Person or persons based on anticipated work activities.
  - Communicate competent person training/experience requirements with the employee and documenting completion of these requirements using *S3NA-202-FM-1 Competent Person Designation* or equivalent.
  - Identify supplemental employee training needs based on local/client requirements.
- For projects controlled by AECOM, when these activities are contracted to another party:
  - Confirm and secure the identity of the Contractor's Competent Person(s) for its activities. Refer to *S3NA-213-PR1 Subcontractor Management*.
  - *S3NA-202-FM1 Competent Person Designation* or equivalent may be used for this purpose.

- Provide the Contractor with a copy of this SH&E Procedure 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 documented and effectively communicated to field personnel on site during daily tailgate safety meetings.

4.1.2 **Safety, Health and Environment (SH&E) Manager**

- Assist the Manager responsible for the work in assessing the competency of all designated persons based on specific requirements outlined in this procedure.
- Assist the Manager in:
  - Establishing competent person training/experience requirements and communicating these requirements to the supervisor.
  - Monitoring the overall implementation of this SH&E Procedure.
  - Monitoring field compliance of this procedure.
  - Providing technical assistance/support as requested.
  - Coordinating internal safety training classes as requested.
- Support the Manager in establishing minimum competent person requirements for regulated job activities based on individual job descriptions, applicable regulatory requirements, operational considerations, and management directives.
- Review as requested by designated operations representatives the Competent Person's qualifications for AECOM employees.

4.1.3 **Competent Person**

- Predict, identify, and control hazards when either AECOM self-performs associated field work or oversees and directs the work of subcontractors.
  - For operations where AECOM is providing oversight of subcontractors (e.g. drilling services), it is the subcontractor's employee who shall be designated as the Competent Person.
- Contractor Competent Persons - Unless AECOM is self-performing, the Contractor shall:
  - Determine the safe means and methods of its work activities.
  - Designate its Competent Person(s) for each category of work the Contractor undertakes and/or controls as required by this procedure.
  - If the contractor is unable to designate a Competent Person, AECOM may designate an appropriate AECOM employee as the contractor's Competent Person only if AECOM is contractually responsible for safety oversight of the contractor's activities.
- The Contractor's Competent Person shall:
  - Technically support the Contractor's site operations for the safe execution of its activities. Identify and remove any field hazards
  - Maintain appropriate knowledge about the work activities, the Contractor's work practices and procedures and compliance with the associated safety and health regulations.

4.2 General Requirements

4.2.1 The AECOM Competent Person project or worksite functions are dependent on the project activities and AECOM's project or worksite function.

4.2.2 Refer to each SH&E Procedure for the activities listed below and the associated legislative standards to determine the details of responsibility.

4.2.3 The following activities require an individual to be designated as a Competent Person:

- Asbestos
- Assured Equipment Grounding Conductor
- Blasting & Explosives
- Concrete & Masonry Construction
- Confined Spaces
- Control of Hazardous Energy (Lockout-Tagout)
- Cranes & Derricks
- Crane Assembly / Disassembly
- Demolition
- Electrical Wiring Design & Protections
- Elevated Work Platforms & Aerial Lifts
- Fall Protection
- Hearing Protection
- Heavy Equipment
- Ionizing Radiation
- Lead
- Material Hoists & Personnel Hoists
- Stairways & Ladders
- Respiratory Protection
- Rigging Equipment
- Scaffolds
- Steel Erection
- Trench & Excavations
- Underground Construction
- Welding & Cutting

4.2.4 Generally, it is the responsibility of the Competent Person(s) to be on site at all times when respective staff (AECOM, subcontractor) are performing work governed by this procedure, make daily inspections of the conditions and work activities, and take actions to control any hazards associated with those activities.

4.2.5 The *S3NA-202-FM1 Competent Person Designation* or equivalent shall be used for all programs or on all projects for documenting Competent Person designations. Documentation shall be filled out completely and updated as necessary.

4.2.6 *S3NA-202-ATT1 Competent Persons in General Industry (29 CFR 1910)* and *S3NA-202-ATT2 Competent Persons in Construction (29 CFR 1926)* include descriptions of various U.S. Occupational Safety and Health Administration requirements for competent persons. The list is not comprehensive and as such 29 CFR 1910 and 1926 shall be consulted for any additional competent person requirements.

5.0 Records

5.1 AECOM Competent Person Designation forms shall be maintained in the program / project file.

5.2 Documentation as to daily inspections and corrective measures by the AECOM Competent Person shall be maintained in the program / project file.

6.0 Attachments

6.1 S3NA-202-FM1 Competent Person Designation

6.2 S3NA-202-ATT1 Competent Persons in General Industry (29 CFR 1910)

6.3 S3NA-202-ATT2 Competent Persons in Construction (29 CFR 1926)

Americas

Medical Screening & Surveillance

S3NA-128-PR1

1.0 Purpose and Scope

1.1 Provides a streamlined process to determine if employees meet the physical requirements to perform assigned duties as defined by applicable regulations.

1.2 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 Applies to all AECOM Americas employees and operations.

2.0 Terms and Definitions

2.1 **Employee Exposure Record** - A record containing any of the following kinds of information:

- Environmental (workplace) monitoring or measuring of a toxic substance or harmful physical agent, including personal, area, grab, wipe or other form of sampling, as well as related collection and analytical methodologies, calculations and other background data relevant to interpretation of the results obtained.
- Biological monitoring results which directly assess the absorption of a toxic substance or harmful physical agent by body systems (e.g., the level of a chemical in the blood, urine, breath, etc.), but not including results which assess the biological effect of a substance or agent or which assess an employee's use of alcohol or drugs.
- Safety data sheets indicating that the material may pose a hazard to human health.
- In the absence of the above, a chemical inventory or any other record which reveals where and when used and the identity (e.g., chemical, common, or trade name) of a toxic substance of harmful physical agent.

2.2 **Medical Director –** A physician, board-certified in occupational medicine, employed by the Medical Services Provider (MSP). The Medical Director manages the services provided by the MSP and provides to AECOM guidance on medical matters.

2.3 **Medical Services Provider (MSP) –** 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 **Participating Employee** – Those employees required to participate in the medical screening and surveillance program will be identified by the Supervisor, Operations and SH&E Manager. Medical surveillance is required for employees who are or may be:

- Exposed to substances at or above the occupational exposure limits.
- Required to participate by regulatory provisions (e.g., asbestos, lead OSHA standards, designated substances).
- Fit-tested for or wearing a respirator in the field.
- Working on sites/projects with specific state, provincial/territorial or federal medical surveillance requirements.
- Driving a commercial motor vehicle.
- Performing safety sensitive tasks.

2.5 **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 (e.g., benzene, lead), a physical agent (e.g., noise), or an activity (e.g., heavy lifting).

2.6 **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 Motor Vehicles (CMV)
- Workers on pipelines carrying fuels or toxic or corrosive substances
- Workers at nuclear power plants
- Employees that operate Nuclear Regulatory Commission -regulated devices (nuclear density gauges)
- Operators of industrial mobile equipment, including: cranes of more than 6,000-pound capacity, forklifts, loaders, etc.
- Laboratory technicians working with hazardous substances

3.0 References

3.1 S3NA-214-PR1 International Travel

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Employees**

- Ensuring that he/she maintains a current work clearance as required for the performance of assigned work duties.
- All employees designated to participate, called Participating Employees, in the medical surveillance program as a condition of employment or participate voluntarily and will be notified in advance if they will be assigned to a location, project or client which requires a Medical Surveillance and Surveillance program.
- If employee knows or suspects that he/she may have an adverse reaction to completing elements of the physical, (such as blood draws, physical limitation, etc.) then the employee should notify the MSP at the time they schedule the physical so that appropriate safeguards may be taken to protect the health of the employee.
- Communicate any change in medical condition (e.g. medications, pregnancy), to MSP to allow for evaluation of the need for additional precautions.

4.1.2 **Supervisors and Operations Managers**

- Evaluates the duties of each employee and prospective employee reporting to him or her for potential participation in the medical screening and surveillance program.
- Responsible for ensuring that the employee is enrolled in the medical screening and surveillance program if the employee's position requires participation. Consult with a SH&E Manager if assistance is needed in determining if an employee is required to participate in the program.
- Assures employees in 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.

4.1.3 **Safety, Health, & Environment (SH&E) Department**

- Serves as the primary point of contact between the employee, employee's supervisor, the MSP 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 MSP.

- Participates in initial SH&E training and subsequent reviews and updates that will provide guidance on exam protocols.

4.1.4 **SH&E Manager**

- 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 MSP to the Occupational Health Manager.

4.1.5 **Occupational Health Manager**

- Provide the MSP with appropriate references (e.g., a copy of this procedure, regulations).
- Designate other employees to participate in certain parameters of the medical screening and surveillance program after consultation with the Medical Director.

4.1.6 **Medical Director**

- Requires an exposure-specific examination when he/she has reason.
- Determine the frequency of the exposure-specific medical examinations.
- Consults with the Occupational Health Manager.

4.2 General Requirements

4.2.1 All AECOM employees whose work assignments involve potential exposure to harmful chemical and/or physical agents should participate in the medical surveillance program. Guidance as to harmful potential exposures is presented in *S3NA-128-FM1 Medical Surveillance Evaluation (MSE).* The form provides the primary guidance for determining whether medical screening is required for an employee and the frequency of periodic exams. The MSE is to be completed by the employee and his/her supervisor at the time of hire for any employee who may work outside an office environment. At each annual performance review, the MSE is to be reviewed for accuracy. Other reviews are required whenever there is a change in job tasks.

4.2.2 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 Supervisor, Operations Manager and SH&E Manager will identify activities/tasks that will require fit-for-duty assessments.

4.2.3 Medical screening and surveillance will only be performed were required by regulatory requirements or this procedure. Screening and surveillance provided at no cost to employees.

4.2.4 For medical screening and surveillance related to international travel, refer to *S3NA-214-PR1 International Travel*.

4.3 Types of Medical Examinations

The medical surveillance program consists of the following types of examinations:

4.3.1 **Baseline (initial)**

- 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.

4.3.2 **Periodic (annual or 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 SH&E Manager will assist in determining 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.
- Employees performing work activities on HAZWOPER sites will receive exams based on the following schedule:

Annual	Working in an exclusion zone and the regulatory required exposure limit is exceeded for 30 or more days a year.
Biennial	Working in an exclusion zone more than 30 days a year and the regulatory required exposure limit is not exceeded.

4.3.3 **Exposure-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 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.

4.3.4 **Exit/termination**

- Employees currently participating in an examination program will receive exit exams when they leave their work assignment as identified in *S3NA-128-ATT1 Exit Exam Determination.* In the event an employee declines the exit exam, the employee will be requested to sign *S3NA-128-FM2 Waiver of Exit Medical Surveillance Exam*.
- 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 or if conditions in the workplace no longer constitutes the need for the medical surveillance (e.g., change in product).
- The exit examination assesses any impact occupational exposures may have had on the employee's health status.

4.4 Exam Protocols

4.4.1 *S3NA-128-ATT2 Exam Protocol* identifies the medical exam components of exam.

4.4.2 The evaluation will be confidential and provided during normal business hours. Employees will be offered the opportunity to discuss the results of the evaluation with the MSP. All exam results are considered personal and confidential information, and will not be stored in any unsecured records not transmitted without the employee's permission.

4.5 Participating Employee Guidance and Documentation

4.5.1 When necessary, based on the position being filled, the hiring Supervisor and 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 Supervisor and Human Resources Representative may not allow the candidate to begin employment until the conditions of the offer letter have been satisfied.

4.5.2 When designated to participate in the medical surveillance program, the Employee completes and signs the following documents:

- Medical and Work History Questionnaire (provided by the MSP).

- Medical Records Release authorizing MSP to receive the work clearance certificate.

4.5.3 Any Employee that has not completed the required medical evaluation after 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.

4.5.4 If an exam becomes due during an employee's pregnancy, it is advised to defer the exam until after delivery and the employee returns to work from family/medical leave status.

4.5.5 Human Resources Representative

- Notifies the SH&E Manager or designee to arrange for exit medical examination, upon notification of termination or impending termination from the Supervisor. In the event an employee declines the exit exam, the employee will be requested to sign *S3NA-128-FM2 Waiver of Exit Medical Surveillance Exam*.
- Place the original waiver in the employee's Human Resources personnel file and send a copy the MSP.

4.5.6 Medical Services Provider (MSP)

- Provides notification approximately 30 days before subsequent periodic or exposure-specific medical examination is due.
- Notify employee 30 days before the periodic or exposure-specific medical examination is due.
- Provides notification of delinquent medical examinations.

4.5.7 Operations Manager

- Facilitate the management and exchange of documentation regarding the medical screening and surveillance program between AECOM (typically employee's supervisor) and MSP using the *S3NA-128-FM3 Scheduling Request Form*. If exams for multiple employees is required, the information from page 1 of the Scheduling Request Form and the requested exams can be placed in a spreadsheet and sent to the MSP.
- Schedule the initial exam for newly hired or re-assigned employees as needed. Special requests should be coordinated with the SH&E Manager, prior to contacting MSP to schedule.
- Assist employees with scheduling examinations as necessary.
- Coordinate medical surveillance program information exchange between Human Resources Representative and the MSP as necessary.
- Notify the candidate's manager and Human Resources upon receipt of the work clearance.
- Provide information from previous examinations that may not be readily available.

4.5.8 SH&E Manager

- Provides such assistance as is requested by the hiring Supervisor 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.
- Provides all necessary assistance to ensure that required and appropriate information is provided with the request and authorization for medical examination.
- Provides assistance to the hiring Supervisor to interpret physical activity restrictions if such restrictions are noted on the work clearance certificate.
- Confirms that all relevant exposure assessments have been appropriately annotated to show the applicability to the employee and forwarded to the MSP.

- Confirms that employees on the delinquent medical examination list have been removed from designated assignments.
- Provides assistance to ensure that terminating and reassigned employees are offered the opportunity to take an exit medical examination.

4.5.9 Supervisor

- Arranges work assignments so that the employee is available to take the medical examination before the work clearance certificate expires.
- Removes the employee from the work assignment before the work clearance certificate expires until the medical evaluation is completed and a qualified statement is issued by the Medical Director.
- Contacts the Human Resources Representative, upon notification of termination or reassignment and requests they arrange for the MSP to perform an exit medical examination.
- Releases the terminating or reassigned employee from duties as necessary to complete the exit medical examination.

4.6 Reports

4.6.1 Report of Examination

- The MSP provides AECOM and the employee with a copy of the work clearance certificate, which will include any medical restrictions and address the employee's ability to use personal protective equipment. AECOM requires the employee to preserve the work clearance certificate in a safe place and provide copies to AECOM managers and clients as requested.
- The MSP will mail a confidential letter detailing the results of the exam to the employee's home address within 30 days of the exam date.

4.6.2 Examinations Due Report

- The MSP 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 Department, who ensures each Supervisor is notified of the employees in his/her charge who are due examinations so they may be scheduled appropriately.
- The MSP notifies each employee via email or phone to the office of record 30 days before the periodic or exposure-specific medical examination is due.

4.6.3 Delinquent Examinations Report

- The MSP distributes a report of delinquent medical examinations to the SH&E Department.
- When an employee's name appears on the delinquent examination report for two consecutive months, the SH&E Department must notify the SH&E Manager, who will bring this to the attention of the employee's Supervisor for resolution. If the delinquency issue is not resolved, the employee's regional management will be notified for final resolution.

4.6.4 Physical Activity Restriction Report

- The Supervisor maintains a list of employees who have physical activity restrictions.
- The SH&E Manager shall evaluate 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 Supervisor for resolution.

4.6.5 Annual Reports

- The MSP 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 screening and surveillance program.

5.0 Records

5.1 Employees who participate in a medical surveillance or physical examination program or had exposure monitoring conducted will have access to all employee exposure and medical records maintained for that employee by AECOM and the MSP.

5.2 Upon an employee entering into a medical surveillance or physical examination program, the employee shall be informed of the following:

- The existence, location and availability of any records covered by this procedure
- The MSP responsible for maintaining and providing access to records and
- The employee's right of access to these confidential records.

5.3 Employees in medical monitoring programs are notified initially and annually thereafter, of the existence, location and ability to access medical records maintained by the MSP. Upon request, each employee (or designated representative) will have access to the employee's medical records. Prior to the release of health information to the employee (or designated representative), a specific written consent must be signed by the employee. Records will be provided in a reasonable time and manner at no cost to the employee.

5.4 Medical records must be preserved and protected in accordance with applicable legislative requirements for the duration of employment plus 30 years, verify local, state of federal regulations to confirm time period. 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 MSP to manage the medical records.

5.5 An employee or designated representative may request to review his/her medical. Such a request must be in writing and be signed and dated. The SH&E Manager or the SH&E Department will forward the request to the MSP, who will provide the employee with a copy of the medical records.

The MSP provides employees with a copy of their results after each physical. If employee would like a copy of their historical records, the MSP will supply the copy within 15 days after the request has been submitted by the employee or designated representative.

MSP performs quality control checks on all medical records to ensure examining physicians appropriately record the findings of the examination and tests. The MSP has access to all medical records to perform quality assurance checks to ensure proper recording and preservation

5.6 Projects that use local clinics or employer/client clinics may store records at that site, but at the termination of the project, all employee medical records must be transferred to long-term record retention.

5.7 If in the event AECOM ceases operations, medical records will be transferred to the successor employer. If no successor employer is available, records will be transferred to the National Institute for Occupational Safety and Health.

6.0 Attachments

6.1	S3NA-128-ATT1	Exit Exam Determination
6.2	S3NA-128-ATT2	Exam Protocols
6.3	S3NA-128-FM1	Medical Surveillance Evaluation
6.4	S3NA-128-FM2	Waiver of Exit Medical Surveillance Exam
6.5	S3NA-128-FM3	Scheduling Request Form
6.6	S3NA-128-FM4	Waiver of Medical Surveillance

Americas

Substance Abuse Prevention

S3NA-019-PR1

1.0 Purpose and Scope

1.1 This policy and procedure applies to all Americas - based employees and operations and is consistent with the U.S. Drug-Free Workplace Act of 1988 and in accordance with federal, state / provincial / territorial, and local laws and regulations. It sets out practices for a drug-free, healthy, productive, safe and secure workplace and provides guidance for employees and supervisors with respect to their responsibilities. Drug and alcohol abuse pose a serious threat to the health and safety of employees, clients, and the general public as well as the security of our job sites, equipment and facilities. The Company is committed to the elimination of illegal drug use and alcohol abuse in its workplace and regards any misuse of drugs or alcohol by employees to be unacceptable.

1.2 AECOM prohibits the use, possession, presence in the body, distribution, manufacture, concealment, transportation, promotion or sale of the following items or substances on company premises:

- Illegal drugs (or their metabolites), designer and synthetic drugs, mood or mind altering substances and drug use related paraphernalia unless authorized for administering currently prescribed medication;
- Controlled substances that are not used in accordance with physician instructions or non-prescribed controlled substances;
- Alcoholic beverages while at work or while on any customer or AECOM controlled property. This prohibition on alcohol applies whenever an employee is on-duty, including during meal or break periods, while on Company premises, or while representing AECOM. AECOM may make exceptions and permit the consumption of alcohol beverages at work-related events, such as Company-sponsored or approved business meals, conferences, or holiday events. Employees who choose to consume alcohol on approved occasions are expected to exercise good judgment and to refrain from becoming intoxicated or impaired. If an employee has consumed alcohol and needs transportation home, the Company will reimburse the cost of a taxicab or other reasonable costs of transportation so that the employee may avoid driving.
- This policy does not prohibit lawful use and possession of current medication prescribed in the employees name or over-the-counter medications. Employees must consult with their health care provider about any prescribed medication's effect on their ability to perform work safely. An employee who has work restrictions due to his or her consumption of a prescribed medication must disclose these restrictions to their supervisor.

1.3 Substance abuse testing procedures shall meet requirements of various U.S. regulatory agencies and / or those of the applicable jurisdiction, with regard to testing employees for the possession and use of illegal drugs (and their metabolites),mood or mind altering substances, synthetic and designer drugs, unauthorized use of prescription drugs and the unauthorized use of alcohol on AECOM or client premises or during working hours. The procedures will also comply with applicable laws and regulations by federal, state and local law. If the law of a particular location differs from the practices expressed in this policy and procedure, AECOM will implement this policy and procedure in accordance with applicable law.

1.4 Although some states may pass laws legalizing medical or recreational marijuana use, the use, sale, distribution and possession of marijuana are violations of federal law. Similarly, the use sale, distribution, presence in the body and possession of marijuana or the presence of marijuana on company premises or while on duty including during lunch and breaks violates the *S3NA-019-ATT1 Substance Abuse Policy Statement* (policy), and will subject an employee to disciplinary action up to and including termination in accordance with controlling law.

1.5 This policy and procedure has been developed to provide employees, managers, supervisors and administrative support personnel with guidelines and procedures for the implementation, administration, and enforcement of this policy and procedure. The company policy statement for substance abuse prevention is included as Attachment 1 of this document and a copy of the included policy statement shall be posted on employee information boards. New employees shall receive and sign *S3NA-019-FM1 Acknowledgement and Consent Form* upon hire or transfer between sites or clients as acknowledgement of the program requirements. A signed or electronic copy of this form should be kept as part of the employee personnel file.

1.6 This policy and procedure does not prohibit employees from the lawful use and possession of current prescribed or over-the-counter medications. Employees must consult with their health care providers about any prescribed medication's effect on their ability to perform work safely. Employees must disclose any relevant work duty restrictions to their supervisor. Employees are required only to provide information necessary for the Company to make an informed decision regarding the ability to perform required work safely, and to evaluate whether the employee may be entitled to a reasonable accommodation. Employees who must bring current prescribed medications to work must carry the medication in the original packaging bearing a current label from a licensed pharmacist for the person in possession of the drugs.

1.7 Compliance with this policy is a condition of initial and continued employment. Failure to comply with these requirements will be grounds for disciplinary action, up to and including termination of employment.

1.8 This procedure will be administered by the Corporate Substance Abuse Program Manager in conjunction with Safety, Health & Environment (SH&E) and Human Resources (HR).

2.0 Terms and Definitions

2.1 **Adulterated Sample** – A urine sample provided by an applicant, employee or contractor that has been intentionally altered to mask the analysis for illegal substance use. Any applicant or employee who knowingly provides a false sample or attempts to adulterate a sample will be terminated or disqualified from employment.

2.2 **Breath test for alcohol (BrAC)** – A method of measuring the breath alcohol concentration (BrAC) of an individual using an approved analyzer performed by a certified analyst using test protocol described in the SAP Procedures.

2.3 **Confidentiality** – The principle in medical ethics that the information a patient reveals to a health care provider is private and has limits on how and when it can be disclosed to a third party.

2.4 **Employees/Applicants** – The SAP program will apply to all individuals who may be: regular full-time, part-time, probationary, temporary, craft (direct hires), casual, contract or leased employees, and applicants of employment as permitted by applicable laws

2.5 **Employee Assistance Program (EAP)** – All salaried employees and their immediate family members are eligible for the EAP assistance limited to five paid counselling sessions per calendar or benefit year. Hourly employees may be eligible on projects, plants and mines or in offices where a substance abuse testing program is implemented. Separate EAP brochures and telephone cards are available through the HR Department. Check with your HR manager for eligibility for EAP.

2.6 **Illegal Drugs, Controlled Substances and Unauthorized Items** – Illegal drugs, designer and synthetic drugs, substances that impair job performance or safety and drug-related paraphernalia: Controlled substances such as medications when usage is abused; Unauthorized alcoholic beverages

2.7 **Medical Review Officer (MRO)** – The MRO is a designated Medical Doctor (MD) with experience and certification in the interpretation of urinalysis test results for drug testing. The MRO examines the positive test results with consideration of whether there is a legitimate medical reason for the result. This is accomplished by telephone interviews with the donor and also with their prescribing physician or pharmacist when prescription or over the counter medications are possibly involved.

2.8 **Negative Drug Test** – A personal sample (urine, blood, hair, breath, swab or other permitted by law) that indicates a concentration(s) of any drug on the panel which is below the cut-off limit and also meets all quality control requirements (e.g., temperature, pH) and no evidence of adulterants.

2.9 **Positive Test Result** – A personal sample (urine, blood, hair, breath, swab or other permitted by law) that indicates a concentration(s) of any drug on the panel which is above the cut-off limit and/or the GCMS confirmation level of that applicable regulation or requirement.

2.10 **Prohibited Substances** – Illegal or unprescribed drugs (or their metabolites), controlled substances and mood or mind-altering substances (i.e. any synthetic derivative/product that produces a marijuana-type high and any herbal products not intended for human consumption); or any prescribed drugs used in a manner inconsistent with the prescription, and alcoholic beverages.

2.11 **Reasonable Suspicion** – Suspicion based upon the observation of objective facts or specific and articulable behavior. May also be warranted based on search or disclosure of evidence obtained on a work site or company controlled property. Supervisor should complete a Reasonable Suspicion training course and document the process and observations.

2.12 **Refusal to Test** – Refusing to provide a sample or refusing to accept and sign the testing consent form, is considered a breach of company policy and subject to disciplinary action up to termination of employment.

2.13 **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. AECOM business groups may further define safety sensitive as it applies to their applicable line of work. Examples, but not a complete list, of positions that may be designated “safety-sensitive” by regulations include:

- Drivers of Commercial Motor Vehicles (CMV)
- Workers on pipelines carrying fuels or toxic or corrosive substances
- Workers at nuclear power plants
- Employees that operate Nuclear Regulatory Commission -regulated devices (nuclear density gauges)
- Operators of industrial mobile equipment, including: cranes of more than 6,000-pound capacity, forklifts, loaders, etc.
- Laboratory technicians working with hazardous substances.

2.14 **Swab Alcohol Test** – A swab test may be required by a client instead of the Breath test for alcohol (BrAC).

3.0 References

3.1 None

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Supervisors and Managers**

- Observe and document employee behavior which appears to violate this policy and procedure and refer employees for drug and alcohol testing as required.
- Ensure all employees have been orientated to this procedure and are knowledgeable about, and in compliance with this procedure, associated policy and applicable programs.
- Make appropriate referrals for a drug and/or alcohol test as per this procedure as well as any client contractual agreements or governmental regulation.
- Be current with the Employee and Supervisor Training and education programs so as to be knowledgeable about the use of alcohol and drugs and be able to recognize the signs and effects of alcohol and drug uses.

- Alert and involve Human Resources (HR), the Corporate Safety, Health and Environment (SH&E) Occupational Health Manager and the Substance Abuse Program Administrator when an employee is believed to be unfit for duty due to drugs or alcohol use in violation of this policy and/or if an employee is tested for a reasonable suspicion use of drugs or alcohol.
- If any illegal drugs or drug paraphernalia are located on company premises, do not handle the items and immediately notify the following as necessary: HR, Resilience Group, the police department and the Corporate Substance Abuse Program Manager.
- Guide employees who voluntarily seek assistance for a personal substance abuse problem to appropriate resources such as the EAP or other local resource.

4.1.2 **Employees**

- Commit to a safe and drug-free workplace by complying with this policy and procedure and understanding their responsibilities.
- Read and understand the *S3NA-019-ATT1 Substance Abuse Policy Statement* detailing the Company's commitment to a drug free workplace. The signed *S3NA-019-FM1 Acknowledgement and Consent Form* attests that they have reviewed and are familiar with this procedure and understand that compliance is a condition of employment. Any questions should be directed to the Substance Abuse Administrator or HR.
- Follow the instructions of their supervisor or Substance Abuse Administrator when informed that they have been chosen for a random or client drug test as allowed by federal, state or local law and regulations. Failure to do so may result in discipline up to and including termination.
- Participate in substance abuse training programs as directed.
- Report for work Fit for Duty and remain Fit for Duty while on Company premises and worksites and adhere to the standards set out in this procedure and any applicable program.
- Notify your supervisor, HR or SH&E representative if you believe another employee or subcontractor is not Fit for Duty or exhibits conduct suggesting substance abuse.
- If having a valid driver's license is a condition of employment, report any loss of license related to drug or alcohol use immediately (no later than 24 hours after losing the license) to your supervisor.
- Consult with health care provider about any prescribed medication's effect on the ability to perform work safely and disclose work restrictions due to consumption of prescribed medications to their supervisor to determine if reasonable accommodation is needed.
- Bring legally prescribed medicine in the original packaging bearing a current label in the employee's name from a licensed pharmacist if the employee carries more than a single day of prescribed medications to work.
- Notify management of any criminal drug or alcohol conviction for a violation no later than five (5) days after such conviction.

4.2 Types of Testing

4.2.1 Employees undertaking Safety-Sensitive tasks or in a Safety Sensitive position may be required to undergo drug and alcohol testing.

4.2.2 Pre-employment Testing - Applicants extended a conditional offer of employment may be required to take, and pass, a pre-hire drug test before beginning work. Individuals who test positive or refuse the test will not be hired and will be ineligible to reapply for a period of six months. Employees who transfer from one company business group or project to another are not required to take a pre-employment drug test if their employment is without interruption, they are not subject to client testing or safety sensitive testing requirements, and they would have been expected to have taken a pre-hire or client mandated drug test.

4.2.3 Random and Annual Testing - Employees may be subject to random drug and/or alcohol testing in accordance with federal, state and local laws. In addition, employees may be subject to random or annual drug tests to meet contract requirements.

- Selections for random testing will be made by the Substance Abuse Program Administer or a Certified Third Party Administrator using employee identification numbers and a random selection process. They will be unannounced and once selected for testing, an individual may not be waived from the testing process.
- Employees will be notified to report for random tests at a time when they should be able to stop working and report immediately to the collection site. Failure to report for a test promptly when instructed to do so may be considered a refusal to test.
- Employees who may be required to submit to random or annual tests will be so notified at the time that they are hired into a covered position, when they transfer into such a position, or when random or scheduled testing becomes applicable to their position.

4.2.4 Reasonable Suspicion Testing - Employees are subject to drug and/or alcohol testing whenever AECOM supervision has reason to believe that the employee has violated this policy and procedure. Requests for tests will be based upon contemporaneous, articulable observations from supervisors suggesting that the employee may be under the influence of illegal drugs, controlled substances, or alcohol.

- Examples of observations that may lead to a test can include the employee's appearance, behavior, speech, body odors, absenteeism, job performance, tardiness, etc. Whenever possible, observations will be documented and reviewed by HR before the individual is asked to submit to a test.
- An employee asked to take a drug and/or alcohol test will be suspended without pay until test results are received. They may use Paid Time Off (PTO) time during this period. An employee who has negative test results will be returned to work status and the employee will then be paid or have their PTO restored for any lost time during that period.

4.2.5 Post Incident/Accident Testing - Employees are subject to drug and alcohol testing in accordance with state / provincial / territorial and local law whenever:

- An employee sustained or caused an injury necessitating off-site medical treatment;
- They have caused or contributed to an accident that results in property damage estimated (including to Company vehicles or equipment) of $2,500 or more (a lower cost of damage requiring testing may be identified in Business Group specific programs);

In either of these instances, the investigation and substance abuse testing must take place immediately following the incident, except that no investigation or request for test will delay the provision of urgent medical care to any person in need of assistance. Employees will not be allowed to return to work until a negative drug/alcohol test result is received.

4.2.6 Return-to-Work and Follow-up Testing - Employees who test positive for drugs or alcohol or who have otherwise violated this Policy and Procedure are subject to discipline, up to and including discharge. Depending on the circumstances, the Company may offer an employee who violates this Policy and Procedure the opportunity to seek assistance in lieu of termination through the Employee Assistance Program ("EAP") or another approved counseling program. Employees offered this opportunity will be required to be evaluated by a substance abuse professional, and to complete any course of education or treatment prescribed before returning to work. In addition, employees must have a negative drug/alcohol test prior to their return to work and follow-up drug and/or alcohol testing may be required as a condition of continued employment, for a period of up to two years following the return to work. If subject to a client-specific substance abuse policy, employees who have had a positive test result will not be permitted to return to work on the client site or facility. Return-to-Work Agreements will be tailored to the individual's circumstances and job responsibilities.

4.3 Collection and Testing

4.3.1 Consent and Refusals to Test: No sample will be collected, or test conducted on any sample, without the consent of the person being tested. However, a refusal to submit to a test will be treated as an admission of a policy violation and will usually result in termination of employment. Job applicants who refuse a test will have their job offers withdrawn.

- Attempts to tamper with, substitute, adulterate, dilute or otherwise falsify a test sample are considered refusals to submit to a test, as is a refusal to accept transportation to the testing facility, failure to appear at the testing location promptly after being asked to submit to a test, or other conduct that has the effect of frustrating the testing process. AECOM will pay the costs of all drug and/or alcohol tests it requires.

4.3.2 Test Methods: Drug test samples may include urine, hair, swab or saliva (oral fluids). All drug test samples will be screened and all presumptive positive drug tests will be confirmed using gas chromatography/ mass spectrometry (GC/MS) (or an equally accurate methodology). Drug tests will be performed by a laboratory certified by the U.S. Substance Abuse and Mental Health Services Administration for federal workplace testing, or as required by the applicable jurisdiction. Breath, blood, swab or urine tests may be used to detect the presence of alcohol. An alcohol test will be considered positive if it shows the presence of .04 percent or more alcohol in a person's system.

- Dilute or invalid results will require a recollection, and the Company may require the individual to provide an alternative test specimen as may be available and consistent with the underlying purpose of the test.

4.3.3 Collection and Chain-of-Custody: Persons being tested will be asked to provide a test sample to a trained collector. Procedures for the collection of specimens will allow for reasonable individual privacy. Urine specimens will be tested for temperature, and may be subject to other validation procedures as appropriate. The collector and the person being tested will follow chain-of-custody procedures for specimens at all times. Tests will seek only information about the presence of drugs and alcohol in an individual's specimen, and will not test for any medical condition.

4.3.4 Notification and Medical Review: Any individual whose test sample is confirmed positive for a drug or drugs will be contacted by a Medical Review Officer ("MRO") (a medical professional with an expertise in toxicology) and offered an opportunity to explain in confidence any legitimate reasons he or she may have that would explain the positive test (such as, for example, evidence that the individual holds a prescription for the substance detected). The MRO may also review suspected adulterated, substituted, and dilute specimens and make determinations about their validity.

- If the individual provides an explanation acceptable to the MRO that a drug test result is due to factors other than the consumption of illegal drugs, the MRO will order the positive test result to be disregarded and will report the test as negative to AECOM. Otherwise, the MRO will verify the test as positive and report that test result.

4.3.5 Right to Explain and Retest: Within three working days after notice of a verified positive drug or alcohol test result on a confirmatory test conducted under this Policy, the tested individual may submit information to the MRO to explain the positive result. An individual who tests positive for drugs also may ask to have his or her remaining or split test sample sent to an independent certified laboratory for a second confirmatory test, at the individual's expense, and provided that a written request is made within five business days of the date the individual of the positive test result. AECOM will notify the original testing laboratory that the employee or applicant has requested that the laboratory conduct a confirmatory retest or arrange for transfer of the sample to the laboratory selected by the individual to perform the confirmatory retest. Tested individuals will be required to pay the testing laboratory for any confirmatory retest they request. AECOM may suspend, transfer, or take other appropriate employment action against an employee pending the results of any such re-test. However, if the re-test fails to confirm as positive the individual will be reimbursed for the cost of the re-test and the prior test results disregarded.

4.3.6 The Company will provide drug and alcohol tests results to candidates and employees automatically, where state law so requires, and otherwise upon written request as may be required by law.

4.4 Inspections

4.4.1 The Company reserves the right to inspect and search all portions of its premises for drugs and other contraband. All employees, contract workers, and visitors may be asked to cooperate in inspections of their persons, work areas, and property brought on site in connection with an inspection. Employees who refuse to cooperate in any such inspections are subject to discipline, up to and including discharge**.**

4.5 Confidentiality

4.5.1 Information and records relating to drug screen test results, drug and alcohol dependencies and medical information shared with the Company in the course of administering this Policy and Procedure shall be treated as confidential and shared with HR and managers on a need-to-know basis. Information will not be released to third parties except with the consent of the individual or where relevant to a grievance, charge, claim, or other legal proceeding initiated by or on behalf of an employee or applicant, or as may be required by law or legal process.

4.6 Employee Assistance Program and Drug Free Awareness

4.6.1 Illegal drug use and alcohol misuse result in a number of adverse health and safety consequences. Information about those consequences and source of help for drug/alcohol problems is available from HR representatives who can also refer employees to the EAP for assistance with drug/alcohol related problems. Information about the EAP program is available on the Company intranet.

4.6.2 The Company will provide support to employees who voluntarily seek help for drug or alcohol problems. Depending upon the circumstances, the employee may be referred for evaluation and allowed to use accrued paid time off or be placed on leave as may be necessary to complete any prescribed education and/or treatment. Employees also may be required to document that they are successfully following a prescribed education and/or treatment plan and pass return to duty and follow-up drug and/or alcohol testing. A request for assistance will be considered voluntary only if made before the employee becomes subject to disciplinary action for violating this or another Company policy, and cannot excuse substandard performance, so AECOM encourages employees who may need assistance to seek it promptly:

4.6.3 In conjunction with the EAP, the Company will promote a drug-free awareness program to inform employees about:

- The dangers of substance abuse in the workplace.
- Available counseling, rehabilitation, and EAPs (both for self-referral or supervisory referral).
- The penalties that may be imposed for violations of this procedure.
- The Company's commitment to promoting a drug-free workplace.

5.0 Records

5.1 None.

6.0 Attachments

6.1 S3NA-019-ATT1 Substance Abuse Policy Statement

6.2 S3NA-019-FM1 Acknowledgement & Consent Form

Americas

Emergency Response Planning

S3NA-010-PR1

1.0 Purpose and Scope

1.1 Providing the requirements for preparation and planning for potential emergencies that may occur while AECOM staff are working.

1.2 Applies to all AECOM Americas-based staff working inside and outside an AECOM office, including location and project environments.

1.3 The intent of this plan is to:

- Enable prompt, informed emergency responses.
- Promote the safety of workers, visitors, and those responding to an emergency.
- Reduce the potential for destruction of goods and other property.
- Reduce the magnitude of environmental and other impacts.
- Help those responding to an emergency quickly determine and initiate proper remedial actions.
- Reduce recovery times and costs.
- Provide confidence to workers, visitors, and those responding to an emergency that emergencies will be properly managed.

1.4 This procedure represents AECOM's minimum requirements and should be augmented by more stringent local regulatory requirements and/or client requirements.

1.5 Location Specific Emergency Response Plans are to be included in the respective Office Safety, Health and Environment Plan (refer to *Global Office Safety, Health & Environment Plan*) or the location specific SH&E Plan (refer to *S3NA-209-PR1 Risk Assessment & Management).*

1.6 Emergency Response is an initial response which may require additional actions as detailed in *RS2-003-PR1 Disruptive Event Response Standard*.

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 **Emergency Response Coordinator –** An individual in a worksite or project environment designated to lead and direct the immediate emergency response.

2.3 **Local Resilience Coordinator (LRC)** – A manager designated as the Office or Worksite lead for local level organizational resilience who may or may not be the emergency response coordinator. The LRC is the point of contact with the Region Resilience Team in determining further action, including notifications, following an initial emergency response. Refer to *RS2-003-PR1 Disruptive Event Response Standard*.

2.4 **First Aid Provider** – Is a First Aid, CPR, and AED trained, volunteer, AECOM employee who provides emergency first aid or treatment (including performing CPR and applying an AED) to someone who is injured or suddenly ill, before emergency medical services (EMS) arrives. This is a voluntary action and not an occupational duty assigned by AECOM. They may use a limited amount of equipment to perform initial assessment and provide immediate life support and care while awaiting arrival of emergency medical services. Refer to *S3NA-012-PR1 First Aid*.

2.5 **Floor Marshall** – An individual in the office environment designated to lead and direct the immediate emergency response.

2.6 **Floor Warden** – An individual in the office environment, as required by building design and employee numbers, designated to assist the Floor Marshall in directing the immediate emergency response.

3.0 References

3.1 GRG-001-RP4 Operational Security Plan

3.2 RS2-003-PR1 Disruptive Event Response Standard

3.3 Global Office Safety, Health & Environment Plan Template

3.4 S3NA-004-PR1 Incident Reporting, Notifications & Investigation

3.5 S3NA-011-PR1 Fire Protection

3.6 S3NA-012-PR1 First Aid

3.7 S3NA-111-PR1 Bloodborne Pathogens

3.8 S3NA-209-PR1 Risk Assessment & Management

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Managers**

- Develop and implement Location Specific Emergency Response Plans and security standards for the applicable office, location and/or project personnel.
- Confirm Location Specific Emergency Response Plans and security standards are included in the respective Office Safety, Health & Environment Plan or location specific SH&E Plan.
- Confirm appropriate training of employees as determined by the potential emergency situations, regulatory requirements and, if applicable, client requirements.
- Confirm the emergency response plan is communicated to all affected personnel.
- Confirm that necessary training and resources appropriate to the potential emergencies is provided to AECOM employees.
- Confirm that necessary and appropriate emergency response equipment is readily available.
- Confirm that emergency drills are completed annually or more frequently as appropriate to the risk of the potential emergency or as required by legislation. Confirm the effectiveness of the procedure and, as needed, take corrective action. The *S3NA-010-FM1 Emergency Response Drill Report* or equivalent shall be used to confirm the completion and effectiveness of the drill.

4.1.2 **Safety, Health &Environment (SH&E) Manager**

- Assist in the development and implementation of emergency response plans and security standards for the applicable office, location and/or project personnel.
- Review and, as necessary, implement emergency response plans and security standards.

4.1.3 **Supervisors**

- Review and, as necessary, implement emergency response plans and security standards.
- Confirm employees have completed any required training associated with the identified potential emergencies.
- As applicable, confirm that employees have access to communication devices that are in good working order. Maintain current rosters of employees under their supervision.

4.1.4 **Employees**

- Participate in any required training and drill exercises.
- Report any potential or actual threatening situations to the Manager, Supervisor and/or Emergency Response Lead.
- As applicable, oriented to the potential risk of violence and instructed how to identify and respond to violent situations.
- Report an injury or adverse symptom as a result of an incident of violence and when appropriate consult a physician for treatment or referral
- Review and, as necessary, implement emergency response plans and security standards.

4.2 Emergency Response Plan (ERP)

4.2.1 An assessment shall be completed by the Manager of each location to determine the potential emergency situations and the adequate number of First Aid Providers, first aid supplies and medical requirements, including determining the response time and availability of Emergency Medical Services (EMS). Refer to *S3NA-012-PR1 First Aid.*

4.2.2 Managers will establish and implement the location specific ERP using *S3NA-010-FM2 Location Specific Emergency Response Plan Template*. The ERP shall be communicated to all affected employees.

4.2.3 The location specific ERP will include:

- The location of the muster point, first aid, fire extinguishers, fire exits, AED, and other emergency equipment.
- Defined roles and responsibilities in the event of an emergency.
- A contact list that includes, as applicable, fire, police, ambulance, poison control, First Aid Providers on location, fire wardens on location, Site Safety Officer, security, SH&E committee, SH&E Reporting number for reporting all AECOM incidents, and other required emergency contacts.
- Procedures appropriate to the potential emergency situations.
- As applicable, maps to appropriate services, such as hospital or medical clinic.
- *S3NA-010-FM2 Location Specific Emergency Response Plan Template* shall be completed according to the office or worksite's needs.

4.2.4 The location specific Emergency Response Plan (ERP) will comply with all governing regulations.

4.2.5 The location specific ERP shall be included in the location specific Office Safety, Health & Environment Plan (refer to *Global Office Safety, Health & Environment Plan*) or the location specific SH&E Plan (refer to *S3NA-209-PR1 Risk Assessment & Management*).

4.2.6 If the hazard assessment for the location indicates a need for planned evacuation or rescue, appropriate written procedures will be developed and implemented.

- Depending upon the various contributing factors to the potential emergencies, the procedures may require coordination with a third party rescue provider, or preparations for mass evacuation away from a site.
- If applicable, procedures should be developed to assist any personnel with disabilities in the event of an evacuation.

4.2.7 The location specific emergency plan will be readily available to personnel.

- Worksites shall post the ERP at all worksite entrances and/or develop alternate methods to confirm ERP accessibility, such as placing the ERP at muster points, on appropriate vehicle dashboards, driver door pockets, glove boxes, muster points, etc.

- In offices and shop locations the plan will be posted at all entrances and other suitable locations throughout the workplace, such as the SH&E noticeboard or first aid room.

4.2.8 Appropriate methods to account for AECOM employees and visitors shall be established.

- Visitor registers, tailgate/toolbox sign-in sheets and/or staff listings shall be available in the event of evacuation.
- Employees leaving location should alert appropriate personnel (supervisor, reception, or other responsible party) prior to departure, as applicable, provide expected time of return and alert the appropriate personnel upon return.

4.2.9 Staff will be trained for involvement in an emergency evacuation or rescue; however, all evacuations may require special preparation and arrangements with third party rescue providers in the following circumstances:

- 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.

4.2.10 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.
- Parking areas shall not restrict access by emergency personnel and vehicles.
- The access route will have a clear line of vision into oncoming traffic lanes.

4.2.11 All staff will be advised of the location of first aid services, equipment, and supplies.

4.2.12 The ERP shall be tested for deficiencies through emergency response drills annually or more frequently as required by legislation. Emergency drills such as man-down, hurricane/tornado drill, security, first aid are recommended to be conducted and lessons learned documented quarterly.

4.2.13 The ERP shall be reviewed annually or more frequently as required by legislation.

4.3 First Aid

4.3.1 Refer to *S3NA-012-PR1 First Aid* and *S3NA-111-PR1Bloodborne Pathogens* for additional information.

4.4 Other Emergency Response Equipment

4.4.1 Portable fire extinguishers shall be provided of appropriate class, size, and quantity in accordance with local legislation and *S3NA-011-PR1 Fire Protection*.

4.4.2 Provide eye wash stations (where appropriate to hazards).

4.4.3 Maintain an ERP and emergency kit appropriate to the hazards associated with the location (e.g., earthquakes, tornadoes, hurricanes, etc.).

4.5 Communications

4.5.1 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.

4.5.2 The Manager will be responsible for confirming that crews have the appropriate means of communication before leaving for the worksite. The type of communication device will depend on the location and circumstances of the job task.

4.5.3 All staff is 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.

4.5.4 All staff is responsible for keeping communication devices clean and dry to facilitate their effective operation.

4.6 Visitors

4.6.1 All visitors to the location shall receive a safety orientation that includes ERP information.

- Visitors to worksite shall review the location specific SH&E Plan or Task Hazard Analysis (THA) and attend/review and sign the applicable tailgate/toolbox meeting.
- Visitors to offices and shop locations shall sign a Sign In/Out register as this record will be used to check and make sure all visitors are accounted for in the event of an emergency (e.g. evacuation to muster point). Refer to *S3NA-010-FM5 Office / Shop Visitor Register*.

4.6.2 In the event of an evacuation, visitors working directly with an AECOM host will be the escorted by their host to the muster point.

4.6.3 For in-house meetings, safety orientations will be delivered before the meeting begins so all visitors are aware of the evacuation routes and procedures

4.7 Emergency Response

4.7.1 Employees responding to emergency situations should take no unnecessary risk. In the case of an emergency, the First Aid Provider 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, secure medical treatment for workers with injuries considered by the first aid attendant as being serious or beyond the scope of the attendant's training.

4.7.2 All incidents will be reported in accordance with *S3NA-004-PR1 Incident Reporting, Notifications & Investigation*.

4.7.3 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.

4.7.4 In the event of an evacuation, all employees and visitors will gather together at the muster point for a roll call. Upon evacuation or dismissal, no unauthorized or nonessential personnel are allowed access to the facility or project area during an emergency.

4.7.5 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.

4.7.6 All emergencies will be managed by the AECOM emergency management personnel identified in the ERP. This may include security personnel.

- The Local Resilience Coordinator (LRC) shall be the key point of contact with the Region Resilience Team in order to obtain further direction following an initial emergency response.
- Additional response via Resilience Teams shall be in alignment with *RS2-003-PR1 Disruptive Event Response Standard.*

4.7.7 During an emergency, AECOM Employees shall take direction from AECOM members of the emergency team, (e.g. emergency coordinator, floor wardens, etc.) and outside professional responders, as appropriate, who are in control of the situation.

4.7.8 Employees should render assistance in the safest possible manner, using appropriate personal protective equipment and precautions.

4.7.9 Other actions that may be necessary shall be included as applicable in the location's specific ERP. These include, but are not limited to:

- Notification of local authorities.
- Contact with appropriate AECOM security personnel for assistance.
- Notification of client representatives and any security group having authority on the worksite.

4.8 Post-Emergency Follow Up

4.8.1 If Regional, Geography or Enterprise Resilience Teams were convened, follow up response will be at the Team's direction.

4.8.2 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. In the case of a fire or bomb threat, this inspection is to be done by the ranking public emergency responder. Management approval to return shall then be obtained in order to return to work.

4.8.3 The Emergency Response Procedure Action Checklist shall be completed (Contained in *S3NA-010-FM2 Location Specific Emergency Response Plan Template)*.

4.9 Security

4.9.1 Conduct an evaluation of the worksite or location, local conditions, and contract stipulations to determine a need for:

- Access Control
- Vehicle Registration
- Identification badges for employees and visitors
- Fencing
- Security Guards
- Outside Lighting
- Secure Storage Areas
- Alarm Systems

4.9.2 *S3NA-010-FM3 Site Security Checklist* may be used to evaluate a location's need for specific security and to subsequently develop appropriate measures. This form may also be used at intervals for a given location to evaluate the need for any change to the security measures in place.

4.9.3 Where physical security of a location is required, management, with the assistance of SH&E personnel, will be responsible for organizing and supervising security guards. A local bonded security force may be used for this purpose. As an alternative, an in-house security organization may be established.

4.9.4 On many projects, identification badges or numbers are provided for employees. It may be necessary to provide a qualified security officer or team to provide the following services:

- Orientation to the location for new hires and visitors.
- Substance abuse testing for new hires.
- Issuance of badges for new hires and visitors.
- Briefing and debriefing for visitors.
- Monitoring of location activities to prevent theft, espionage, and malicious damage.

4.9.5 When a security program is established, the location specific ERP, including the procedures, and fire prevention and protection programs, shall be planned and coordinated with the program's security force.

4.9.6 On many projects involving military installations, nuclear work, and defense contracts, it may be necessary to provide a qualified security officer or team to monitor activities to prevent espionage, theft, malicious damage, and any compromise of classified information.

4.9.7 Contact the Human Resources Department for assistance if personnel security clearances are required.

4.10 Violence

4.10.1 Violence in the workplace training will be conducted where there is an elevated exposure to violence or, if required by regulation. Refer to *S3NA-003-PR1 SH&E Training*.

4.10.2 A risk assessment, refer to *S3NA-010-FM3 Potential Violence Assessment Form,* will be performed in any workplace in which there exists a risk of injury to workers from violence arising out of their employment or where required by regulation.

4.10.3 The risk assessment will include the consideration of:

- Previous experience in that workplace,
- Occupational experience in similar workplaces, and
- The location and circumstances in which the work will take place.

4.10.4 If an assessment identifies a risk of injury to workers from violence, the employer will establish procedures and work environment arrangements to eliminate or minimize the risk to workers from violence.

4.10.5 Controls will be implemented and communicated to employees to address the violence hazard. Control may include, but is not limited to, working in pairs, being assisted by police or other authority, having a clear emergency response procedure, and having access to a communication device.

4.10.6 Risk Assessment/Potential Violence Inspection Forms conducted for violence will be distributed to Managers and the applicable health and safety committees**.**

4.10.7 Workplace violence may include:

- Threatening behavior such as shaking fists, destroying property, or throwing objects.
- Verbal or written threats—any expression of intent to inflict harm.
- Harassment—any behavior that demeans, embarrasses, humiliates, annoys, alarms, or verbally abuses a person and that is known to be or would be expected to be unwelcome. This includes words, gestures, intimidation, bullying, or other inappropriate activities.
- Verbal abuse—swearing, insulting, or condescending language.
- Physical attacks—hitting, shoving, pushing, or kicking.

4.10.8 The risk of violence may increase during certain times of day and location. Be sure to plan ahead and take into account time of day, what tasks will be conducted, location(s), method of travel, and who might be accompanying.

4.10.9 Be prepared. Always carry electronic communications, such as mobile phones with emergency services numbers in speed dial list. If 911 is the emergency number, confirm that both mobile signal coverage and the 911 service work from the work location(s).

4.10.10 Public Meetings or Presentations:

- Facilitate and/or provide proper instruction to project employees on this procedure and how to identify and avoid potentially violent situations in public meetings or presentations.
- Identify community and emergency contacts.
- Determine whether a community leader should accompany employees to the public meeting or presentation.
- Ask a community leader or local police if there are any homes/areas to be avoided.
- Work with community leaders to make community residents aware of the work being undertaken. If in doubt, err on the side of caution. Do not expose employees to potentially violent situations.
- Send out advance notice to area residents about the nature and purpose of the visit.

4.11 Public Visitations

4.11.1 Before entering any home or sampling site, employees shall assess the risk of violence and confirm safety of and proper protection of themselves and co-workers. If there is any doubt about individual or group safety, do not enter the premises/area.

- Where possible, work with someone from the community who is known by and knows the residents.
- Have easily visible identification available.
- Be sensitive to cultural, social, and economic differences.
- Attempt to learn about potential problems before entering the area.
- Employees may not enter premises posted with Beware of Animal signs unless the owner has confirmed employees will be safe.

4.11.2 Employees shall report all acts of violence to their Supervisor, SH&E Manager or Human Resources Manager.

4.11.3 All acts of violence will be reported by the employee to their Supervisor or Region Human Resources Manager.

- Report any physical contact or any violent threats to the local authorities immediately, and summon help.
- Any reported incidents of violence will be held in confidence and will be handled with integrity and discretion. All incidents will be handled in accordance with *S3NA-004-PR1 Incident Reporting, Notifications & Investigation* procedure. Any injuries or results of exposure to violence will be handled in accordance with AECOM policies and procedures.

5.0 Records

5.1 The Location Specific ERP will be filed in the project file.

5.2 ERPs shall be part of site SH&E audits.

5.3 Emergency Response Drill Reports, Security Checklists and Potential Violence Assessment Forms shall be maintained in the location or project safety files.

6.0 Attachments

6.1 S3NA-010-FM1 Emergency Response Drill Report

6.2 S3NA-010-FM2 Location Specific Emergency Response Plan Template

6.3 S3NA-010-FM3 Site Security Checklist

6.4 S3NA-010-FM4 Potential Violence Assessment Form

6.5 S3NA-010-FM5 Office / Shop Visitor Register

Americas

Risk Assessment & Management

S3NA-209-PR1

1.0 Purpose and Scope

1.1 This procedure requires hazard identification, risk evaluation, control measures, and documentation to manage safety, health and environment (SH&E) risks associated with work activities.

1.2 The objective is to establish and enhance SH&E performance, to mitigate and reduce losses due to injury, illness, property damage, or environmental impairment incident, and maintain regulatory compliance.

1.3 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

2.1 **Control Measure** - Actions that can be taken to reduce the potential of exposure to the hazard. The control measure could be to remove the hazard or to reduce the likelihood of the risk of the exposure to that hazard being realized.

2.2 **Hazard** - An object, condition or behavior that has the potential to cause human injury or illness, property damage, damage to the environment, business interruption, or a combination of these.

2.3 **Risk** – The possibility of loss or injury.

2.4 **Task Hazard Assessment (THA) –** A THA is a tool for evaluating work activities for the purpose of:

- Identifying the SH&E hazards and risks associated with the activity being performed;
- Identifying and implementing control measures to eliminate or reduce hazards and risks; and,
- Evaluating the effectiveness of control measures and making modifications as needed.

3.0 References

3.1 S3NA-002-PR1 Stop Work Authority

3.2 S3NA-010-PR1 Emergency Response Planning

4.0 Procedure

4.1 Roles & Responsibilities

4.1.1 **SH&E Manager**

- Assisting management personnel to identify any necessary SH&E planning documentation required.
- Assisting in the preparation of necessary SH&E risk assessment documentation.
- Reviewing and approving SH&E risk assessment documentation prior to its implementation for work activities.
- Providing SH&E technical and regulatory input as necessary.

4.1.2 **Manager**

- Confirming the completion of SH&E risk assessment documentation as required, that addresses the full range of work activities, SH&E risks and that all requirements and procedures are implemented and enforced during the work activities.
- Confirming SH&E requirements are implemented successfully, including but not limited to:
    - Subcontractor evaluations

- SH&E training
- Personal protective equipment
- First aid and emergency response
- Client requirements

- Contacting the SH&E Manager to discuss SH&E risk assessment documentation needs/ requirements at the start of each new project involving AECOM and at designated intervals or:
  - When changes occur to the work operations or work location/ conditions
  - When work activities are modified/ changed, or
  - When additional tasks are added to the work scope.
- Confirming that the SH&E Plan has been reviewed and approved by the SH&E Manager prior to its use by AECOM personnel or prior to release to clients, outside agencies or organizations.
- Making appropriate resources available to protect the health and safety of AECOM employees, the environment and to comply with occupational health and safety, and environmental legislation and for the effective implementation of this procedure.
- Identifying and reporting to a Manager/Supervisor when changes occur to the work operations or work location/conditions.
- Identifying appropriate and applicable SH&E regulatory requirements, and implement into respective SH&E Plan.

4.1.3 **Employee**

- Obtaining necessary training identified in the SH&E Plan and associated documents.
- Understanding the potential hazards and controls of the task before work commences.
- Complying with all required controls as identified in the SH&E Plan and associated documents. Reporting any program, SH&E plan or regulatory variances to their Supervisor.

4.2 Risk Assessment Strategy

4.2.1 Hazard Identification

Hazard identification is the precursor to being able to assess risk. Before undertaking any activity, the hazards shall be identified by persons competent to recognize them using professional experience and training including the following:

a. Utilization of a formal hazard identification process;
b. Information from review and improvement processes;
c. Consideration of hazardous materials required for task(s);
d. Location of work and proximity to outside hazards or equipment;
e. Anticipation or possible change of conditions;
f. Consideration of risk of human error;
g. Identifying level of training required for task; and
h. Any other factors that can introduce hazard or risk into the activity.

4.2.2 Hazard identification should consider:

a. Routine and non-routine activities;
b. Activities of all persons having access to the workplace (including contractors and visitors);
c. Human behavior, capabilities and other human factors;

d. Identified hazards originating outside the workplace capable of adversely affecting the health and safety of persons under the control of AECOM within the workplace;

e. Hazards created in the vicinity of the workplace by work-related activities under the control of AECOM and neighboring activates not under AECOM control;

f. Infrastructure, equipment, and materials at the workplace, whether provided by AECOM or others;

g. Changes or proposed changes in the organization of AECOM, its activities, or materials;

h. Modification to the SH&E management system, including temporary changes, and their impacts on operations, processes, and activities;

i. Any applicable legal obligations relating to risk assessment and implementation of necessary controls;

j. The design of work areas, processes, installations, machinery/equipment, operating procedures, and work organization, including their adaptation to human capabilities; and

k. Driving and travel activities.

4.2.3 Risk Assessment

a. Evaluate the work area for hazards as defined above. This applies to field, office, and travel settings.

b. Determine whether identified hazards could affect employees, subcontractors, members of the public, visitors, or others.

c. Assess the severity and probability of any identified hazard occurring. This is generally based on experience, although incident statistics are available for most industries. The assessment of probability must also take into consideration the frequency with which exposure to a particular hazard will take place (e.g., the probability of occurrence is much greater if the activity is a daily event involving a number of individuals, compared with the same activity carried out twice a year by few individuals as part of a maintenance procedure).

d. Severity

Be realistic when considering how severe the result of exposure to a hazard could be. For example, it is remotely possible that someone tripping over a cable in an office may be killed, but the most probable result is bruising or a fractured bone. If, however, the cable is trailing across the top of a very busy stairway, a more severe injury is possible.

The following table shall be used to evaluate severity:

Severity – Potential Consequences				
	People	**Property Damage**	**Environmental Impact**	**Public Image/Reputation**
Catastrophic	Fatality, Multiple Major Incidents	>$1M USD, Structural collapse	Offsite impact requiring remediation	Government intervention
Critical	Permanent impairment, Long term injury/illness	>$250K to $1M USD	Onsite impact requiring remediation	Media intervention
Major	Lost Time /Restricted Work	> $10K to $250K USD	Release at/above reportable limit	Owner intervention
Moderate	Medical Treatment	> $1K to $10K USD	Release below reportable limit	Community or local attention
Minor	First Aid	</=$1K USD	Small chemical release contained onsite	Individual complaint

e. Probability

Determining the probability of a hazard actually causing harm can be much more difficult than determining the severity. The factors affecting the analysis of probability are:

- The number of times the situation occurs
- The position of the hazards
- Distractions
- The duration of exposure
- Quantities of materials involved
- Environmental conditions
- Competence of the people involved
- Condition of equipment.

In analyzing the probability of harm, it will be necessary to take into account the possibility of the control measures not being used because of human error, lack of maintenance, difficulty in compliance, complexity, etc.

The following table shall be used to determine probability:

Probability		
Frequent	Expected to occur during task/activity	9/10
Probable	Likely to occur during task/activity	1/10
Occasional	May occur during the task/activity	1/100
Remote	Unlikely to occur during task/activity	1/1,000
Improbable	Highly unlikely to occur, but possible during task/activity	1/10,000

4.2.4 Risk Matrix

A quantitative risk rating can be derived for each hazard using the following table.

Probability	**Severity**				
	5 - Catastrophic	4 – Critical	3 – Major	2 – Moderate	1 - Minor
5 – Frequent	**25**	**20**	**15**	**10**	**5**
4 – Probable	**20**	**16**	**12**	**8**	**4**
3 – Occasional	**15**	**12**	**9**	**6**	**3**
2 – Remote	**10**	**8**	**6**	**4**	**2**
1 - Improbable	**5**	**4**	**3**	**2**	**1**

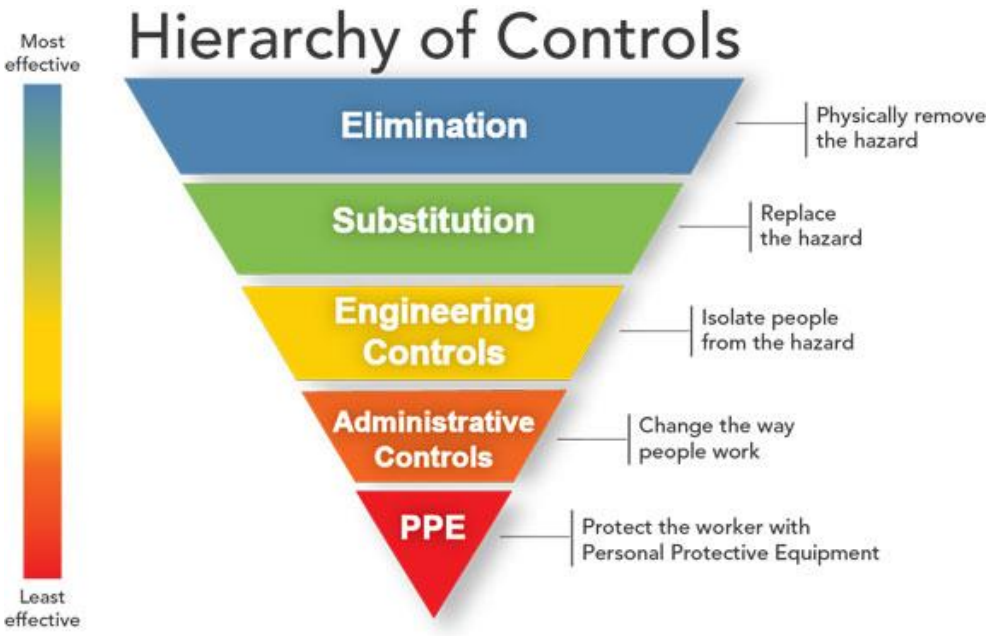
Use of the quantitative risk table shown above can help to determine whether or not the level of risk is tolerable. This can assist in deciding priorities for action. In general, higher risks (yellow and red) may require the provision of considerable additional resources involving special equipment, training, high levels of supervision, and consideration of the most effective methods of eliminating or controlling hazards. Lower-level risks may be considered as acceptable, but actions should still be taken to try to reduce them further, if possible. The risk rating for a project should be revised if the scope of work changes and at a minimum, the risk rating should be re-assessed on an annually basis.

Risk Rating (Probability x Severity)	Risk Acceptance Authority
1 to 4 (Low)	Risk is tolerable, manage at local level
5 to 9 (Medium)	Risk requires approval by Operations Lead/Supervisor & SH&E Manager
10 to 25 (High)	Risk requires the approval of the Operations Manager & SH&E Director

4.2.5 Hierarchy of Controls

Controlling exposures to hazards is the fundamental method of protecting workers. Traditionally, a hierarchy of controls has been used as a means of determining how to implement feasible and effective control solutions.

The idea behind this hierarchy is that the control methods at the top of graphic are potentially more effective and protective than those at the bottom. Following this hierarchy normally leads to the implementation of inherently safer systems, where the risk of illness or injury has been substantially reduced.



Source: http://www.cdc.gov/niosh/topics/hierarchy/

Eliminating a hazard is the most effective means to manage a hazard. Substitution and engineering strategies include replacing a hazardous substance with a safer one, reducing the hazard (e.g., ventilation), or isolating it from where employees are working (e.g., enclosing a noisy machine).

Administrative controls include policies, training, job rotation, signage, or temporary barriers to warn of a hazard or describe safe procedures.

Personal protective equipment (PPE) such as safety glasses and hardhats place a barrier between the worker and the hazard, but do not prevent the occurrence of the incident. PPE is considered the least effective method of controlling a hazard because it depends on proper selection and fit, employee compliance, and availability.

4.3 Preplanning for Development of Risk Assessment Documentation

4.3.1 Coordination must be made by management with representatives of the client, regulatory authorities (if needed), and other appropriate personnel to determine and coordinate such items as:

a. Measures to protect the public and/or other persons exposed to the work operations.

b. Client requirements and local, state, and/or federal laws and regulations that are applicable to the project.

c. Procedures for handling and reporting incidents, property damage, and other emergencies.

d. Disciplinary policies and management of restricted access for company employees and subcontractors/vendors.

4.3.2 As soon as possible, conduct an initial review of the work location and review the proposed work activity to determine, to the extent possible, existing or probable hazardous conditions and restricted areas.

4.4 Risk Assessment Documentation

Risk assessment documentation includes SH&E Plans, Pre-Job Hazard Assessments, Daily Tailgate Meetings and Task Hazard Assessments.

4.4.1 **SH&E Plan.** All AECOM office locations are required to prepare an SH&E Plan using *S3NA-209-FM1 Office SH&E Plan Template*. A SH&E Plan is required for work activities outside of an AECOM office. The SH&E Plan is often required by regulation, insurance policy requirements, or client requirement. A template is provided in *S3NA-209-FM2 Industrial Site / Project SH&E Plan Template*. In addition, *S3NA-209-FM3 Procedure Checklist* can be used to assist in determining which AECOM SH&E procedures apply to the scope of work. Applicable procedures shall be attached to the SH&E Plan. A typical SH&E Plan includes the following components:

a. Descriptions of roles and responsibilities for the activity.

b. Hazard analysis for each task and operation found in the work plan.

c. Supplementary information to the attached procedures (e.g., jurisdiction-specific requirements, client requirements, etc.)

d. Supervision.

e. Training requirements.

f. Personal protective equipment requirements for the separate tasks or operating areas.

g. Medical surveillance requirements (for chemical exposure, noise, radiation, etc.).

h. Frequency and types of monitoring for physical and chemical hazards.

i. Pre-entry briefings requirements for visitors and workers.

j. Location-specific Emergency Response Plan. Refer to *S3NA-010-PR1 Emergency Response Planning.*

k. Client requirements that are more stringent than AECOM's SH&E requirements.

l. In California, the SH&E Plan must also address the Injury Illness Prevention Program. Refer to *S3NA-209-ATT1* for additional information.

m. A SH&E Plan for hazardous waste operations may also include:

- Site access and control measures.
- Site specific information on chemical, biological or radiation hazards.
- Decontamination procedures.
- Confined Space Entry plan.
- Spill containment plan.
- Waste management.

n. A SH&E Plan for construction activities may also include:

- Traffic plan and site access controls.
- Electrical and machinery protective measures.
- Trench and excavation safety.
- Fall protection and rescue plans.
- Storage for combustible and flammable materials.
- Sediment and community noise control plans.

o. A SH&E Plan for a demolition project may also include:

- Materials movement plan.
- Critical task sequencing.
- Explosives safety.
- Dust control measures.
- Removal of asbestos and lead-containing materials.

4.4.2 **Pre-Job Hazard Assessment.** Pre-Job Hazard Assessment is essential to ensure that hazards and risks are recognized. A Pre-Job Hazard Assessment describes the task being performed, the inherent risks, and the control measures for those risks.

- Pre-Job Hazard Assessments are completed before the work activities commence and are updated based on lessons learned.
- Workers involved in the task should participate in the hazard assessment process so that best practices are shared and all possible hazards of the task are identified.

Pre-job Hazard Assessments are performed by:

- Identifying the principle steps of each task being performed.
- Potential hazards are identified for each step and the initial risk rating is determined using the Risk Matrix.
- Control measures are then identified including PPE for each hazard.
- Each hazard is then re-evaluated and assigned a final risk rating using the Risk Matrix.
- If the final risk rating is a 5-9 (medium risk) or 10-25 (high risk), additional hazard controls shall be identified and applied until the final risk rating is reduced to 4 or below. If the final risk rating cannot be reduced to 4 or lower, additional approvals are needed before the activity can begin.

Pre-Job Hazard Assessments may be completed as a stand-alone document, or may be incorporated into an SH&E Plan. Pre-Job Hazard Assessments are similar to Activity Hazard Analysis (AHA), Job Hazard Analysis (JHA), Job Safety Analysis (JSA) and other terms and formats; however, unless otherwise indicated by client requirement, *S3NA-209-FM4 Pre-Job Hazard Assessment* shall be utilized.

Information collected during the Pre-Job Hazard Assessment must be referenced as part of the site- specific SH&E Plan. In addition Pre-Job Hazard Assessments must be communicated to employees and subcontractors on-site. Copies of the Pre-Job Hazard Assessments will be kept on-site for review.

4.4.3 **Daily Tailgate Meeting.** A tailgate meeting for all project personnel will be held daily (excluding fixed-facility locations where AECOM employees permanently work full time). A record of the meetings will include the name of all attendees, items discussed, and date/time of meeting. *S3NA-209-FM5 Daily Tailgate Meeting Form* may be used to document the meeting.

At a minimum, the meeting will involve representatives from all organizations with a direct contractual relationship with AECOM on the project site. Other contractors working in the area of AECOM's activities should also be invited to the meeting when possible. All members of the meeting should be engaged and encouraged to participate and provide input and feedback. Objectives for the meeting should include:

- Eliminating injuries, illnesses, and damage to the environment or property.
- Review planned work activities.
- Clarify roles and responsibilities.
- Confirm work crew is fit-for-duty.
- Assess, identify and mitigate hazards.
- Share lessons learned and observations.
- Review simultaneous operations with other non-AECOM controlled activities (e.g., other contractors performing work in the vicinity of AECOM's operations, fuel delivery at the location, utility company working near AECOM operations).

4.4.4 **Task Hazard Assessment (THA).** A THA is the most important element in an effective hazard identification and risk reduction program. *S3NA-209-FM6 Task Hazard Assessment* shall be completed before every assigned task at the work location. The focus of the analysis shall be on the specific assigned task and the evaluation of risks and assignment of control measures based on actual work conditions.

A THA is a portion of the overall job scope, focused at the specific foreman and/or crew level. Task Hazard Assessments must be completed prior to the start of work. Re-assessment must also be completed when a significant change of scope occurs or if conflicting work is being done. Completion of the THA involves both the site supervision and employees involved in the work.

Task Hazard Assessment steps:

- Assemble employees involved in the work.
- Review the scope of work being performed.
- Break the task into individual steps.
- Identify actual and potential hazards.
- Rank the risk using the Risk Matrix.
- Develop appropriate controls measures for each hazard.
- Rank the post control measure risk using the Risk Matrix.
- Review the assessment.
- Confirm communication of the THA to all affected employees.
- Confirm the THA is reviewed by any visitors or additional or new personnel brought on to perform the task.

If the final risk rating is a 5-9 (medium risk) or 10-25 (high risk), additional hazard controls shall be identified and applied until the final risk rating is reduced to 4 or below. If the final risk rating cannot be reduced to 4 or lower, additional approvals are required before the activity can begin.

Employees shall monitor the activities for compliance with the THA. Workers should stop any work on a task if conditions change from the planned and agreed approach to the work. The THA should be updated to reflect new conditions or changes in task methods.

4.5 Key Elements in Risk Management at a Site

4.5.1 Regularly, or at least once per month, conduct safety meetings for supervisory personnel, including those of other contractors and subcontractors. Suggested action items for these meetings include:

a. Reviewing of the safety procedures and policies applicable to the project.

b. Identifying responsibilities of the various parties, including contractor(s) and subcontractor(s) obligations.

c. Reviewing noted and anticipated hazards, and plan methods to eliminate or control them.

d. Discussing incidents and near misses to determine causes and steps necessary to prevent reoccurrence.

e. Discussing suggestions and ideas for improving the project's safety program.

f. Maintaining a record of these meetings; this will be done by the safety representative or supervisor.

4.5.2 Regular inspections of active work areas will be made by the project supervisors and the site SH&E representative. To be effective, such inspections should occur on all shifts, should be unannounced, and should occur at varied intervals.

a. Imminent danger situations must be stopped and corrected immediately. Refer to *S3NA-002-PR1 Stop Work Authority.*

b. Inadequate or deficient protective measures and unsafe or unhealthy work practices must be brought to the immediate attention of the appropriate supervisor and/or manager for correction and disciplinary action, as required.

c. Inform the manager of all deficiencies not immediately correctable, and/or that may result in damage to facilities, equipment, or work in progress, or that create hazardous exposures to employees or the public.

4.5.3 Signs and posters of appropriate size and design, and bearing standard pertinent regulations, will be used to convey warnings, directions, and instructions to personnel and the public, as required by the client and other applicable regulations. The observance of such safety and incident prevention signs will be strictly required of company employees and visitors while on the project site.

4.5.4 Consideration must be given to make the project environmental protection plan effective. The type and extent of the measures needed for pollution control, hazardous materials handling, hazardous waste control and disposal, and for relating occupational health issues will depend upon the contract stipulations, hazard involved, type of operation, and the mandatory requirements of regulatory authorities. Such measures will include appropriate control methods necessary to prevent or reduce to safe levels exposure to hazardous substances.

4.5.5 It is the practice of AECOM to commend and reward employees and their supervisors for achieving excellence in their field of work, particularly when that work is performed safely. Project management is encouraged to promote and participate in safety recognition programs by developing project-specific safety goals and including safety incentive programs in project budgets. Project goals should include proactive goals such as training participation and training support, safety observations conducted, and management participation in safety reviews (e.g., safety walk-downs).

4.5.6 All employees are empowered and expected to stop work or not start work when it is unsafe. Employees will be trained on stop work authority upon initial assignment. Refer to *S3NA-002-PR1 Stop Work Authority*.

4.6 Other Requirements

4.6.1 The following requirements apply to SH&E risk assessment documentation:

- Preparation of the SH&E documentation may be performed by a member of the project team or SH&E.
- SH&E documentation (including draft versions of documents) will be reviewed by a SH&E Manager prior to release for outside agency review (e.g., clients, regulatory agencies, etc.) and prior to its field implementation.

- Changes to approved SH&E documentation require concurrence from a SH&E Manager (or designee). This includes those made in response to changing field conditions or operational requirements and those made in response to regulator/client comments. Any written responses made to regulator/client comments also must be reviewed by the SH&E Manager.
- The SH&E documentation for any project lasting twelve (12) months or longer will be reviewed at periodic intervals, but at least annually. The SH&E Manager will review the changes and determine whether modifications are required to the existing SH&E planning documentation. This confirms that the documentation continues to reflect the current scope of work and knowledge of site conditions, and that any revised regulatory requirements are properly addressed. The Manager will provide a master copy of the SH&E documentation to be maintained on site for reference by personnel, together with copies of any required SH&E-related records or operational documentation. The master copy must be current in all respects, and will include any changes or modifications made as work progresses.
- Managers will confirm that SH&E documents have been reviewed with affected personnel prior to implementation of field work. Sign-off and concurrence is mandatory and to be kept in the project records.

5.0 Records

5.1 Completed SH&E Plans, Pre-job Hazard Assessments, Tailgate Meeting Forms and Task Hazard Assessment will be filed in the appropriate project file.

6.0 Attachments

6.1	S3NA-209-ATT1	California Injury & Illness Prevention Program
6.2	S3NA-209-FM1	Office SH&E Plan Template
6.3	S3NA-209-FM2	Industrial Site / Project SH&E Plan Template
6.4	S3NA-209-FM3	Procedure Checklist
6.5	S3NA-209-FM4	Pre-Job Hazard Assessment
6.6	S3NA-209-FM5	Daily Tailgate Meeting Form
6.7	S3NA-209-FM6	Task Hazard Assessment
6.8	S3NA-209-FM6-A	Task Hazard Assessment – Management Services Group
6.9	S3NA-209-FM7	Office Relocation Plan

Americas

Stop Work Authority Table

S3NA-002-ATT1

AECOM Role		* Formal Safety Stop Work Authority and use of the AECOM Red Card		
Contract Type	**SH&E Performance Role**	**Imminent Danger - Immediately Dangerous to Life, Health, and the Environment**	**Violation of organization or regulatory safety rules, but not deadly / not an immediate threat**	**Safe workplace, but employee feels uncomfortable in situation**
Self-Perform AECOM – directed work	Oversight of self and coworkers	**Yes** Use *Stop Work Order – AECOM Employees and Direct Subcontractors S3NA-002-FM1*.	**Yes** – primarily if activity could lead to a significant injury or incident. May require the use of *Stop Work Order S3NA-002-FM1* depending upon situation.	**Yes** – Even in a safe workplace, if employee is uncomfortable with their work situation, employee can stop their own work.
Subcontractor Oversight AECOM – directed work	Oversight of subcontractor	**Yes** Use *Stop Work Order – AECOM Employees and Direct Subcontractors S3NA-002-FM1*.	**Yes**– primarily if activity could lead to a significant injury or incident. May require the use of *Stop Work Order S3NA-002-FM1* depending upon situation.	**Yes** - Even in a safe workplace, if sub-contractor employee is uncomfortable with their work situation, employee can stop their own work.
PM-CM Contractor – controlled work	AECOM PM-CM has specific contractual role for safety oversight of contractor	**Yes** - AECOM employee can confront contractor worker and/or contractor supervisor/foreman and identify the imminent danger situation for contractor to immediately correct; AECOM employee shall notify their manager; completion of a written stop work order may be warranted. Use *Stop Work Order – Project Management / Construction Management S3NA-002-FM2*.	**Yes** – AECOM employee can inform contractor worker and/or contractor supervisor/foreman. AECOM employee shall immediately notify their manager. Manager shall monitor and track to provide to the client for contractor closure of outstanding safety issues.	**N/A**
PM-CM Contractor – controlled work	AECOM PM-CM has not contractually agreed to the specific responsibility of safety oversight.	AECOM Employee can inform contractor site supervisor/foreman and identify the Imminent Danger situation; AECOM employee shall immediately notify their manager. Manager shall immediately notify client.	**No**	**N/A**
No contract with party performing unsafe activity but on same jobsite or project location	No relationship except being on the same client property or project location.	Employee can confront contractor site supervisor/foreman and identify the imminent danger situation; AECOM employee shall immediately notify manager. Manager shall immediately notify client in charge of the party performing the unsafe activity.	**No**	**N/A**

* Notes:

- Appropriate reporting (e.g. LifeGuard, IndustrySafe) must be completed. Refer to *S3NA-004-PR1 Incident Reporting, Notifications & Investigation* for guidance.
- In most cases only the task needs to be stopped for an imminently dangerous situation. Unless required by the AECOM/Client contract, stopping or shutting down the whole project should be by the project manager only in coordination with the client.
- When an imminently dangerous situation is stopped and work is corrected, the responsible organization should investigate and identify the systemic issue to prevent a reoccurrence. When it is an AECOM employee or AECOM subcontractor, the Near Miss incident shall be reported and investigated to the same degree as if a serious incident actually occurred.
- In all cases, if an AECOM employee or subcontractor is in an imminently dangerous situation they shall remove themselves from the location until there is a safe work environment.
- The AECOM Safety Red Card is derived from its use in football (soccer), where circumstances are such that a referee has to stop the play, similar to an imminently dangerous situation on a project site. The Safety Red Card is a physical tool that reinforces the Stop Work Authority Procedure.
- All intervention should be done tactfully with the message, “I am pointing out the imminently dangerous situation because I care about your life and health.”

Americas

Bloodborne Pathogens

S3AM-111-PR1

1.0 Purpose and Scope

1.1 Define the AECOM procedures for eliminating and/or controlling occupational exposure to Bloodborne Pathogens on AECOM projects and activities.

1.2 A written Exposure Control Plan shall be developed and implemented during all AECOM operations where there is a reasonable potential for occupational exposure of AECOM employees and/or subcontractors to bloodborne pathogens as a regulated waste.

1.3 This procedures requirements apply to all AECOM Americas employees and operations. Any jurisdictional requirements exceeding those identified in this procedure shall be met when conduction work in the given jurisdiction.

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, human T-lymphotrophic virus Type I, and viral hemorrhagic fever (Ebola).

2.3 **Exposure Control Plan** *(S3AM-111-ATT1)* – A plan that addresses the requirements applicable to specific AECOM projects and activities designed to eliminate or minimize employee exposure. The Exposure Control Plan shall be incorporated into the location specific SH&E Plan and shall be accessible to all employees. The Exposure Control Plan shall include:

- Exposure determination.
- The schedule and method of implementation for:
  - Methods of compliance;
  - Hepatitis B Vaccination;
  - Post exposure Evaluation;
  - Communications of Hazards to employees; and
  - Record Keeping.
- Documentation methods for exposure incidents, to include:
  - Routes of exposure; and
  - The circumstances for which and exposure incident occurred.

Note: In the State of California this plan shall also address exposures to airborne pathogens.

2.4 **SH&E Plan** – A document prepared for a specific project or program that details the hazards, precautions, emergency planning, medical, and training requirements for that project or program.

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 or program.

2.6 **Other Potentially Infectious Materials (OPIM)** – 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: In the State of California airborne pathogens are also considered infectious materials.

2.7 **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.

2.8 **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.

2.9 **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.

3.0 References

3.1 S3AM-003-PR1 SH&E Training

3.2 S3AM-004-PR1 Incident Reporting, Notifications & Investigation

3.3 S3AM-017-PR1 Injury & Illness Recordkeeping

3.4 S3AM-128-PR1 Medical Screening & Surveillance

3.5 S3AM-208-PR1 Personal Protective Equipment

3.6 S3AM-209-PR1 Risk Assessment & Management

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Occupational Health Manager**

- 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 **SH&E Manager**

- Will review project / program-specific Exposure Control Plans (normally part of the SH&E Plan) prior to the initial mobilization, at least annually for continuing projects or programs, and whenever necessary to reflect modified tasks or procedures that affect occupational exposure to bloodborne pathogens.
- Will consult with the Occupational Health Manager 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 the Hepatitis B vaccine is made available to all employees with a potential occupational exposure (e.g. paramedic, medical laboratory employee, etc.).
- 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 **Manager**

- See that all recommendations made by the SH&E Manager are implemented.
- Support the SH&E Manager in their efforts to prevent occupational and non-occupational exposures to bloodborne pathogens.

4.1.4 **Employee**

- Use all PPE and universal precautions required to prevent exposure to infectious materials.
- Follow the exposure control methods outlined in their Exposure Control Plan.
- Report potential exposure incidents to their Supervisor or Manager immediately.

4.2 Potential Exposure Situations

4.2.1 There are a few activities within AECOM where potential occupational exposures to blood or other potentially infectious materials are of concern. These activities may 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 (if the action is part of the employee's occupations duties [e.g. paramedic] and not provided as a voluntary action).

4.2.2 Although AECOM does offer first-aid and CPR training to its employees on a regular basis, providing such aid is often on a voluntary basis and not directed by AECOM. As such, potential exposures may not be considered occupational exposures within the context of the OSHA Bloodborne Pathogens Standard. Site-specific Exposure Control Plans shall differentiate voluntary first-aid duties from occupational exposures as a component of the exposure determination. Refer to *S3AM-209-PR1 Risk Assessment & Management.*

4.3 Unforeseen Exposure Situations

4.3.1 Occasionally, potentially infectious material is encountered during a activity 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 Employee Training

4.4.1 All personnel who will work on projects or programs which involve potential contact with regulated wastes will be required to attend a training class prior to the start of the project or program and annually for continuing projects or programs. Refer to *S3AM-003-PR1 SH&E Training.* The specific requirements and provisions of the written Exposure Control Plan shall be provided to each AECOM Employee and subcontractor assigned to work at the program / project.

4.4.2 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.

4.4.3 Training sessions will review the following:

- Requirements of OSHA's Bloodborne Pathogens Standard or equivalent, applicable jurisdictional requirements.
- 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.
- AECOM's Post-Exposure Medical Follow-Up Procedures:

4.4.4 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. This procedure will be reviewed and a question-and-answer session will be conducted at the end of the presentation.

4.4.5 If the training provider cannot provide such training, AECOM will conduct a Blood Borne Pathogen training session prior to the start of the first aid or CPR class.

4.4.6 AECOM has and will have little control over employees who have not received AECOM provided 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.

4.5 Personal Protective Equipment

4.5.1 All body fluids and materials potentially contaminated by body fluids will be considered to be infectious. 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), refer to *S3AM-208-PR1 Personal Protective Equipment*.

4.5.2 The use of PPE to prevent exposure is more appropriate for the types of occupational and non-occupational exposures 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.

4.5.3 PPE 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. Site-specific PPE requirements will be identified in the written Exposure Control Plan. The same type of PPE will also be available, if it is deemed necessary, for Employees involved with activities at TSD facilities that handle regulated wastes.

4.5.4 PPE will be provided to affected Employees at no cost.

4.6 Universal Precautions Kits

4.6.1 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 litre 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

4.7 Personal Hygiene

4.7.1 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.

4.7.2 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.

4.7.3 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.

4.7.4 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 and reported immediately.

4.8 Reporting Exposure Incidents

4.8.1 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 SH&E Manager immediately. An IndustrySafe on-line report shall be completed in accordance with *S3AM-004-PR1 Incident Reporting, Notifications & Investigation*. After reviewing the report, the SH&E Manager will provide recommendations, when appropriate, for preventing recurrence of the incident.

4.9 Medical Follow-Up to Exposure Incidents

4.9.1 Once notified, the SH&E Manager will in turn discuss the incident with AECOM's Occupational Health Manager and/or medical provider and make arrangements for an evaluation, refer to *S3AM-128-PR1 Medical Screening & Surveillance*. 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.

4.9.2 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 counselling efforts, the Employee voluntarily consents to HIV testing.

4.9.3 AECOM will rely on the professional judgment of its Occupational Health Manager 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), World Health Organization, or other Public Health organization in Canada and other countries in the Americas 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
- Counselling, if necessary
- Evaluation of reported illnesses

4.9.4 Any and all follow-up recommendations offered by the physician will be immediately instituted by the SH&E Manager with the guidance of the Occupational Health Manager 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 Occupational Health Manager and/or the local medical provider to provide counselling to Employees concerning infection status, including results of and interpretation of medical tests and advising the Employee about the protection of personal contacts.

4.9.5 All medical providers shall submit to AECOM's Occupational Health Manager and the affected Employee a written opinion of the post-exposure evaluation within 15 days of the completion of the evaluation.

4.9.6 All medical records generated as a result of the post-exposure evaluation will be retained in the office of the Occupational Health Manager, and as applicable AECOM's medical services provider, under lock and key and will be maintained with the strictest confidentiality. Refer to *S3AM-017-PR1 Injury & Illness Recordkeeping.*

4.10 Hepatitis Vaccination

4.10.1 Prior to performing site visits or field investigations where regulated wastes are stored, processed, or known to have been disposed of, AECOM will consult with the Occupational Health Manager 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 occupational exposures.

4.10.2 Although AECOM does offer first-aid and CPR training to its Employees on a regular basis, providing such aid is often voluntary and not as a specified job duty of an Employee. As such, potential exposures may not be considered occupational within the context of the government Bloodborne Pathogens Standard. Pre-exposure hepatitis vaccinations will not typically be offered for voluntary roles.

4.10.3 Post-exposure hepatitis vaccination will be offered to Employees involved in an exposure incident within 24 hours of possible exposure.

4.10.4 The vaccinations discussed above shall be provided to Employees at no cost if required by the exposure determination.

4.11 Housekeeping

4.11.1 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.

4.11.2 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.

4.11.3 When working at a client's facility, AECOM will review the facilities plan for 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 written Exposure Control Plan.

4.12 Regulated Waste Generated by AECOM

4.12.1 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 disposed of through a permitted regulated waste facility.

4.12.2 Disposal manifests shall be maintained in accordance with local or governmental regulations.

4.13 Material Decontamination

4.13.1 Any areas or equipment that are contaminated by potentially infectious material will be decontaminated using a 10% solution of household bleach. Utilize appropriate personal protective equipment to control exposure to the bleach (e.g. safety goggles, gloves, etc.). Refer to *S3AM-208-PR1 Personal Protective Equipment*.

4.14 Procedure and Plan Review

4.14.1 All Exposure Control Plans for projects or programs extending over one year shall be reviewed annually by the SH&E Manager and affected Employees.

5.0 Records

5.1 Each SH&E Manager will maintain records and provide copies of the records to the Occupational Health Manager, related to bloodborne pathogens in accordance with the provisions of the standard and *S3AM-017-PR1 Injury & Illness Recordkeeping.*

5.2 Records maintained in accordance will include bloodborne pathogens exposure incidents, post-exposure follow-up, vaccination status, and training for all Employees with potential occupational exposure.

5.3 Employee medical and training records required by this procedure shall be provided upon request for examination and copying to the Employee, to anyone having written consent of the subject employee, or to State, Province, or Federal Occupational Safety and Health regulatory agencies.

6.0 Attachments

6.1 S3AM-111-ATT1 Bloodborne Pathogens Exposure Control Plan

6.2 S3AM-111-FM1 Hepatitis B Vaccination Declination

Americas

Cold Stress

S3NA-112-PR1

1.0 Purpose and Scope

1.1 To protect employees 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 employees can be repeatedly exposed without adverse health effects.

1.2 This procedure applies to all AECOM Americas based employees and operations working outdoors in damp and cool (below 50 degrees Fahrenheit [°F] or 10 degrees Celsius [°C]) conditions or anytime temperatures are below 32°F or 0°C.

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 References

3.1 S3NA-003-PR1 SH&E Training

3.2 S3NA-128-PR1 Medical Screening & Surveillance Program

3.3 S3NA-208-PR1 Personal Protective Equipment

3.4 S3NA-314-PR1 Working Alone

3.5 S3NA-315-PR1 Working On or Near Water

3.6 S3NA-333-PR1 Marine Safety & Vessel Operations

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Manager**

- Ensuring the safety of employees on their project sites, consistent with regulatory standards.
- 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 employees physically capable of performing the assigned tasks. Consider acclimation to cold weather when evaluating employee capability.
- Confirm employees are properly trained to recognize the symptoms of cold stress.

4.1.2 **Safety, Health and Environment (SH&E) Manager**

- 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.

4.1.3 **Supervisor**

- 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 employees are physically capable of performing the assigned tasks and are not in a physically compromised condition.

4.1.4 **Employee**

- 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 rested condition.
- Report all suspected cold stress-related illnesses.

4.2 Requirements

4.2.1 Carefully plan work anticipated to be performed in cool or cold conditions. If possible, heavy work should be scheduled during the warmer parts of the day or when the wind is most calm. Include costs in project budgets for specialized equipment and supplies needed to complete the field activities.

4.2.2 Staff working in extreme cold (wind chill or ECT below 10^{o}F or -12^{o}C) shall not work alone. The Buddy System shall be utilized to keep an eye on each other and to watch for signs of cold stress. Refer to *S3NA-314-PR1 Working Alone*. Watch for symptoms and signs of hypothermia

4.2.3 Monitor weather forecasts and weather conditions such as ambient temperature, wind speed, and precipitation. Use observations prior to entering and while in the field to ensure appropriate protections are in place:

- If possible, move the work to a warm location.
- If possible and as applicable, erect shelters or screens around the work area.
- If possible, heat the work area.
- If possible, adjust schedule according to the cold conditions, work level and worker acclimatization.
- Implement a work-warming regimen by taking breaks out of the cold. As applicable, consult *S3NA-112 ATT1 Temperature Thresholds* to determine wind chill and work-warming schedule.
- Take frequent short breaks in warm dry shelters to allow your body to warm up. Limit time of exposure to the cold. If shelter is not readily available, consider supplying temporary shelters.

- Provide assistance to prevent body heat loss, such as:
    - Providing appropriate sources of heat (e.g. warm packs, portable heaters, etc.).
    - Use of insulating materials on equipment handles when temperatures drop below 30°F (-1°C).

4.2.4 All staff working in extreme cold or snow conditions should understand the following guidelines for preventing and detecting hypothermia and frostbite; refer to *S3NA-112-ATT2 Symptoms & Treatment*:

- Ensure appropriate PPE requirements are established and adhered to.
- 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.
- Eat high calorie snacks to help maintain body metabolism.
- Confirm extra blankets or sleeping bags are on-site.
- Drink plenty of warm liquids. It is easy to become dehydrated in cold weather.
- Avoid caffeine and alcohol, which can act as diuretics. Alcohol consumption, depending upon quantity, can dilate blood vessels enhancing body heat loss or constrict blood vessels decreasing heat delivery to extremities.
- NEVER IGNORE SHIVERING. Persistent or violent shivering is a clear warning that you are on the verge of hypothermia.
- If you experience frost bite or hypothermia, find shelter and warmth and contact a medical practitioner if symptoms persist, refer to *S3NA-128-PR1 Medical Screening & Surveillance*.

4.3 Training

Before they begin work in a cold environment, employees that might be exposed to cold stress will be informed of the potential for cold stress and how to prevent cold stress. Employees that have not had the training within the twelve prior months shall repeat the training before exposure to cold stress, refer to *S3NA-003-PR1 SH&E Training*. Employees potentially exposed to cold stress will receive training including, but not limited to:

4.3.1 Sources of cold stress, the influence of protective clothing, and the importance of acclimatization.

4.3.2 How the body loses heat.

4.3.3 Recognition of cold-related illness symptoms.

4.3.4 Cold stress preventative/corrective measures including, but not limited to:

- Weather monitoring.
- Proper eating and drinking practices.
- Work-warming schedules and proper re-warming techniques.
- Buddy system.
- Safe cold work practices appropriate to the work that is to be performed.
- Proper use of cold environment personal protective clothing.

4.3.5 The harmful effects of excessive alcohol consumption in a cold stress environment.

4.3.6 The hazards associated with unstable snow or ice build ups.

4.3.7 First aid procedures for symptoms related to cold stress.

4.4 Personal Protective Equipment (PPE)

Wearing the right clothing is crucial to avoiding cold stress. The type of fabric also makes a difference. Cotton loses its insulation value when it becomes wet. Wool, on the other hand, retains its insulation even when wet. Adequate insulating dry clothing will be required in air or wind chill temperatures below 40 °F (4.4°C)

All PPE will comply with the requirements of *S3NA-208-PR1 Personal Protective Equipment* and consider the following requirements:

4.4.1 Wear at least 3 layers of clothing to help prevent cold stress. It is important to preserve the air space between the body and the outer layer of clothing to retain body heat.

- Wear a middle layer of down, wool, or similar materials to provide insulation.
- Avoid cotton, especially blue jeans.
- Wear an outer layer to break the wind and allow some ventilation (e.g., Gortex® or nylon)
- Do not wear tight clothing. Loose clothing allows better ventilation.

4.4.2 Wear proper clothing, including head coverings and gloves or mittens for cold, wet, and windy conditions.

4.4.3 Wear a hat or hardhat liner. Up to 40 percent of body heat can be lost when the head is left exposed.

4.4.4 Use insulated footwear with adequate traction to prevent slips and falls.

4.4.5 Wear insulated boots or other insulated footwear, and insulated gloves to help reduce the chance of frostbite.

4.4.6 Keep a change of dry clothing available in case work clothes become wet.

4.4.7 Eye and face protection for employees employed outdoors in a snow and/or ice-covered terrain should be supplied.

- Sunglasses (with UVA and UVB protection) and sunscreen should be used when there is a persistent combination of snow and direct sun.
- 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.
- Ensure face guards are used to protect skin in cold, windy conditions, including riding on an unshielded vehicle.

4.5 General Cold Stress Prevention Measures

4.5.1 In order to prevent hypothermia:

- Wear appropriate clothing and PPE as determined by the weather conditions.
- 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 / location 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 do not consume 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°F (37°C) shall be provided to employees if work is performed in air temperatures below 40°F (4.4°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-112-ATT1 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°F (0°C) regardless of wind speed. However, older employees, those with circulatory problems and those with previous cold injuries 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°F (-32°C) or below.

4.5.6 At air temperatures of 40°F (4.4°C) or less, it is imperative that employees 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 Confirm that employees carry fire starter materials if working in remote areas.

4.5.13 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 Manager and made available. 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^{o}F (15^{o}C), special provisions should be established for keeping the employees' 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^{o}F (-1^{o} C).
- If the air temperature falls below 60^{o}F (15^{o}C) for sedentary work, 40^{o}F (4.4^{o} C) for light work, or 20^{o}F (-6^{o}C) for moderate work, and fine manual dexterity is not required, employees should use gloves.

4.6.2 To prevent contact frostbite, employees should wear anti-contact gloves:

- When cold surfaces below 20°F (-6°C) are within reach, each employee should be warned to prevent inadvertent contact by bare skin.
- If the air temperature is 0°F (-18°C) or less, employees should protect their hands with mittens or appropriate gloves. Machine controls and tools for use in cold conditions should be designed so that they can be handled without removing the mittens or gloves.
- Ensure an adequate supply of dry gloves is available to replace wet gloves.

4.6.3 Provisions for additional total body protection are required if work is performed in an environment at or below 40^{o}F (4.4^{o}C). The employees 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^{o}F (-12^{o}C) ECT, the following will apply:

- The employee 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. Refer to *S3NA-112-ATT1 Temperature Thresholds* for guidance.
- The weight and bulkiness of clothing should be included in estimating the required work performance and weights to be lifted by the employee.
- 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 employee should be protected from drafts to the greatest extent possible.

4.6.5 Employees 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.

4.6.6 Trauma sustained in freezing or subzero conditions requires special attention, because an injured employee 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 Hypothermia in Water

4.7.1 Loss of body heat heat to the water is a major cause of deaths in boating and working near water incidents. Often the cause of death is listed as drowning; however, the primary cause is often hypothermia. It should also be noted that alcohol lowers the body temperature around 2 to 3 degrees by dilating the blood vessels. Do not drink alcohol around cold water. The following table shows the effects of hypothermia in water:

WATER TEMPERATURE		EXHAUSTION	SURVIVAL TIME
32.5°F	(0°C)	Under 15 minutes	Under 15 to 45 minutes
32.5 to 40°F	(0 to 4°C)	15 to 30 minutes	30 to 90 minutes
40 to 50°F	(4 to 10°C)	30 to 60 minutes	1 to 3 hours
50 to 60°F	(10 to 16°C)	1 to 2 hours	1 to 6 hours
60 to 70°F	(16 to 21°C)	2 to 7 hours	2 to 40 hours
70 to 80°F	(21 to 27°C)	3 to 12 hours	3 hours to indefinite
Over 80°F	(27°C)	Indefinite	Indefinite

4.7.2 Some points to remember when water is a potential hazard:

- Wear a personal flotation device when drowning is a potential hazard. Refer to *S3NA-315-PR1 Working On or Near Water*, and *S3NA-333-PR1 Marine Safety & Vessel Operations*.
- If the water is less than 50°F (10°C), wear a wet suit or dry suit for work in water (e.g., wading, or if a significant potential to fall in water exists).
- While in the water, do not attempt to swim unless to reach nearby safety. Unnecessary swimming increases the rate of body heat loss. Keep the head out of the water. This will increase survival time.
- Keep a positive attitude about rescue. This will increase chances of survival.
- If there is more than one person in the water, huddling is recommended to conserve body heat.

4.7.3 If an employee or equipment is to work on ice and the water beneath the ice is or may be more than 3¼ feet (1m) deep at any point:

- Test the ice prior to commencing to ensure it will support the load to be placed on it. Ongoing testing may be necessary.
- If there is any risk of falling through the ice employees must wear personal protective equipment that will ensure buoyancy and protect against hypothermia at all times while on the ice.

4.8 Work-Warming Regimen

4.8.1 If work is performed continuously in the cold at an equivalent chill temperature (ECT) at or below 19°F (–7°C), heated warming shelters (tents, cabins, rest rooms, etc.) should be made available nearby. The employees should be encouraged to use these shelters at regular intervals; the frequency will depend on the severity of the environmental exposure. Refer to *S3NA-112-ATT1 Temperature Thresholds* for guidance.

4.8.2 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.

4.8.3 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.

4.8.4 A change of dry work clothing should be provided as necessary to prevent employees from returning to the cold environment with wet clothing.

5.0 Records

5.1 Exposure assessments will be documented in the location's files.

6.0 Attachments

6.1 S3NA-112-ATT1 Temperature Thresholds

6.2 S3NA-112-ATT2 Symptoms & Treatment

Americas

Heat Stress

S3AM-113-PR1

1.0 Purpose and Scope

1.1 Establishes a Heat Illness Prevention Program to guide employees in preventing heat illness, recognition of the symptoms of heat stress-related illnesses and in taking the appropriate corrective action.

1.2 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

2.1 **Acclimated –** Employees who have developed physiological adaptation to hot environments characterized by increased sweating efficiency, circulation stability, and tolerance of high temperatures without stress. Acclimatization occurs after 7 to 10 consecutive days of exposure to heat and much of its benefit may be lost if exposure to hot environments is discontinued for a week.

2.2 **Chemical Protective Clothing (CPC)** – Apparel that is constructed of relatively impermeable materials intended to act as a barrier to physical contact of the Employee with potentially hazardous materials in the workplace. Such materials include Tyvek® coveralls (all types) and polyvinyl chloride coveralls and rain suits.

2.3 **Heat Cramps** – A form of heat stress brought on by profuse sweating and the resultant loss of salt from the body.

2.4 **Heat Exhaustion** – A form of heat stress brought about by the pooling of blood in the vessels of the skin and in the extremities.

2.5 **Heat Rash** – A heat-induced condition characterized by a red, bumpy rash with severe itching.

2.6 **Heat Stress** – The combination of environmental and physical work factors that constitute the total heat load imposed on the body.

2.7 **Heat Stroke** – The most serious form of heat stress, which involves a profound disturbance of the body's heat-regulating mechanism.

2.8 **Sunburn** – Caused by unprotected exposure to ultraviolet radiation present in sunlight that is damaging to the skin (Refer to *S3AM-121-PR1 Non-Ionizing Radiation*). The injury is characterized by red painful skin, blisters, and/or peeling.

2.9 **Unacclimated** – Employees who have not been exposed to hot work conditions for one week or more or who have become heat-intolerant due to illness or other reasons.

3.0 References

3.1 S3AM-003-PR1 SH&E Training

3.2 S3AM-004-PR1 Incident Reporting, Notifications & Investigation

3.3 S3AM-010-PR1 Emergency Response Planning

3.4 S3AM-121-PR1 Non-Ionizing Radiation

3.5 S3AM-208-PR1 Personal Protective Equipment

3.6 S3AM-209-PR1 Risk Assessment & Management

4.0 Procedures

4.1 Roles and Responsibilities

4.1.1 Managers

- Evaluate the need for heat illness prevention measures and incorporate as appropriate into the Safe Work Plan or Task Hazard Analysis.
- Allocate sufficient resources for the management of heat illness in the field including the provision of water, a shaded break area, and sufficient schedule to allow for breaks.

4.1.2 Safety, Health and Environment (SH&E) Manager

- Provide heat illness awareness training.
- Assist in developing appropriate work-rest schedules.
- Conduct/support incident investigations related to potential heat stress-related illnesses.

4.1.3 Supervisor

- Identify those tasks that may be most impacted by heat stress and communicate the hazard to the assigned Employees.
- Confirm that Employees have been trained on the recognition of heat illness.
- Confirm that this procedure, along with any applicable Safe Work Plan and/or Task Hazard Analysis (and heat exposure control plan that may be contained therein) are made available to affected Employees.
- Confirm that adequate supplies of appropriate fluids are readily available to Employees.
- Confirm that a proper rest area is available.
- Conduct heat illness monitoring, as applicable.
- Implement the work-rest schedule.
- Confirm that first aid measures are implemented once heat stress symptoms are identified.
- Confirm personnel are physically capable of performing the assigned tasks and are not in a physically compromised condition.
- Report all suspected heat illnesses.

4.1.4 Employee

- Observe each other for the early symptoms of heat illnesses.
- Maintain an adequate intake of available fluids.
- Be familiar with heat stress hazards, predisposing factors, and preventative measures.
- Report to work in a properly vested and hydrated condition.
- Report all suspected heat stress-related illnesses.

4.2 Restrictions

4.2.1 The Buddy System is required when working in high heat conditions; Employees shall not work alone.

4.2.2 Employees shall not be exposed to levels exceeding those specified for the given work level and work-rest regimen as listed in *S3AM-113-ATT1 Temperature Thresholds*.

4.2.3 Clothing corrections shall be applied in accordance with the tables provided in *S3AM-113-ATT1 Temperature Thresholds*.

4.3 Exposure Controls

4.3.1 It shall be determined whether Employees are or may be exposed to hazardous heat levels. The Supervisor shall:

- Conduct a heat stress assessment to determine the potential for hazardous exposure of Employees. Assessment shall include, but not limited to:
  - Ambient temperature.
  - Amount of sunshine (cloudy, clear). Refer to *S3AM-121-PR1 Non-Ionizing Radiation* additional direction concerning ultraviolet radiation exposures.
  - Other radiant heat sources (e.g. motor, fire, etc.).
  - Humidity.
  - Air flow.
  - Amount or type of physical labor being performed,
  - Physical condition of the Employees (e.g., acclimated/not)
  - Protective clothing in use.
  - Referral to *S3AM-113-ATT1 Temperature Thresholds* to assist in determining whether hazardous heat exposures may exist.
- If potential for hazardous exposure is identified, the Supervisor shall develop and implement a heat stress exposure control plan within the Safe Work Plan and/or Task Hazard Analysis. Refer to *S3AM-209-PR1 Risk Assessment & Management.*

4.3.2 If Employees are or may be exposed, the Supervisor shall implement engineering controls (e.g., shelters, cooling devises, etc.) to reduce the exposure of Employees to levels below those specified for the given work level and work-rest regimen as listed in *S3AM-113-ATT1 Temperature Thresholds*.

4.3.3 If engineering controls are not practicable, the Supervisor shall reduce the exposure of Employees to levels below those listed in *S3AM-113-ATT1 Temperature Thresholds* by providing administrative controls, including a work-rest cycle or personal protective equipment, if the equipment provides protection equally effective as administrative controls.

4.3.4 If Employees are or may be exposed, the Supervisor shall provide and maintain an adequate supply of cool, fresh, potable water close to the work area for the use of a heat exposed Employee. Water shall be provided (paid) by the project or program; if Employees purchase their own drinking water because water is not otherwise available on site, they shall be reimbursed.

4.3.5 If an Employee shows signs or reports symptoms of heat stress or strain, they shall be removed from the hot environment and treated by an appropriate first aid attendant on site, if available, or by a physician, refer to *S3AM-113-ATT2 Symptoms & Treatment* for more specifics.

4.4 Heat Stress Planning

4.4.1 Heat stress can be a significant site hazard, especially for Employees wearing CPC. To prepare for emergency response planning, refer to *S3AM-010-PR1 Emergency Response Planning* procedure.

4.4.2 The project and site specific risks need to be planned using the SH&E Plan and the Task Hazard Assessments (THA). Refer to the *S3AM-209-PR1 Risk Assessment & Management* procedure.

4.4.3 The heat a worker is exposed to may be a combination of air temperature, radiant heat, and humidity. The WBGT (wet-bulb globe thermometer) is a useful index of the environmental contribution to heat stress. Because WBGT is only an index of the environment, the contributions of

work demands, clothing, and state of acclimatization shall also be accounted for, as described in the following steps.

- Monitor ambient temperatures and conduct heat stress monitoring in accordance with the location specific SH&E Plan. Revise the heat stress monitoring and controls if there are any reports of discomfort due to heat stress.
- Monitor temperatures in each unique environment in which workers perform work (e.g., take WBGT measurements inside truck cabs for truck drivers, and take separate WBGT measurements in the outdoor area where field employees work, etc.). Follow manufacturer's instructions on proper use of the WBGT.
- Determine if individual workers are acclimatized or un-acclimatized. Full heat acclimatization requires up to 3 weeks of continued physical activity under heat-stress conditions similar to those anticipated for the work. Its loss begins when the activity under those heat-stress conditions is discontinued, or when there is a sustained increase in temperatures of 10 °F (5.6 °C) or more, and a noticeable loss occurs after 4 days. A worker can be considered acclimatized for the purpose of this procedure when they have been exposed to the site conditions (including level of activity) for 5 of the last 7 days.
- Determine the approximate workload of each worker or group of workers. The following examples (Table 1) can be used for comparison:

Table 1
Examples of Activities within Workload Categories

Categories	Example Activities
Resting	Sitting quietly
	Sitting with moderate arm movements
Light	Sitting with moderate arm and leg movements
	Standing with light work at machine or bench while using mostly arms
	Using a table saw
	Standing with light or moderate work at machine or bench and some walking about
Moderate	Scrubbing in a standing position
	Walking about with moderate lifting or pushing
	Walking on level at 3.5 miles/hr (6 km/hr) while carrying 6.6 lbs (3kg) weight load
Heavy	Carpenter sawing by hand
	Shoveling dry sand
	Heavy assembly work on a non-continuous basis
	Intermittent heavy lifting with pushing or pulling (e.g., pick-and-shovel work)
Very Heavy	Shoveling wet sand

- Determine the approximate proportion of work within an hour during a typical shift. Typically, the initial work schedule will be 60 minutes of work per hour (100 percent work) with a small break in the morning and afternoon, as appropriate, and a 30-minute lunch break mid-day.
- For workers wearing cloth coveralls (e.g., Nomex fire resistant clothing), add 3 to the measured WBGT. For impermeable clothing, such as Tyvek or Saranex, the WBGT procedures cannot be used. For these situations, workers should begin physiological monitoring as soon as the temperature in the work area exceeds 70ºF (21°C).
- Use the collected information to develop appropriate work to rest schedules as detailed in *S3AM-113-ATT1 Temperature Threshold*.

4.4.4 Given the work demands (light, moderate, heavy or very heavy), heat of the work environment, and such aspects as PPE in use, workload will be adjusted appropriately to allow for proper acclimation.

- This is the process by which the body "gets used to" hot work environments. This is achieved by slowly increasing workloads.
- New and returning Employees (absent one week or more) who have not had time to acclimatize may be more susceptible to heat related illnesses, even in seemingly low risk heat exposures.
- All Employees shall be allowed time to acclimatize in the event of a heat wave. All Employees assigned to a new process with additional heat exposures shall be allowed to acclimatize.
- Minimize workload and gradually increase as tolerance is built up. Allow for more frequent breaks.
- While acclimatization normally takes approximately 5 to 7 days, heightened monitoring of these Employees will be maintained for the first 14 days.

4.4.5 Employees shall be instructed in the recognition of heat stress symptoms, the first aid treatment procedures for severe heat stress, and the prevention of heat stress injuries. Employees shall be encouraged to immediately report any heat stress that they may experience or observe in fellow Employees. Supervisors shall use such information to adjust the work-rest schedule to accommodate such problems.

4.4.6 Wherever possible, a designated break area should be established in an air conditioned space, or in shaded areas where air conditioning is impractical. The break area should be equipped to allow Employees to loosen or remove protective clothing, and sufficient seating should be available for all Employees. During breaks, Employees shall be encouraged to drink plenty of water or other liquids, even if not thirsty, to replace lost fluids and to help cool off. Cool water should be available at all times in the break area, and in the work area itself unless hygiene/chemical exposure issues prevent it.

4.5 Symptoms and Treatment

4.5.1 Refer to *S3AM-113-ATT2 Symptoms & Treatment*.

4.5.2 Employees who exhibit ANY signs of significant heat stress (e.g., profuse sweating, confusion and irritability, pale, clammy skin) shall be relieved of all duties at once, made to rest in a cool location, and provided with large amounts of cool water.

4.5.3 Anyone exhibiting symptoms of heat stroke (red dry skin, or unconsciousness) shall be taken immediately to the nearest medical facility. Steps shall be taken to cool the person during transportation (clothing removal, wet the skin, air conditioning, etc.).

4.5.4 Severe heat stress (heat stroke) is a life-threatening condition that shall be treated by a competent medical authority.

4.6 Prevention

4.6.1 Requirements for working in extreme heat may be triggered by a regulatory established criteria (e.g. CAL/OSHA requires high heat procedures when temperature equals or exceeds 95°F) or as a result of a hazard analysis assessing various contributory factors (refer to *S3AM-113-ATT1 Temperature Thresholds*). Employees working in extreme heat or sun should understand and apply the following guidelines for preventing and detecting heat exhaustion and heat stroke.

- When possible, begin hydrating at least three days prior to working in high heat conditions.
- Review the heat stress exposure control plan within the Safe Work Plan and/or Task Hazard Analysis.
- If the supervisor is not immediately available confirm a reliable method of communication is in place to allow for contact with supervision. In the absence of cellular reception a satellite phone or similar device may be required.

- Take frequent short breaks in areas sheltered from direct sunlight; eat and drink small amounts frequently.
- Try to schedule work for the coolest part of the day, early morning and evening.
- Avoid strenuous physical activity outdoors during the hottest part of the day.
- Avoid sudden changes of temperature. Refer *to S3AM-113-ATT1 Temperature Thresholds*.
- Air out a hot vehicle before getting into it.
- Obtain medical direction if taking diuretics during hot weather (a lower dose may be necessary).
- When working in heat, drink 1 quart of water per hour of work.
- Avoid caffeine and alcohol as they increase dehydration.
- Monitor urine frequency and color to detect dehydration. Refer to the *S3AM-113-ATT3 Dehydration Chart.*
- The Buddy System is required when working in high heat conditions to enable effective communication and cross-observation for indications of heat stress.
- Initiate emergency response procedures when necessary, including contacting emergency medical services as appropriate and in accordance with the Emergency Response Plan.

4.6.2 Personal Protective Equipment

- Review the *S3AM-208-PR1 Personal Protective Equipment* procedure.
- Wear a hat and light-colored, loose-fitting clothing to reflect the sun.
- Apply sunscreen to exposed skin (SPF 30 or greater, follow directions on label).
- Wear sunglasses with UV protection.
- Pack extra water to avoid dehydration (try freezing water in bottles overnight to help keep the water cooler for longer during the day).

4.7 Work-Rest Schedule Practices

4.7.1 Intake of fluid will be increased beyond that which satisfies thirst, and it is important to avoid "fluid debt," which will not be made up as long as the individual is sweating.

- Two 8-ounce glasses of water should be taken prior to beginning work, then up to 32 ounces (1 quart) per hour during the work shift; fluid replacement at frequent intervals is most effective.
- The best fluid to drink is water; liquids like coffee or soda do not provide efficient hydration and may increase loss of water.
- If commercial electrolyte drinks (e.g., Gatorade) are used, the drink should be diluted with water, or 8 ounces of water should be taken with each 8 ounces of electrolyte beverage.

4.7.2 Additional salt is usually not needed and salt tablets should not be taken.

4.7.3 Replacement fluids should be cool and fresh, but not cold.

4.7.4 Breaks will be taken in a cool, shaded location, and any impermeable clothing should be opened or removed.

- A relatively cool, shaded area shall be provided for breaks when working in hot environments. For hazardous waste sites, the rest area should be located in the support zone adjacent to the contamination reduction zone, situated so that part of it is in the decontamination area so workers can take breaks without going through full decontamination.

- If shade is not available, shaded areas shall be constructed. This same type of canopy can be set up to shade personnel performing various types of work in hot weather.
- Cooling measures other than shade (e.g., misting, air conditioned break areas, air conditioned vehicles, etc.) can be used in lieu of shade provided it can be demonstrated that they are at least as effective in cooling employees.
- Employees should have access to these rest areas at break times and at any other time when suffering from heat illness or believing a preventive recovery period is needed.

4.7.5 Dry clothing or towels will be available to minimize chills when taking breaks.

4.7.6 Manual labor will not be performed during breaks, other than paperwork or similar light tasks.

4.7.7 Other controls that may be used include:

- Scheduling work at night or during the cooler parts of the day (6 am–10 am, 3 pm–7 pm).
- Erecting a cover or partition to shade the work area.
- Auxiliary cooling - wearing cooling devices beneath protective garments, but over any underclothing.
  - If cooling devices are worn, only physiological monitoring will be used to determine work activity.
  - These vests typically provide cooling via one of two methods: the use of ice or other frozen media, or the use of a vortex cooler. Each method has its advantages and disadvantages.
  - The frozen media vest requires a means for freezing the media, and the media (usually water or "blue ice") will melt, requiring replacement.
  - The vortex cooler tends to cool more uniformly. Instead of frozen media, this vest uses the expansion of compressed air to cool the wearer. The drawback is the compressed air requirement, but this is negated when the wearer is already using an airline respirator supplied by a compressor. A vortex cooler should not be supplied from air cylinders, as this will draw down the cylinders rapidly.
- Auxiliary cooling should be considered when the following conditions exist:
  - Ambient temperature over 80°F (26°C).
  - Workers are wearing impermeable garments (i.e., Tyvek, Saranex, Chemrel, etc.).
  - It is desirable to have long work shifts with minimum interruption.

4.8 Evaluating the Work-Rest Schedule's Effectiveness

4.8.1 Once a work-rest schedule is established, the Supervisor shall continually evaluate its effectiveness through observation of Employees for signs/symptoms of heat stress. Have workers assess themselves and their body's reaction to the heat and work conditions (self-assessment), and report any signs or symptoms of heat illness. These can include nausea or dizziness, heat cramps, extreme thirst, or very dark urine.

4.8.2 Measurement or physiological monitoring of each Employee's vitals (e.g., pulse, blood pressure, and temperature) can provide additional information in determining if the schedule is adequate. Refer to *S3AM-113-ATT1 Temperature Thresholds* for additional guidance on when physiological monitoring should be conducted.

4.8.3 Frequency of physiological monitoring is increased or decreased depending upon such factors as worker fitness, acclimatization, temperature of the work environment, type of PPE, etc.

Based on the results of the physiological monitoring and on the workers' self-assessments, the work period may be adjusted as follows:

- The work period may be increased (generally, by 5- to 10-minutes intervals, up to a maximum of 4 hours) if the results of the first 2 hours of the physiological monitoring and the workers' self-assessments indicate that workers are recovering adequately (see below), and on the judgment of the SH&E Manager.
- The work period shall be decreased if the results of the physiological monitoring and the workers' self-assessment indicate that workers are NOT recovering adequately (see below).

4.8.4 If physiological monitoring is conducted, the Employee and/or the SH&E Manager (or appropriate designate) shall measure and record body temperature and pulse rate as described below.

4.8.5 Monitor body temperature to determine if Employees are adequately dissipating heat build-up. Ear probe thermometers which are adjusted to oral temperature (aural temperature) are convenient and the preferred method of measurement. Determine work/rest regimen as follows:

- Measure oral body temperature at the end of the work period. Oral body temperatures are to be obtained prior to the employee drinking water or other fluids.
- If temperature exceeds 99.6°F (37.5°C), shorten the following work period by 1/3 without changing the rest period.
- If, at the next rest period, temperature still exceeds 99.6°F (37.5°C), the worker should not be allowed to continue work until repeated temperature measurements are in the acceptable range (i.e., less than 99.6°F). Do not leave the worker alone during the recovery time. Watch for signs of heat illness and be prepared to implement emergency response as necessary.
- Do not allow a worker to wear impermeable PPE when his/her oral temperature exceeds 100.6°F (38.1°C).

4.8.6 At the start of the workday each Employee's baseline pulse rate (in beats per minute [bpm]) is determined by taking a pulse count for 15 seconds and multiplying the result by four or by using an automated pulse count device. Pulse rates can then be measured at the beginning of each break period and two minutes thereafter to determine if the rest period allows for adequate recovery.

- Take the radial (wrist) pulse as early as possible in the rest period and determine the worker's heart rate in beats per minute. The heart rate is determined by counting the pulse for ten seconds and multiplying the number by 6 to get the beats per minute. Record this as P1.
- Wait 2 minutes and repeat the pulse measurement. Record this as P2.
- If P1 is greater than or equal to 110 beats per minute (bpm) and if (P1 – P2) is less than or equal to 10 bpm (indicating that workers are not recovering adequately), shorten the next work cycle by 1/3 without changing the rest period.
- At the next rest period, if P1 is still equal to or greater than 110 bpm, and if (P1 – P2) is still less than or equal to 10 bpm, shorten the following work cycle by 1/3 without changing the rest period.
- At the third rest period, if P1 is still equal to or greater than 110 bpm and (P1 – P2) is still less than or equal to 10 bpm, the worker should not be allowed to continue work until repeated pulse measurements are in the acceptable range (i.e., P1 is less than 110 bpm and (P1 – P2) is greater than 10 bpm). Do not leave the worker alone during the recovery time. Watch for signs of heat illness and be prepared to implement emergency response as necessary.

4.8.7 Use of an automated or similar blood pressure device will be used to assess each Employee's blood pressure at the beginning and end of each break period to determine if the rest period allows adequate cooling by applying the following criteria:

- If the blood pressure of an Employee is outside of 90/60 to 150/90, then the Employee will not be allowed to begin or resume work; extend the break period by at least five minutes, at the end of which blood pressure rates will be re-measured and the end-of-break criteria again applied.

4.8.8 All physiological monitoring of heat stress will be documented using *S3AM-113-FM1 Heat Stress Monitoring Log.*

4.9 Training

4.9.1 Employees and their Supervisors that may be exposed to the hazard will be trained and oriented to the hazard and the controls prior to work commencing.

4.9.2 Those Employees, including Supervisors, potentially exposed to heat stress will receive training, refer to the *S3AM-003-PR1 SH&E Training* procedure. Training will include, but is not limited to:

- Sources of heat stress (environmental and personal), influence of protective clothing, and importance of acclimatization;
- How the body handles heat and acclimatization;
- Recognition of heat-related illness symptoms;
- Preventative/corrective measures including, but not limited to;
  - Employees will be informed of the harmful effects of excessive alcohol consumption in the prevention of heat stress.
  - All Employees will be informed of the importance of adequate rest and proper diet in the prevention of heat stress.
- First aid procedures for heat stress-related illnesses; and
- Immediate reporting of any heat-related incident (injury, illness, near-miss), refer to the *S3AM-004-PR1 Incident Reporting, Notifications & Investigation* procedure.

5.0 Records

5.1 None

6.0 Attachments

6.1 S3AM-113-ATT1 Temperature Thresholds

6.2 S3AM-113-ATT2 Symptoms & Treatment

6.3 S3AM-113-ATT3 Dehydration Chart

6.4 S3AM-113-FM1 Heat Stress Monitoring Log

Americas

Radiation

S3AM-120-PR1

1.0 Purpose and Scope

1.1 The primary aim of AECOM's Radiation Safety Program is to provide an appropriate standard of protection for employees without unduly limiting the beneficial practices that result in radiation exposure. This procedure provides AECOM requirements for:

- Limiting occupational and public exposure to ionizing radiation;
- Developing plans to control occupational exposure to radioactive materials, and
- Implementing radiological exposure assessment activities whenever employees are working with ionizing radiation or radioactive materials.

1.2 The Radiation Safety Program is intended to prevent the occurrence of deterministic effects, by keeping doses As Low As Reasonable Achievable (ALARA), and to confirm that all reasonable steps are taken to reduce the probability of stochastic effects.

1.3 This procedure applies to all AECOM Americas-based employees and operations.

1.4 Any exceptions to this procedure must be approved in writing by the Business Group Radiation Safety Officer (RSO).

2.0 Terms and Definitions

2.1 **Absorbed dose** – The energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the rad and the gray (Gy): 1 Gy = 100 rad.

2.2 **Activity** – The rate of disintegration or transformation or decay of radioactive material. The units of activity are "disintegrations per second (or minute)" (dps or dpm), curie (Ci) and the Becquerel (Bq).

- 1 Ci = 37,000,000,000 dps (3.7 x 1010 dps)
  1 Ci = 2,220,000,000,000 dpm (2.22 x 1012 dpm)
  1 Bq = 1 dps

2.3 **Administrative Exposure Limit- (AL)** Established to support implementation of the ALARA philosophy and confirm compliance with regulations.

2.4 **Adult** – An individual 18 years of age or more.

2.5 **Agreement State** – A state that has executed an agreement with the U.S. Nuclear Regulatory Commission (NRC) transferring to the state the responsibility for regulating uses of certain radioactive materials within its borders.

2.6 **Airborne radioactive material** – Any radioactive material dispersed in the air in the form of dusts, fumes, particles, mists, vapors or gases.

2.7 **ALARA (As Low As is Reasonably Achievable)** – Means making every reasonable effort to maintain exposures to radiation as far below regulatory dose limits as is practical, consistent with the purpose for which the licensed or registered activity is undertaken, as well as activities with occupational radiation exposures, taking into account the state of technology, the economics of improvements in relation to benefits to public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of ionizing radiation.

2.8 **Background radiation** – Radiation from cosmic sources; non-technologically enhanced naturally occurring radioactive material, including radon, except as a decay product of source or special nuclear material, and including global fallout as it exists in the environment from the testing of nuclear explosive devices.

2.9 **Bioassay** – The determination of kinds, quantities, or concentrations, and, in some cases, the locations of radioactive material in the human body, whether by direct measurement, in vivo counting, or by analysis and evaluation of materials excreted or removed from the human body.

2.10 **Business Group Radiation Safety Officer (Business Group RSO) –** The member of the Safety, Health and Environment (SH&E) Department designated by the Business Group Vice President of SH&E to manage all AECOM radiation issues related to ionizing radiation and/or radioactive materials.

2.11 **Committed Dose Equivalent** The dose equivalent to organs or tissues of reference (T) that will be received from an intake of radioactive material by a person during the 50-year period following the intake.

2.12 **Committed effective Dose Equivalent** The sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues (HE,50 = SWT HT,50).

2.13 **Declared Pregnant Woman** – A woman who voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception. The declaration remains in effect until the declared pregnant woman withdraws the declaration in writing or is no longer pregnant.

2.14 **Deterministic Effects** – Health effects, the severity of which varies with the dose and for which a threshold is believed to exist.

2.15 **Derived Air Concentration (DAC)** – The concentration of a given radionuclide in air which, if breathed by Reference Man (1.2 cubic meters of air per hour) for a working year of 2,000 hours under conditions of light work, results in an intake of one annual limit of intake (ALI).

2.16 **Disintegration per Minute (dpm)** - The rate of emission by radioactive material as determined by correcting the counts per minute observed by a detector for background, efficiency, and window size associated with the instrument.

2.17 **Dose** – A generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, total organ dose equivalent or total effective dose equivalent.

2.18 **Dose equivalent (HT) –**means the product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and Sievert.

2.19 **Dosimeter** – Devices designed to be worn or carried by a single individual for the assessment of dose equivalent. Examples of individual monitoring devices are film badges, thermoluminescent dosimeters (TLD) and pocket ionization chambers.

2.20 **Embryo/fetus** – The developing human organism from conception until the time of birth.

2.21 **Entrance or access point –** Any opening through which an individual or extremity of an individual could gain access to radiation areas or to licensed or registered sources of radiation. This includes portals of sufficient size to permit human access, irrespective of their intended use.

2.22 **Exposure** – being exposed to ionizing radiation or to radioactive material. A measure of ionization produced in air by x- or gamma radiation. The unit of exposure is the coulomb per kilogram (C/kg) or the roentgen (R): 1 R = 2.58 x 10-4 C/kg.

2.23 **Exposure rate** – The exposure per unit of time, typically milliroentgen per hour (mR/h).

2.24 **External dose** – That portion of the dose equivalent received from any source of radiation outside the body.

2.25 **Extremity** – Hand, elbow, arm below the elbow, foot, knee, and leg below the knee. The arm above the elbow and the leg above the knee are considered part of the whole body.

2.26 **Fixed Contamination** - Radioactive material that cannot readily be removed from surfaces by nondestructive means such as causal contact, wiping, brushing, or washing.

2.27 **Frisking** - Process of monitoring personnel for contamination.

2.28 **Five-year Dosimetry Period** – The period of five calendar years beginning on January 1 of the year following the year in which the Canadian Radiation Protection Regulations came into force (2000) and every period of five years after that period (e.g., 2000 – 2005, 2005- 2010, 2010 – 2015, etc.).

2.29 **Gray (Gy)** – The System International (SI) unit of absorbed dose. One Gy is equal to an absorbed dose of 1 joule per kilogram (100 rad).

2.30 **High radiation area** – Means an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.1 rem (1 millisievert) in 1 hour at 30 centimeters from any source of radiation or from any surface that the radiation penetrates.

2.31 **Internal dose** – That portion of the dose equivalent received from radioactive material taken into the body.

2.32 **Ionizing radiation** – Any electromagnetic or particulate radiation capable of producing ions, directly or indirectly, in its passage through matter. Ionizing radiation includes gamma rays and x rays, alpha and beta particles, high-speed electrons, neutrons, and other nuclear particles.

2.33 **License** – A form of permission given by an Agreement State, the NRC, or the Canadian Nuclear Safety Commission (CNSC) to an applicant who has met the requirements for licensing set out by that Agency

2.34 **Licensed material –** Radioactive material received, possessed, used or transferred under a license issued by a regulatory agency.

2.35 **Licensee** – Any person or organization that is licensed by a regulatory agency.

2.36 **Member of the public –** Any individual, except an individual who is performing assigned duties for a licensee or registrant involving exposure to sources of radiation.

2.37 **Minor** – An individual less than 18 years of age.

2.38 **Natural radioactivity** – Radioactivity of naturally occurring nuclides whose location and chemical and physical form have not been altered by man.

2.39 **Naturally Occurring Radioactive Material (NORM) -** Includes radioactive elements found in the environment. Long-lived radioactive elements of interest include uranium, thorium and potassium, and any of their radioactive decay products, such as radium and radon. These elements have always been present in the earth's crust and within the tissues of all living beings.

2.40 **Non-ionizing Radiation** – Any type of electromagnetic radiation that does not carry enough energy per quantum to ionize atoms or molecules. Near ultraviolet, visible light, infrared, microwave, radio waves, and low-frequency RF (longwave) are all examples of non-ionizing radiation. Sources of non-ionizing radiation include lasers, communication devices and towers, and high-voltage power lines.

2.41 **Nuclear Energy Worker** – See “Radiation Worker.”

2.42 **Occupational dose –** The dose received by an individual in the course of employment in which the individual’s assigned duties involve exposure to sources of radiation. Occupational dose does not include dose received from background radiation, as a patient from medical practices, from voluntary participation in medical research programs, or as a member of the public.

2.43 **One-year Dosimetry Period –** The periods of one calendar year beginning on January 1.

2.44 **Personnel Dosimetry** - Devices designed to be worn by a single person for the assessment of dose equivalent such as film badges, thermoluminescent dosimeters (TLDs), and pocket ionization chambers.

2.45 **Radiation Producing Device** – Any device capable of producing ionizing radiation except those devices with radioactive material as the only source of radiation [e.g., x-ray fluorescence devise].

2.46 **Radiation Protection Program (RPP)** – This radiation safety program also functions as a General RPP used to address the radiation safety needs associated with a general set of operational activities involving the use of or exposure to radioactive materials, or ionizing radiation. A project or site-specific RPP is used to address the radiation safety needs associated with a specific work location or field activity or to supplement the requirements of the general RPP.

2.47 **Radiation Safety Officer (RSO)** – The person appointed to oversee and manage the specific radiation safety issues associated with a particular use or contact with radioactive material or exposure to ionizing radiation, in accordance with an established RPP.

2.48 **Radiation Work Permit (RWP) –**Permit that identifies radiological conditions, establishes worker protection and monitoring requirements, and contains specific approvals for radiological work activities. The RWP serves as an administrative process for planning and controlling radiological work and informing the worker of the radiological, health, and safety issues.

2.49 **Radiation Worker –**Worker whose job assignment requires work on, with, or in the proximity of radiation production machines or radioactive materials. A radiological worker has the potential to be exposed to more than 100 mrem per year, which is the sum of the dose equivalent to external irradiation and the committed effective dose equivalent to internal irradiation.

2.50 **Radioactive material** – Any material (solid, liquid, or gas) that emits ionizing radiation spontaneously.

2.51 **Radioactivity** – The disintegration of unstable atomic nuclei with the emission of radiation.

2.52 **Radon Progeny** – Includes the following radioactive decay products of radon-222: polonium-218, lead-214, bismuth-214, and polonium-214.

2.53 **Removable Contamination -** Radioactive material that can be removed from surfaces by nondestructive means, such as casual contact, wiping, brushing, or washing.

2.54 **Restricted area** – An area, access to which is limited by the licensee or registrant for the purpose of protecting individuals against undue risks from exposure to sources of radiation. Restricted area does not include areas used as residential quarters, but separate rooms in a residential building may be set apart as a restricted area.

2.55 **Sealed source** – Radioactive material that is permanently bonded or fixed in a capsule or matrix designed to prevent release and dispersal of the radioactive material under the most severe conditions that are likely to be encountered in normal use and handling.

2.56 **Stochastic effects** – Health effects that occur randomly and for which the probability of the effect occurring, rather than its severity, is assumed to be a linear function of dose without threshold. Hereditary effects and cancer incidence are examples of stochastic effects.

2.57 **Survey** – An evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, and/or presence of sources of radiation. When appropriate, such evaluation includes, but is not limited to, tests, physical examination of location of materials and equipment, and measurements of levels of radiation or concentration of radioactive material present.

2.58 **Technologically Enhanced Naturally Occurring Radioactive Material (TENORM)** – Any naturally occurring radioactive materials not subject to regulation under the Atomic Energy Act whose radionuclide concentrations or potential for human exposure have been increased above levels encountered in the natural state by human activities.

2.59 **Total Effective Dose Equivalent (TEDE**) means the sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

2.60 **Total Organ Effective Dose Equivalent (TODE**) The sum of the deep dose equivalent (for external exposures) and the committed dose equivalent to an individual organ or tissue (for internal exposures).

2.61 **Unrestricted area** – An area, access to which is neither limited nor controlled by the licensee.

2.62 **Whole body** – For purposes of external exposure, head, trunk (including male gonads), arms above the elbow, or legs above the knees.

2.63 **Working level** – The concentration of radon progeny in 1 cubic meter that has a potential aloha energy of 2.08 x 10-5 joules.

3.0 References

3.1 S3AM-003-PR1 SH&E Training

3.2 S3AM-121-PR1 Non-Ionizing Radiation

3.3 S3AM-122-PR1 Gauge Source Radiation

3.4 S3AM-123-PR1 Respiratory Protection

3.5 S3AM-208-PR1 Personal Protective Equipment

3.6 S3AM-209-PR1 Risk Assessment & Management

4.0 Procedures

4.1 Roles and Responsibilities

4.1.1 **Business Group RSO**

A person to whom the VP of SH&E has delegated the responsibility for the Radiation Safety Program. The RSO may designate employees with experience and appropriate radiation credentials to support the radiation safety program. Confirm that Project Managers understand their responsibilities for development and implementation RPPs as applicable to the planned work activities. Further Business Group RSP responsibilities include:

- Review and approve all initial and renewals applications for radioactive material/special nuclear material license prior to submittal.
- Approve the appointment of each AECOM license/site RSO.
- Provide AECOM management and operations personnel with technical assistance in the identification, control, and safe handling of radioactive materials.
- Investigate any employee radiation exposures above the administrative limits.
- Review annual activity summary reports submitted by the License/Program/Site RSO.

4.1.2 **License/Program/Site Radiation Safety Officer (Site RSO)**

The Business Group RSO will designate or approve a qualified employee to be a Site RSO. The Site RSO will be responsible to the Project Manager and to the Business Group RSO for implementation of Radiation Protection Programs (RPP) and performance of project radiation safety responsibilities. The Site RSO receives radiation safety technical guidance from the AECOM Business Group RSO. Responsibilities of the Site RSO include:

- Manage all license, program, or project radiation safety procedures as specified in the applicable RPP.
- Review real-time monitoring results to determine compliance with the RPP-specified requirements.
- Maintain administrative and operational compliance with all license conditions and requirements.
- Identify individuals or work groups containing individuals who are likely to receive doses exceeding 0.1 rem/year, to the responsible Manager.
- Manage site dosimetry program, if applicable.
    - Evaluate the need for bioassay; ensure they are completed if required.
    - Confirm Employees are trained in the proper wear, handling, and storage of dosimeters.
    - Distribute and collect dosimeters, and review results.
    - Provide Employees with their annual dose reports.

- Provide copies of all dosimetry results to the Business Group RSO on an annual basis.

- Notify the Business Group RSO of any suspect personnel exposures above administrative limits.
- Confirm that Employees working with radioactive material or ionizing radiation sources have received all necessary safety-related training, certifications and/or licenses.
- Conduct and document all ALARA dose assessment investigations and lost dosimeter investigations.
- Confirm that the presence of radioactive materials, ionizing radiation sources, radiation-producing devices, radiologically controlled areas, contamination areas, airborne radioactivity areas, and radiation areas at project work sites are identified (where reasonably possible) prior to commencing field activities.
- Notify the Employee if he or she is likely to exceed their ALARA goal and discuss options for managing the situation.
- Submit an annual summary report to the Business Group RSO which includes the following.
  - Exposure monitoring (cumulative project dose).
  - Exposure trends or ALARA issues.
  - Annual audit findings.
  - Licensing actions.

4.1.3 **Manager (Operations)**

- Notify and get approval from the Business Group RSO of possession of or intent to acquire radioactive material under any general or specific radioactive material license or conduct field work at sites with the potential for employee radiation exposures.
- Notify the Business Group RSO of the intent to renew, or amend an existing AECOM radioactive materials license.
- Provide the Business Group RSO with the names and qualifications of individuals who may be designated as AECOM License/Program/Site RSOs.
- With the support of the Site RSO, identify individuals or work groups containing individual who are likely to receive doses exceeding 0.1 rem/year.
- Confirm Project Managers/ Site Supervisors, are aware of his/her Radiation Protection Program responsibilities.
- Operations Managers, Project Managers, and Project Safety Professionals are responsible for implementing any required radiological exposure assessment procedures in their work activities.

4.1.4 **Project Manager** / **Site Supervisor**

Confirms that the project is conducted in accordance with the requirements of contract documents, applicable regulations, radioactive material license conditions and ALARA requirements. . He/she has authority over all work activities of AECOM employees and subcontractors both on the job site and involved in off-site project support. The Project Manager is responsible for organizing the field team, including the Site Supervisor, Site RSO, and the Site Safety Officer. The Project Manager is responsible for communication and information exchange with the client and regulatory authorities and will officially represent AECOM in all project-related coordination. Further responsibilities include:

- Consult with the Business Group RSO or designee to determine if a site-specific RPP will be required.

- Identify project sites that do not involve direct exposure to or work with radioactive materials, but have the potential for incidental exposure to radiation.
- Involve the Site RSO in the planning phase of radiological work to be accomplished.
- Confirm that all radiation safety issues associated with their projects are properly addressed, and worker safety is confirmed through development of appropriate radiological safety requirements and procedures.
- Confirm that RPPs are prepared, reviewed, and approved in accordance with this procedure.
- Confirm that Employees working with radioactive material or ionizing radiation sources have received all necessary safety-related training, certifications and licenses.
- Facilitate compliance with client-required radiation safety programs in coordination with the Site RSO.

4.1.5 **Employees**

Before an Employee (including subcontractor personnel) may engage in handling or processing radioactive material or radioactive contaminated materials or perform the decontamination activities at the site, he or she will receive site-specific radiation safety training and acknowledge receipt of that training by signing a statement to that effect. Each Employee will comply with this AECOM Radiation Safety Program and all RPP provisions, guidance, and procedures. Further responsibilities include:

- Work in accordance with all established RPP requirements, and radiation work permits.
- Will not disturb or handle any radioactive material or work in any identified radiation area without appropriate training and safety procedures.
- Notify the Project Manager of the presence or suspected presence of previously unidentified radioactive material or ionizing/non-ionizing radiation sources in the workplace, and cease all work activities involving potential exposure to ionizing/non-ionizing radiation until further direction is received.
- Be generally aware of their current, annual, dose-to-date.
- Participate in ALARA evaluations, as requested.
- Implement the ALARA controls specified in plans and procedures,
- Immediately report to the Program/Site RSO or Project Manager any situations where they believe that they or another employee may have had an internal deposition of radioactive material.
- Properly wear, handle, and store any dosimeter or other dose assessment device issued to them.

4.2 Restrictions

4.2.1 This Radiation Safety Program was developed with the premise that the success of any program designed to minimize exposures and avoid accidents must necessarily rely on the experience, ability, and forethought of the user. The policies and procedures contained in the Radiation Safety Program are designed to achieve a reasonable and practical standard of safety in compliance with government regulations and codes and a degree of safety awareness for those who work with radiation devices.

4.2.2 This Radiation Safety Program, including the related policy, manual, and safe job procedures, must be adhered to for all tasks which involve nuclear densometers. Specific requirements for the safe management of nuclear densitometer and gauge sources are provided in AECOM procedure *S3AM-122-PR1 Gauge Source Radiation*.

4.2.3 Only Employees trained in the use and handling of nuclear densometers are authorized to handle or receive these devices. This includes technicians using the devices or anyone shipping them by ground transportation or by air.

4.2.4 Specific safety requirements related to non-ionizing radiation are provided in *S3AM-121-PR1 Non-Ionizing Radiation*.

4.2.5 This Radiation Safety Program does not apply to AECOM Employees who are working full-time under another client-supported radiation safety program. For example, AECOM Employees working on a Department of Energy site who are actively monitored under the site's program are not subject to the requirements of this AECOM Radiation Safety Program. However, Employees visiting a site or working temporarily under a client-supported program should provide dose monitoring reports to the Site RSO, if they are also working under this AECOM Radiation Safety Program.

4.3 Training Requirements

4.3.1 Training requirements for a project or program shall be provided in or referenced in the applicable RPP.

4.3.2 AECOM Employees shall receive radiation safety training and certifications commensurate with their job duties. Employees may require training to a level such that occupation (non-public) dose limits apply. These persons will then be qualified as Radiation Workers (U.S.), Nuclear Energy Workers (Canada) or Naturally Occurring Radioactive Material (NORM) Surveyors.

4.3.3 Records shall be maintained to demonstrate compliance with the training requirements, refer to *S3AM-003-PR1 SH&E Training*. Training records shall include either a copy of an examination showing a passing score of 80 percent or higher or a certificate from an outside vendor. For Radiation Awareness (RA) training, no test or certificate is required. RA training can be documented with a training sign-in sheet, e-mail acknowledgement from the trainer, or similar documentation.

4.3.4 Radiation safety training is required under the following circumstances:

- Before being permitted unescorted access to radiologically controlled areas (i.e., areas posted with the radiation trefoil symbol);
- Before exceeding public dose limits during access to radiologically controlled areas (i.e., areas posted with the radiation trefoil symbol);
- Before handling, storing, or transporting nuclear gauge sources;
- When there is a significant change to radiation protection policies and procedures that may affect the individual;
- When specified in the program-specific or license-specific RPP;
- When required by a state permit or other regulation for the possession of a radiation-producing devise; and
- When required by a client for site access to perform a specific task.

4.4 Training Topics

4.4.1 Radiation safety training shall be detained in the RPP and should include the following topics to the extent appropriate to each individual’s prior training, work assignments, degree of exposure to potential radiological hazards, and applicable program or license:

- Risk of exposure to radiation and radioactive materials, including prenatal radiation exposure;
- Basic radiation fundamentals and radiation protection concepts;

- Controls for both routine and emergency actions implemented at the local level to manage and maintain doses ALARA (e.g., physical design features, administrative controls, limits, policies, procedures, alarms, radiation survey instrumentation, dose monitoring devices and other measures);
- Transportation and storage of radioactive materials;
- The individual's rights and responsibilities for implementing the facility's radiological protection program;
- The individual's responsibilities for implementing ALARA measures; and
- Reports the individual may request.

4.5 Training Courses

4.5.1 AECOM recognizes multiple training levels that are commensurate with an Employee's job functions as described below. For these descriptions, Radiation Worker training is considered the same as Nuclear Energy Worker training.

4.5.2 RA – This course contains the basics in radiation protection and should be site/project specific.

- This training is for AECOM Employees that may require non-routine or short-term unescorted access to radiological controlled areas (excluding Radiation Areas and Airborne Radiation Areas) to perform work functions.
- This training is also acceptable for short-term site assessment activities for sites with known low-levels of radiation and contamination or where a qualified health physics or radiation protection technician has control of site access.
- RA training is also given to personnel who work in areas where radioactive materials are stored but do not have authorized access to the materials or areas where radioactive materials may be inadvertently encountered (such as during environmental sampling in uncontrolled areas).
- Personnel who receive RA training are NOT considered Radiation Workers or Nuclear Energy Workers and public dose limits apply. To exceed public dose limits, Employees must be trained to one of the requirements below.

4.5.3 Site-Specific Radiation Worker Training- This course is designed to provide the OSHA 1910.1096 (i)(2) and site-specific training necessary to work in a radiation area or exposed to radioactive materials.

- The instruction shall include safety problems resulting from exposure to materials, instructed in the applicable provisions on exposure protection, and where individuals can get information on their radiation exposure.

4.5.4 NORM Surveyor – This course is designed to provide surveyor training for individuals performing "NORM" surveys. Topics include why survey, types of surveys, types of equipment surveyed, and techniques in the operation, use, and handling of various radiation survey instruments.

4.5.5 Radiation Worker I (RWI) – This course contains the core academics and the appropriate practical factors.

- This training is for radiological workers whose job assignments require routine access to Radiological Buffer Areas and Radiation Areas.
- RW I training is also suggested for unescorted entry into Radioactive Material Areas containing either sealed radioactive sources or radioactive material labelled in accordance with 10 CFR 20, 10 CFR 835, or applicable Agreement State regulations.
- RW I training alone does not prepare the Employee to work around higher radiation levels or with contaminated materials. It is suggested that RW I tasks be limited to inspections, tours and activities that involve work on non-radiological systems.

4.5.6 Radiation Worker I Training with High/Very High Radiation Area Training – This course contains the core academics, the High/Very High Radiation Area (HR/VHR) module, and the appropriate practical factors.

- The HR/VHR Area lesson plan may be added to the RW I course to give personnel unescorted entry into High Radiation Areas where contamination is not a concern.

4.5.7 Radiation Worker II Training (RW II) – This course consists of the core academics, the HR/VHR module, the Contamination Control module, and the appropriate practical factors.

- This training is recommended for the radiological worker whose job assignments involve unescorted entry into High Radiation Areas, Contamination Areas, High Contamination Areas, and Airborne Radioactivity Areas.
- Further, Employees who have potential contact with hot particles or use glove boxes with high contamination levels should complete RW II training.
- RW II training prepares the Employee to work around higher radiation levels and with contaminated materials normally associated with radiological facilities/activities.

4.5.8 Nuclear Gauge Training – All Employees asked to work with nuclear gauges will be trained in safe radiation work practices and procedures in accordance with *S3AM-122-PR1 Gauge Source Radiation*.

4.5.9 Other Instrument-Specific Training – All Employees asked to work with devises that emit ionizing or non-ionizing radiation will be trained in safe work practices and procedures.

4.6 ALARA

4.6.1 Even though current occupational exposure limits provide a very low risk of injury, it is prudent to avoid unnecessary exposure to radiation. AECOM's objective is thus to reduce occupational exposures as far below the specified limits as is reasonably achievable by means of good radiation protection planning and practice, as well as commitment to policies that foster vigilance against departures from good practice.

4.6.2 In addition to maintaining doses to individuals ALARA, the sum of the doses received by all exposed individuals should also be maintained at the lowest practicable level. It would not be desirable, for example, to hold the highest doses to individuals to some fraction of the applicable limit if this involved exposing additional people and significantly increasing the sum of radiation doses received by all involved individuals.

4.6.3 Two basic assumptions are considered necessary in this program for keeping occupational exposures as far below the specified limits as is reasonably achievable. Those two conditions are management commitment to maintaining exposures as low as is reasonably achievable, and the personnel responsible for radiation protection should be continuously vigilant for means to reduce exposure.

4.6.4 ALARA Policy Statement and Implementation

- 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 confirm that efforts are taken to reduce radiological exposures and releases to the environment ALARA, taking into account social, technical, economic, practical and public policy considerations. AECOM is committed to implementing a radiological control program that reflects this policy.
- To implement this policy, AECOM shall:
    - Review radiological operations and analyze the hazards;
    - Develop and implement controls that reduce or eliminate unnecessary dose and keep the necessary doses low and document the controls in the RPP or other work document.
    - Document areas surveyed for radioactive material and retain record of the survey.

- Establish ALARA goals for individuals or work groups.
- Provide feedback to Employees and Managers by tracking an individual's dose (from all operations) relative to his/her ALARA goal.
- Re-evaluate the situation if it appears an individual is likely to exceed his/her ALARA goal.

4.6.5 ALARA Committee

- Form an ALARA Committee for each site for which ALARA goals will be developed and when there is a potential for exposure to ionizing radiation at levels that significantly exceed natural background.
- At a minimum, this Committee will be made up of the Site RSO, the Project or Site Manager, the Health Physics Supervisor (if applicable), and one representative of the site labor force.
- The Committee will meet periodically to review previous site radiation exposure, air monitoring, effluent monitoring, and contamination level data to assess the presence of unacceptable trends.
- The Committee will also assess the success of the radiological controls, serve as a forum for recommendations for improvements, and maintain a written record of the Committee's activities in the project files. The Committee will also support the development of project or site-specific ALARA goals.

4.6.6 ALARA Goals and Evaluations

- ALARA goals shall be established for individuals who may be involved in operations that could result in exposures greater than 100 mrem (1 mSv) from all operations in a calendar year. The Program/Site RSO shall work with the radiation safety committee to establish ALARA goals in conjunction with the Project Manager or Program Manager. The ALARA goals should be:
  - Based on historical values for this type of work or on estimations of dose and should be modified either up or down depending upon the nature of the work involved.
  - Approved by the Project Manager or Program Manager and exposed individual's supervisor.
  - Periodically evaluated relative to accrued dose received by the worker.
  - If it is observed that an individual is approaching 100 mrem (1 mSv) for the year and no ALARA goal has been established, then the Program/Site RSO will notify the Business Group RSO of this and provide an ALARA goal.
- The License/Program/Site RSO shall:
  - Conduct and document a post-job review/critique if the program ALARA goal of 0.5 rem or 40 DAC- hours in a year is exceeded.
  - Notify the Employee if they is approaching his/her ALARA goal;
  - Complete an ALARA re-evaluation prior to allowing an Employee to exceed an ALARA goal or raising an ALARA goal;
  - Inform the Business Group RSO of any increased ALARA goals; and
  - Evaluate and respond (as appropriate) to increasing dose, airborne, or contamination trends and other indicators that could be precursors to unnecessary dose.
- An ALARA evaluation (see form *S3AM-120-FM1 ALARA Evaluation*) is required for individuals or work groups who have an ALARA goal of 500 mrem (5 mSv) or more for a given calendar year. As part of the evaluation, the Program/Site RSO is responsible to the Business Group RSO to provide names of individuals who have ALARA goals greater than 500 mrem (5 mSv).

4.7 RPP and Radiation Work Plans

4.7.1 AECOM projects shall comply with the SH&E procedures with respect to project planning, hazard identification, and communication.

4.7.2 The project SH&E documents should identify radiation hazards and mitigate the risk through the use of proper engineering and administrative controls to minimize the spread of contamination and maintain low exposure levels.

4.7.3 Manager (Operations)/Project Managers will confirm that a General RPP or Site RPP is completed by or approved by the Corporate RSO prior to initiating operations if required as described below.

4.7.4 General RPP – This Radiation Safety Program will function as a general RPP.

4.7.5 Site RPP shall be prepared on a project-by-project basis for field operations where:

- AECOM Employees may enter any radiation area;
- AECOM Employees may enter a radiologically controlled area without an escort operating under a separate RPP;
- AECOM Employees may enter areas where radionuclide airborne concentrations exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the ALI or 12 DAC-hours, and respiratory protection is not in use.

4.7.6 The Site RPP must be a stand-alone document, or may be incorporated into other project health and safety documentation (e.g., health and safety plans). (Refer to *S3AM-209-PR1 Risk Assessment & Management*.) The RPP must:

- Be prepared by the designated Site RSO or other radiation safety professional, and reviewed by the Business Group RSO or designee*;*
- Address all radiological hazards associated with the identified use of licensed radioactive material, exposure/contact with radioactive material, or exposure to ionizing radiation;
- Provide appropriate and applicable training requirements, monitoring procedures, dosimetry requirements, protective equipment requirements, operational safety procedures and limitations for each identified radiological hazard;
- Identify specific minimization procedures consistent with AECOM's ALARA requirements; and
- Address storage and transportation issues, security and operator qualification requirements, device maintenance requirements, leak testing requirements, and any other radioactive material license compliance needs when prepared for a radioactive material license.

4.7.7 Radiation Work Permit (RWP)

- An RWP is issued for short, non-routine tasks to provide inform Employees of the radiological controls and entry requirements for a specific work activity and is valid only for the duration of the activity.
- If RWPs are expected to be used during a project or to implement a specific program, the RPP must define the terms of issuance, approval, and implementation. Generally the RWP is prepared by the Site RSO and approved by the Manager. (Refer to S3AM-120-FM2, *Radiation Work Permit*.) Employees must be trained on the RWP, read it, and signed-off on it before performing a task described in the RWP

4.7.8 Hazardous Work Permit (HWP)

- An HWP is a combination document issued to inform Employees of both radiological and hazardous material exposure and entry requirements for short, non-routine tasks on to provide additional protection under a project/program RPP.

- If HWPs are expected to be used during a project or to implement a specific program, the RPP must define the terms of issuance, approval, and implementation. Generally the HWP is prepared by the Site RSO and approved by the Manager. (Refer to S3AM-120-FM3, *Hazardous Work Permit*.) Employees must be trained on the HWP, read it, and signed-off on it before performing a task described in the HWP.

4.8 Considerations for Non-Radiological Hazards. Implementation of a radiation safety control may introduce unintended consequences that may negatively impact the overall safety of the operation. For example:

4.8.1 Excessive protective clothing or equipment used to control dose or personnel contamination events may have deleterious consequences, such as heat stress and ergonomic impacts.

4.8.2 Respirators used to reduce intakes of radionuclides may impair visual acuity and communications capabilities among Employees.

4.8.3 Protective clothing and equipment used to protect Employees from chemical hazards may slow down work, leading to increased worker dose.

4.9 Radiation Protection Standards

4.9.1 The U.S. and Canadian government agencies have established limits on annual radiation exposure for occupationally exposed workers, including exposures to radon (10 CFR 20, SOR-2000/203).

4.9.2 These limits have been shown to prevent deterministic effects of radiation exposure while limiting the probability of stochastic effects.

4.9.3 Additionally AECOM has established its own set of administrative limits to confirm compliance with Federal regulations and to implement the AECOM ALARA philosophy.

4.10 Occupational Dose Limits

4.10.1 Tables 1 and 2 provide the legal U.S. and Canadian dose limits as well as AECOM's administrative dose limits.

4.10.2 Note that doses from background radiation, therapeutic and diagnostic medical and dental exposures, and those resulting from participation as a subject in medical research programs are not included in dose records or when assessing compliance with the occupational dose limits.

4.11 Occupationally Exposed Minors

4.11.1 AECOM policy is no worker under 18 years of age will be allowed to work on site where there is the potential for exposure to radiation. This requirement is consistent with EM-385-1-1, Section 6E, which does not allow the occupational radiation exposure of minors.

Table 1 – Occupational Dose Limits (English units)

	United States	Canada	AECOM
	10 CFR 20, Subpart C	**SOR-2000/203, Sect. 13**	**Administrative Limit**
Total Effective Dose Equivalent (TEDE)	5 rem/yr	5 rem/yr	500 mrem/yr
Total Organ Dose Equivalent (TODE)	50 rem/yr	NA	5 rem/yr
Shallow Dose Equivalent (SDE)	50 rem/yr	50 rem/yr	5 rem/yr
Extremity Dose Equivalent	50 rem/yr	50 rem/yr	5 rem/yr
Lens of Eye Dose Equivalent	15 rem/yr	15 rem/yr	1.5 rem/yr
Individual Member of the Public	2 mrem/hr	NA	2 mrem/hr
	100 mrem/yr	100 mrem/yr	100 mrem/yr
Occupational Dose to Minors	10% of above limit	NA	NA
Dose to Embryo/Fetus of a Declared Pregnant Worker	500 mrem	400 mrem	100 mrem/ gestation

Table 2 – Occupational Dose Limits (SI units)

	United States	Canada	AECOM
	10 CFR 20, Subpart C	**SOR-2000/203, Sect. 13**	**Administrative Limit**
TEDE4	50 mSv/yr	50 mSv/yr	5 mSv/yr
TODE	500 mSv/yr	NA	50 mSv/yr
SDE	500 mSv/yr	500 mSv/yr	50 mSv/yr
Extremity Dose Equivalent	500 mSv/yr	500 mSv/yr	50 mSv/yr
Lens of Eye Dose Equivalent	150 mSv/yr	15 rem/yr	15 rem/yr
Individual Member of the Public	0.02 mSv/hr	NA	0.02 mSv/hr
	1 mSv/yr	1 mSv/yr	1 mSv/yr
Occupational Dose to Minors	10% of above limit	NA	NA
Dose to Embryo/Fetus of a Declared Pregnant Worker	5 mSv	4 mSv	1 mSv/gestation

4.12 Embryo/Fetus of a General Employee

4.12.1 A special situation arises when a Radiation Worker or Nuclear Energy Worker becomes pregnant. Under these conditions, radiation exposure could also involve exposure to the embryo or fetus. A number of studies have indicated that the embryo or fetus is more sensitive than the adult, especially during the first trimester of pregnancy. This can be a concern since many users are unaware of their pregnancy during the first month or two of gestation. Hence, the NRC and the CNSC require that all occupationally exposed Employees be instructed in the potential health risks associated with prenatal radiation exposure.

4.12.2 As defined in 10 CFR 20.1003, a "declared pregnant woman" (refer to S3AM-120-FM4, *Declaration of Pregnancy*) means a woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception. The maximum permissible exposure to the fetus of a declared pregnant worker during the gestation period is 10 percent of the NRC's annual limits or 500 mrem. An effort should be made to avoid substantial variation of uniform monthly exposure rate. There are very few locations within AECOM where radiation levels are high enough that a fetus could potentially receive a dose that approaches these limits.

4.12.3 The National Council on Radiation Protection and Measurements (NCRP) Report No. 116 recommends a monthly equivalent dose limit of 0.05 rem (0.5 mSv) to the embryo/fetus once the pregnancy is known. In view of the NCRP recommendation, any monthly dose of less than 0.1 rem (1 mSv) is not a substantial variation above a uniform monthly dose rate and as such will not require justification (specified in NRC Regulatory Guide 8.13).; however, a monthly dose greater than 0.1 rem (1 mSv) should be justified (specified in NRC Regulatory Guide 8.13)

4.12.4 If a Radiation Worker or Nuclear Energy Worker becomes pregnant, she shall declare her pregnancy in writing. This can be done by email or by letter to the Site RSO applicable, using form S3AM-120-FM4, *Declaration of Pregnancy*, or the equivalent. It is recommended the Worker's applicable human resources representative be notified. A member of the Site RSO staff will assess her potential radiation exposure and measures to keep her exposures ALARA and make any appropriate accommodations. (See form S3AM-120-FM5, *Embryo/Fetus Initial Dose Calculations*.) Early declaration of a pregnancy is encouraged and confidentiality is maintained at all times.

4.12.5 AECOM's administrative limit of 500 mrem (5 mSv) based on CNSC regulations. If notification of a pregnancy is not made in writing, the radiation exposure limits remain at the occupational limits of 5 rem (50 mSv) per year. An individual may also "un-declare" her pregnancy in writing at any time (using form S3AM-120-FM6, *Withdrawal of Declaration of Pregnancy*, or the equivalent).

4.13 Planned Special Exposures (PSE)

4.13.1 PSE are not practiced at AECOM.

4.14 Means of Exposure Control

4.14.1 Means of controlling Employee exposures for a project or program shall be provided in the applicable RPP.

4.14.2 There are three basic ways in which Employees can control exposure to a radioactive source: limit exposure time, increase their distance from the source, and the interposition of a shielding material.

4.14.3 These concepts are thoroughly presented in AECOM radiation safety training but should also be continuously reinforced through daily or weekly radiation safety briefings. AECOM projects shall use postings, labels, project/task plans, "dry-runs," engineering controls, and PPE as appropriate to limit occupational exposures.

4.15 Postings

4.15.1 Access to radioactive materials is controlled by posting areas containing radiation fields, radioactive materials, and/or radioactive contamination.

4.15.2 AECOM's policy shall be to post areas as required below based on U.S. radiation protection regulations (10 CFR 20).

4.15.3 Projects in Canada shall also post in accordance with these requirements unless Canadian regulators or the client require that areas only display postings based on Canadian regulations (SOR-2000/203).

4.15.4 Warning signs shall be durable and legible and shall bear the radiation warning symbol (tri-foil) and the applicable caution. The three blades and the central disk of the tri-foil symbol shall be:

- Magenta or black; and
- Located on a yellow background

4.15.5 Postings shall be displayed at the boundary of and at every point of access to an area, room or enclosure and bare the applicable words below.

4.15.6 Signs and postings should be removed by health physics only and only when conditions no longer warrant that posting.

4.15.7 Where physical barriers do not exist, pole barriers shall be erected using yellow and magenta or yellow and black rope.

4.15.8 Postings shall include the following language:

- "Caution (or Danger) Contamination Area" – Any area where removable contamination levels exceed or are likely to exceed those specified in Table 3 (from 10 CFR 835, Appendix D).
- "Caution (or Danger) Radiation Area" – Any area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 5 mrem in 1 hour at 30 centimeters from the source of radiation or from any surface that the radiation penetrates (i.e., dose rates in the area exceed 5 mrem/hr or 50 µSv/hr).
- "Caution (or Danger) High Radiation Area" – Any area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 100 mrem in 1 hour at 30 centimeters from the source of radiation or from any surface that the radiation penetrates (i.e., dose rates in the exceed 100 mrem/hr or 1.0 mSv/hr).
- "Caution (or Danger) Very High Radiation Area" – Very high radiation area means an area, accessible to individuals, in which radiation levels from radiation sources external to the body could result in an individual receiving an absorbed dose in excess of 500 rads (5 grays) in 1 hour at 1 meter from a radiation source or 1 meter from any surface that the radiation penetrates (i.e., dose rates exceed 500 rads/hr or 5 Gy/hr). No AECOM personnel shall have access to a Very High Radiation Area without written approve from the Site RSO.
- "Caution (or Danger) Airborne Radioactivity Area" – Any area, accessible to individuals in which airborne radioactivity levels could result in an individual being exposed to a concentration in excess of the following concentrations. Work in an Airborne Radioactivity Area must be conducted in accordance with a Respiratory Protection Program approved by the Site RSO or designee.
    - In excess of the DAC specified in appendix B, to 10 CFR 20.1001-20.2401, 10 CFR 835 or
    - To such a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the ALI or 12 DAC-hours.

4.15.9 The following postings are required only on Canadian project sites (SOR-2000/203):

- "RAYONNEMENT-DANGER-RADIATION" – when there is a radioactive nuclear substance in a quantity greater than 100 times its exemption quantity in the area, room or enclosure or there is a reasonable probability that a person in the area, room or enclosure will be exposed to an effective dose rate greater than 2.5 mrem/hr (25 µSv/hr).

4.15.10 No Employee shall post or keep posted a sign that indicates the presence of radiation, a nuclear substance, or prescribed equipment at a place where the radiation, nuclear substance, or prescribed equipment indicated on the sign is not present.

Table 3 – Surface Contamination Values[1] in dpm/100 cm2 (60 dpm = 1 Bq)

Radionuclide	Removable[2,4]	Total (Fixed + Removable)[2,3]
U-nat, U-235, U-238, and associated decay products	[7]1,000	[7]5,000
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	20	500
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200	1,000
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above[5]	1,000	5,000
Tritium and STCs[6]	10,000	See Footnote 6

[1]The values in this appendix, with the exception noted in footnote 6 below, apply to radioactive contamination deposited on, but not incorporated into the interior or matrix of, the contaminated item. Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides apply independently.

[2]As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[3]The levels may be averaged over one square meter provided the maximum surface activity in any area of 100 $cm^2$is less than three times the value specified. For purposes of averaging, any square meter of surface shall be considered to be above the surface contamination value if: (1) From measurements of a representative number of sections it is determined that the average contamination level exceeds the applicable value; or (2) it is determined that the sum of the activity of all isolated spots or particles in any 100 cm^2area exceeds three times the applicable value.

[4]The amount of removable radioactive material per 100 $cm^2$of surface area should be determined by swiping the area with dry filter or soft absorbent paper, applying moderate pressure, and then assessing the amount of radioactive material on the swipe with an appropriate instrument of known efficiency. (Note—The use of dry material may not be appropriate for tritium.) When removable contamination on objects of surface area less than 100 $cm^2$is determined, the activity per unit area shall be based on the actual area and the entire surface shall be wiped. It is not necessary to use swiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.

[5]This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

[6]Tritium contamination may diffuse into the volume or matrix of materials. Evaluation of surface contamination shall consider the extent to which such contamination may migrate to the surface in order to confirm the surface contamination value provided in this appendix is not exceeded. Once this contamination migrates to the surface, it may be removable, not fixed; therefore, a "Total" value does not apply. In certain cases, a "Total" value of 10,000 dpm/100 cm^2may be applicable either to metals, of the types which form insoluble special tritium compounds that have been exposed to tritium; or to bulk materials to which particles of insoluble special tritium compound are fixed to a surface.

[7]These limits only apply to the alpha emitters within the respective decay series.

4.16 Labelling

4.16.1 In the U.S., the Site RSO shall confirm that each container of licensed radioactive material bears a durable, clearly labelled with:

- The radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL" or "DANGER, RADIOACTIVE MATERIAL."

- A label containing the name, quantity, contamination levels, dose rates, date of measurement and form of the radioactive substance in the container or device.

4.16.2 In Canada, the Site RSO shall confirm that no person shall possess a container or device that contains a radioactive substance unless the container or device is labelled with the following.

- The radiation warning symbol and the words “RAYONNEMENT — DANGER —RADIATION.”
- A label containing the name, quantity, contamination levels, dose rates, date of measurement and form of the radioactive substance in the container or device.

4.17 Personal Protective Equipment

4.17.1 PPE is the least effective control for minimizing the exposure to high-energy beta radiation and gamma radiation and should be used in conjunction with other PPE requirements, typically required for construction sites. Refer to *S3AM-208-PR1 Personal Protective Equipment*, including:

- Long sleeves & pants;
- Boots;
- Hard hats and safety eyewear (where required); and
- In some cases protective materials containing a shield such as lead (e.g. common during X-rays) should be used.

4.17.2 PPE can be effective in protecting against alpha radiation and low-energy beta radiation and respiratory protection should be considered for work in areas with known or potential airborne contamination. PPE requirements are included in the RPP and/or the RWP.

4.18 Visitors

4.18.1 To control exposures to site visitors, site visitors must be escorted at all times.

4.18.2 Visitor escorts must point out any hazardous area that a visitor may be entering and must confirm that all AECOM radiation safety rules and precautions are observed.

4.18.3 The arrival and departure of site visitors should be recorded in a visitors log and on the RWP if applicable.

4.18.4 Visitors shall be provided temporary dosimetry in accordance with the RPP and dosimeter results shall be recorded in a visitor log.

4.19 Surveys and Instrumentation

4.19.1 Radiation surveys are used to identify and quantify radiological hazards and to document compliance administrative and regulatory limits.

4.19.2 The Site RSO and all field Employees must work together to confirm safety in the workplace and to protect both the public and the environment from the harmful effects of radiation.

4.19.3 The Site RSO is responsible to make or cause to be made, surveys that:

- May be necessary for the licensee to comply with the requirements of the AECOM Radiation Safety Program or Site/Program RPP;
- Are reasonable under the circumstances to evaluate;
- The magnitude and extent of radiation levels;
- Concentrations or quantities of radioactive material; and
- The potential radiological hazards.

4.19.4 The Site RSO shall confirm that instruments and equipment used for quantitative radiation measurements (e.g., dose rate and effluent monitoring) are calibrated periodically for the radiation measured.

4.19.5 The Site RSO shall confirm that a licensed (Canada) or certified (U.S.) dosimetry service is used to measure and monitor the doses of AECOM personnel that may receive any dose in excess an AECOM administrative dose limit.

4.19.6 For U.S. operations, all personnel dosimeters (except for direct and indirect reading pocket ionization chambers and those dosimeters used to measure the dose to the extremities) that require processing to determine the radiation dose and that are used to comply with applicable regulations must be processed and evaluated by a certified dosimetry processor:

- Holding current personnel dosimetry accreditation from the National Voluntary Laboratory Accreditation Program (NVLAP) of the National Institute of Standards and Technology and
- Approved in this accreditation process for the type of radiation or radiations included in the NVLAP program that most closely approximates the type of radiation or radiations for which the individual wearing the dosimeter is monitored.

4.20 Types of Surveys

4.20.1 Radiation surveys may be performed to measure exposure or dose rates from sources of radiation that are in buildings, soil, or water. Surveys shall be conducted as necessary to prevent exposures from exceeding occupational dose limits and to confirm areas are posted in accordance with action levels.

4.20.2 Exposure and dose rate calculations may be substituted for actual radiation surveys if based on reliable scientific, peer-reviewed assumptions/historical data.

4.20.3 Contamination surveys may be performed to monitor the magnitude and extent of loose surface and/or fixed contamination on building floors/walls/surfaces, equipment, materials, supplies, or personnel.

4.21 Selection of Instruments

4.21.1 The selection of a proper radiation detection instrument is extremely important in implementing a proper radiation protection program and for measuring the proper types and levels of radiation required to meet project objectives.

4.21.2 Those selecting instruments must consider the minimum level of detection, the type of radiation measured, the energy level of the radiation source and the detector's ability to measure it, and durability of the instrument to perform in the prescribed field conditions.

4.21.3 Personnel using radiological instrumentation shall be trained in the proper operation, use and instrument limitations.

4.21.4 Project Managers and Site Supervisors should consult with the Site RSO, the Business Group RSO, or designee before purchasing, renting or using radiation detection instruments.

4.21.5 Personnel using radiological instrumentation shall be trained in the proper operation, use and instrument limitations.

4.22 Instrument Calibration and Maintenance

4.22.1 All instruments will be calibrated by a qualified calibration/repair facility at least annually in accordance with manufacturers' instructions. A calibration certificate will be maintained on site for each instrument and included in the project file (maintained for 3 years) and in the final report.

4.22.2 Each instrument shall be checked at the beginning and end of each shift with check sources to verify that it's responding adequately. Unless more stringent site-specific criteria have been established satisfactory performance test results will be within +/- 20% of the expected response. If the instrument fails the post-survey source check, the Site RSO will review all data collected during that time period with the instrument and will adjust it or discard it, as appropriate. The affected data shall be flagged and later studied by the Site RSO to determine if they are useable.

4.22.3 Control charts shall be maintained to monitor the performance of field instruments for the duration of the project. If survey equipment requires repair during a workday, it shall be repaired and its proper function verified before it is returned to use.

4.22.4 Project or group-specific procedures may be developed to provide more detailed procedures and forms for instrument calibration and maintenance.

4.23 External Dose Monitoring

4.23.1 Use of external dosimetry or other method of estimating worker exposure for a project or program shall be described in the applicable RPP. All contact with the radiation badge service company for a new project or program is to be made through the Site RSOs and will coordinate delivery and receipt of dosimeters and dose reports.

4.23.2 External radiation dosimeters such as TLDs or optically stimulated luminescent dosimeters appropriate for the radiations to be monitored shall be issued by the Site RSO to the individual and shall be required to be worn by:

- Adults, minors and declared pregnant women likely to receive, in one year, a dose from sources external to the body in excess of 10 percent of the administrative dose limits, or Individuals entering a HR/VHR Area; and
- Individuals responding to emergencies involving radioactive material or ionizing radiation.

4.23.3 Individuals who are likely to exceed 10 percent of the applicable extremity-absorbed dose limit must wear ring dosimeters.

4.23.4 The Site RSO shall determine the “likely to exceed 10 percent” status of an individual, the dosimeter type, the wear period, exchange period, etc. Any AECOM Employee shall immediately notify the Site RSO of changes in site conditions or radiation producing device procedures that could significantly increase or decrease radiation doses to personnel or which could otherwise affect the need for external dosimetry.

4.23.5 Radiation dosimeters shall:

- Not be issued for wear periods greater than 3 months;
- Not be deceptively exposed;
- Be issued to only one person and not shared;
- Not be stored near sources of radiation when is storage;
- Not be exposed to high heat, chemical or physical insults, or washed in a washing machine;
- Not be worn during medical or dental x-ray examinations; and
- Not be worn after medical administration of radioactive materials (thyroid ablation therapy, cardiac stress tests, diagnostic nuclear medicine tests, etc.) until approved by the Site RSO.

4.23.6 No person shall wear dosimeters issued by AECOM while working for another employer or institution without prior approval from the Site RSO. Employees shall notify the Site RSO if they are concurrently working for another (non-AECOM) employer and working with sources of ionizing radiation or radioactive material.

4.23.7 Employees shall notify the Program/Site RSO immediately upon learning of possible deceptive exposures of dosimeters. Intentional deceptive exposures of dosimeters are forbidden and may result in enforcement actions.

4.23.8 Lost or damaged dosimeters shall be reported to the Site RSO as soon as possible. Persons who have lost or damaged their dosimeters shall be required to provide documentation of doses.

4.24 Wearing Dosimeters

4.24.1 Whole body dosimeters shall be worn at the location on the whole body likely to receive the highest dose. Normally this is the mid-section of the torso unless otherwise specified. The “whole body” is defined as the area between the knees and the neck including the upper arms.

4.24.2 Whole body dosimeters shall be worn inside PPE such as coveralls and leaded aprons.

4.24.3 For fetal monitoring for declared pregnant females, whole body dosimeters should be worn on the abdomen. If a leaded apron is worn (as in radiology), the dosimeter should normally be placed on the abdomen, under the apron.

4.24.4 Extremity dosimeters shall be placed on the applicable hand or foot. Ring dosimeters shall be placed on the dominant hand facing in (palm side of the hand). Extremity dosimetry requirements are provided in the RWP.

4.24.5 If multiple dosimeters are required, the procedure for wearing these dosimeters shall be described in the RPP or RWP.

4.25 Reporting Dose

4.25.1 Employees of AECOM that are assigned dosimetry badges shall collect and return used dosimeters to the Site RSO promptly prior to receiving replacement dosimeters at the beginning of a new wear period. The Site RSO will then send the Employee dosimeters, along with the control dosimeter, to the contracted dosimetry provider. Upon receiving the results from them, the Site RSO shall notify the Employees of their reported dose and place copies of the reports in the project files. Dose records are copied and summaries provided to the employee on an annual basis or at the end of project that lasts less than one year.

4.25.2 AECOM Employees may make a written request to obtain a copy of his/her dose records at any time. These records are maintained by and are available from the Site RSO.

4.25.3 After termination of employment, the Site RSO shall provide the former employee with a dose report (termination report) in the recorded dose exceeded 10 percent of any radiation dose limit in the applicable reporting period.

4.26 Internal Dose Monitoring

4.26.1 Use of internal monitoring for a project or program shall be described in the applicable RPP. This section identifies the procedure to be followed when determining if and when Employees are to be included in an internal radiation dose monitoring program. An internal radiation dose monitoring program helps verify that the implemented radioactive material controls maintain internal employee exposures ALARA.

4.26.2 This section applies to AECOM operations and should be used as guidelines for subcontractors who perform radiological investigation, characterization, and remediation work for AECOM. The term Employee refers only to AECOM personnel and the requirements apply only to them and not to subcontractor personnel.

4.26.3 Initial Employment

- New Employees beginning work with AECOM whose job duties specifically require working with and/or exposure to loose or airborne radioactive materials routinely shall inform the Site RSO of their previous radiation exposure history, if any. NRC Form 4 or equivalent may be used.
- Applicable Employees with a previous radiation exposure history who cannot provide documentation of their previous internal exposure shall submit a urine specimen for radiological analysis and/or submit to having a whole body radiation count if requested by the Site RSO.

- Employees without previous radiological exposure experience shall be required to initially submit a urine specimen or have a whole body count accomplished prior to beginning work with radioactive materials.

4.26.4 Initiation of a Project

- Employees assigned to work in a radiologically controlled area where there is loose and/or airborne radioactive material and there is a potential for internal deposition of radionuclides, shall, at the direction of the Site RSO, submit either a 24-hour urine specimen for radiological analysis prior to being permitted in the radiologically controlled area. This requirement establishes the individual's internal radionuclide deposition baseline.
- No Employee shall be permitted in an area where there is the potential for internal deposition of radioactive material without having a baseline bioassay established.
- Bioassays shall only be required if radionuclide(s) present can be effectively monitored for using bioassay methods.

4.26.5 Routine Bioassays

- For Class D (Absorption Type F) radionuclides, a weekly, bi-monthly, or monthly specimen(s) will be collected. A change in sampling frequency may be performed if the Site RSO determines that more sampling is necessary.
- For Class W (Absorption Type M) radionuclides, monthly to quarterly specimens will be collected. A change in sampling frequency may be performed if the Site RSO determines that more sampling is necessary.
- For Class Y (Absorption Type S) radionuclides, quarterly or annual specimens will be collected. A change in sampling frequency may be performed if the Site RSO determines that more sampling is necessary.
- Any Employee who has reason to believe that he/she may have had an internal deposition of radioactive material shall note the time of the suspected intake and promptly notify the Site RSO and Project Manager as soon as possible. When an investigation by the establishment that internal deposition could have occurred, the Employee shall provide a urine specimen for radiological analysis.

4.26.6 Termination of a Project/Exit Bioassay

- At the completion of the project, upon demobilization from the radiologically controlled area, upon termination of employment, or at a time determined by the Site RSO, each Employee who participated in a routine bioassay program shall submit either a urine specimen for radiological analysis or submit to a whole body count at the direction of the Site RSO.

4.26.7 Exceptions to Exit Bioassay

- The Site RSO may request from the Business Group RSO an exception to the above requirement be made. At a minimum, the written request for exception should include measurements and/or calculations that demonstrate that no legal or administrative dose limit was exceeded. The Business Group RSO will approve or disapprove of the request for exception and provide the decision in writing to the Site RSO.

4.26.8 Emergency Response Projects

- Some projects, by their nature, require emergency response personnel to assist in mitigating and/or removing conditions that exist outside normal operating parameters. These responses usually require immediate attention.
- Applicable procedures for emergency response bioassays are found in *S3AM-120-ATT1 Bioassays Procedure*.

4.27 On-Site Management of Radioactive Materials

The on-site management of radioactive materials for a project or program shall be described in the applicable RPP. The safe and efficient management of radioactive material (RAM), low-level radioactive waste (LLRW), and limited generation of Mixed LLRW is paramount to the success of many of field projects. General controls that should be in place for the storage of RAM, LLRW and MLLW include:

- Materials and waste should be segregated and only be stored in a designated Radioactive Material Area.
- Storage of non-radioactive materials in a Radioactive Materials Area is discouraged.
- Each Radioactive Material Area should be approved by the Site RSO.
- The Site RSO or Site Supervisor should conduct walkthroughs of the Radioactive Materials Area to ensure material and waste is properly segregated and stored.
- Generally outdoor storage of RAM is discouraged. However outdoor storage of waste and contaminated equipment may be necessary. Ensure all material is properly stored and contained to prevent the release of radioactivity. Additionally ensure the area is properly secured from inadvertent access and is properly posted.
- RAM should be stored in a manner that reduces combustible loading. The use of cardboard containers for storage is discouraged.
- Flammable or combustible materials should not be stored adjacent to Radioactive Materials Areas.
- Fire protection measures, such as smoke detectors, water sprinklers and fire extinguishers, should be considered when establishing a Radioactive Materials Area.

The following sections address specific on-site controls that's should be in place to confirm that materials will be managed properly without creating unnecessary exposures or spreading contamination.

4.27.1 Material Controls

RAM should only be stored in areas that are clearly designated as Radioactive Materials Areas. Each RAM package stored in a radioactive materials area must be clearly labelled with a "Radioactive" warning label on the outside of the package (10 CFR 20.1904 [a]). Additionally, RAM should be stored such that:

- o Storage areas shall be cordoned off to prevent unauthorized access. If public access to the project site is not strictly controlled, RAM storage areas should be locked in a cage, room or building, or enclosed by a fence.
- o Storage areas having dose rates in excess of 5 mrem/hr at 1 foot from any surface are "radiation areas" and shall posted as such (10 CFR 20.1902 [a]).
- o Storage areas having dose rates in excess of 100 mrem/hr at 1 foot from any surface are "high radiation areas" and shall be posted as such and locked or guarded (10 CFR 20.1902 [b]).
- o Areas in which RAM is used or stored shall be posted as a Radioactive Materials Area (10 CFR 20.1902 [c]).
- o RAM should be stored to minimize exposure in accordance with the ALARA concept. Shielding may be necessary to reduce dose rates to acceptable levels. The Site RSO is responsible for maintaining exposures ALARA.
- o Storage areas shall, at a minimum, be surveyed quarterly for radiation and contamination unless otherwise authorized by the Corporate RSO. Unexpected changes in radiation or contamination levels should be reported to the Corporate RSO as soon as possible.

4.27.2 Contamination Control

- General contamination control methods should be described in RPPs. However, some specific practices may be implemented to help control the spread of contamination during the handling of RAM.
- Personnel should perform and document a survey on incoming used material that may come into contact with radiological contamination. This survey will include scanning measurements and removable contamination smears or large-area maslin wipes and should be conducted before the container enters a controlled area. Survey forms should include a unique container number and date of survey. Should contamination be identified, the container will not be used and the container provider must be notified immediately by the Project Manager or Site Supervisor.
- When practical, personnel should bag or wrap material coming from a Contamination, High Contamination, or Airborne Radioactivity Area if it is confirmed or suspected of having removable radioactive contamination above the site release criteria prior to placing the material in a storage or waste container. Thick or durable bags and plastic wrap should be used to reduce the possibility of punctures and tears. Material with sharp edges or projections should be taped or additionally protected to confirm package integrity. Wrapping or bagging contaminated materials will limit spreading contamination to the interior of the container. If the RAM has removable contamination levels that far exceed the release criteria (e.g., 100 times), additional packaging controls such as double-wrapping, or bagging should be used.
- Alternatively, a reusable waste container, such as an intermodal, may be lined with plastic. Often such containers may be placed at the edge of a contaminated area so that material can be placed into it directly, without prior wrapping. Measures must still be taken to protect the outside of the container and the surrounding area from contamination.
- Removable contamination surveys should be taken on the exterior of waste containers and nearby surfaces each day that waste is placed in the containers to confirm that waste loading activities are not contaminating the container or loading area.

4.27.3 Segregation of Materials

AECOM personnel should attempt to segregate RAM and LLRW by like materials to prevent the unwanted mixing of materials. The following measures should be taken at project sites:

- Solid material shall be stored and packaged separately from liquid materials.
- Liquid materials shall be stored in such a manner that a secondary containment will limit the spread of the material in the event a storage container leaks or ruptures.
- Materials contaminated only with radionuclides with short half-lives (< 120 days) should be placed in separate containers to allow for decay-in-storage.
- Radioactive syringe needles, broken glass, laboratory glassware, and other sharps shall be packaged in a thick-walled plastic bottle with a tight-fitting screw top, a sharps container, or plastic pail.
- Hazardous or potentially hazardous materials shall not be stored with or placed in a container with RAM or LLRW.
- All pathogenic (capable of spreading disease) waste must be deactivated.

4.27.4 LLRW Minimization

AECOM shall institute waste minimization practices at project sites to reduce the generation of radioactive waste and spread of contamination. The following practices should be instituted to support waste minimization:

- Restrict material entering controlled areas to those needed for performance of work. Specifically, packaging materials should remain outside of radiological areas.

- Reuse equipment when practical.
- On larger projects, reserve an assortment of tools primarily for use in controlled areas. Tools should be maintained in a designated storage or distribution area or a contaminated tool crib within the controlled area.
- Emphasize training in waste reduction philosophies and waste minimization techniques.

4.27.5 Naturally Occurring Radioactive Materials

- NORM and TENORM consist of radioactive elements found in the environment, such as uranium, thorium and potassium and any of their decay products, such as radium and radon. They are present in very low concentrations in the earth's crust and are brought to the surface through many activities such as oil and gas exploration or mining and through natural processes like leakage of radon gas to the atmosphere or through dissolving in ground water. They cause problems in many industries and transportation.
- Project Managers on sites suspected of containing NORM should contact the Business Group RSO or designee for information on NORM-related issues such as safety, instrument selection, transportation and disposal, etc. Many states and provinces deal with NORM regulations differently.
- It is recommended the Project Manager or Site Supervisor be familiar with the correct rules and regulations specific to the project site, and determine if employees using radiological instruments need to be trained as NORM Surveyors.
- MicroRoentgen or MicroRem instrumentation is the type of detector most recommended to observe low levels of NORM.

4.27.6 Gauge Sources

- Only Authorized Users trained in the use and handling of portable gauges are authorized to handle the gauges.
- The Business Group RSO is responsible for overall administration, management, coordination, effectiveness, and control of the radiation safety program for AECOM. The Site RSOs are authorized to supervise and administer the radiation safety program at the AECOM locations where gauge sources are stored. Specific requirements for the safe management of gauge sources is provided in AECOM procedure *S3AM-122-PR1 Gauge Source Radiation*.

4.27.7 Transportation

In general, AECOM does not ship radioactive waste from a project site to a disposal facility.

- Project Managers should use certified radioactive waste brokers to support shipments of radioactive waste.
- However, AECOM may be involved in the transportation of radiologically contaminated environmental samples, exempt radioactive check sources, and regulated radioactive gauge sources. Shipping procedures should be provided in by project- or program-specific documents. In the event that a project does not have appropriate procedures to ship radioactive materials, the Project Manager should contact the Site RSO or the Business Group RSO.
- DOT and the CNSC have very specific rules and regulations that govern the transportation of radioactive materials. The DOT's Hazardous Material Regulations are found in 49 CFR 172 and 49 CFR 173. AECOM Employees involved in shipping radioactive materials shall meet the training requirements provided in the appropriate regulations.

4.28 Emergency Procedures

4.28.1 Emergency procedure for a project or program shall be provided in or referenced in the applicable RPP.

4.28.2 Medical Emergencies

- A medical emergency is a situation that presents a significant threat to the health of Employees on site. Chemical exposure, heat stress, injuries, and poisonous insect bites can cause medical emergencies. Proper care must be initiated immediately. Proper care may be in the form of first aid treatment or emergency hospitalization.
- Emergency medical care always has priority over health physics/radioactive contamination concerns and will not be delayed because of such concerns. If possible, health physics personnel should accompany or follow contaminated or potentially contaminated victims to the medical care facility with survey instruments to help medical care providers address this issue.

4.29 Unexpected Levels of Radiation or Airborne Radioactivity

4.29.1 AECOM performs surveys and calculations to demonstrate that exposure rates and airborne radioactivity mandate the use of dosimetry and respiratory protection.

4.29.2 Should these surveys and calculations indicate ambient dose rates greater than 50 mR/hr or airborne radioactive could be greater than 5 percent of an applicable DAC (or if the unity rule applied to airborne radioactivity exceeds 0.05), the Business Group RSO shall be notified and they will then determine the requirements, if any, for additional health physics measure, such as self-reading dosimeters and respiratory protection.

4.30 Excessive Personnel Contamination

4.30.1 Generally, in application of the ALARA principle, no personnel contamination is tolerable.

4.30.2 Any detected personnel contamination shall be reported to the Site RSO immediately. The Site RSO will investigate the cause of and determine the extent of any personnel contamination. The Site RSO will document the incident in case dose evaluations are required later. The Site RSO will report the incident to the Site Supervisor and Project Manager at the earliest opportunity.

4.30.3 Contaminated personnel shall be decontaminated, with assistance from support personnel, prior to exiting the Controlled Area (RCA) or the general area where the contamination occurred. Contaminated personnel shall be decontaminated using materials such as soap and water, waterless hand cleaner, and paper towels or rags whenever possible. All contaminated areas on the body, including hair, should be thoroughly decontaminated. If clothing is contaminated, it should be removed in a way to minimize further contact with the substance.

4.30.4 The Business Group RSO will be consulted for additional guidance if these basic decontamination measures are not completely effective.

4.31 Suspected Inhalation or Ingestion

4.31.1 The Site Supervisor and Business Group RSO will be notified immediately of suspected inhalation or ingestion of radioactive material. The Business Group RSO shall provide appropriate instructions for a suitable response, which may include bioassay.

4.32 Internal Program Assessment

4.32.1 AECOM shall conduct internal assessments of the Radiation Safety Program at least annually to identify its strengths and weaknesses, areas of vulnerability, and noncompliance. The assessment shall include a review of the annual summary reports provided to the Business Group RSO by Site RSO's, examination of the radiological protection program content, and implementation.

5.0 Records

5.1 The Site RSO shall maintain records of ALARA evaluations for a period of 5 years.

5.2 ALARA evaluations shall also be transmitted to the Employee's Area Safety Manager and placed in the Employee's safety training file.

5.3 The Program and Site RSOs shall maintain records of periodic ALARA trending, annual ALARA summary reports, and ALARA evaluations for a period of 5 years.

5.4 General Record-Keeping Requirements

5.4.1 The following records presented in Table 4 shall be maintained by AECOM personnel. These records shall be maintained in a readily retrievable manner that will be subject to internal AECOM inspection and/or regulatory audit.

5.4.2 Surveys, instrument control records, and waste generation/transportation/disposal records generated during work performed for a client at a temporary job location shall become part of the project file and retained or transfer to the client along with other project documents. If work is being performed under an AECOM license, however, all records are also retained by the Site RSO. All records that describe or support assigning occupational dose to AECOM personnel, regardless of whose license the dose was acquired under, shall be maintained by AECOM.

Table 4 – Record Keeping Requirements

Record to Retain	Retention Period	Retained By (Copies To)
Provisions of the Radiation Protection Program for an AECOM License	Until License is Terminated by Agency	Site RSO
Audits of License's Program	3 years	Site RSO
Radiation, Contamination, and Airborne Surveys	3 years	Site RSO or Project File
Instrument Calibrations	3 years	Site RSO or Project File
Training Records	3 years	Site RSO and Project File
Surveys used to perform dose estimates when no instrument data are present	For the life of the company	Site RSO and Human Resources)
Measurements and calculations to determine intake of radionuclides	Forever	Site RSO
Results of air samples, surveys, and bioassays used to determine intake of radionuclides	Forever	Site RSO
Measurements of calculations and measurements used to evaluate the release of radioactive effluents to the environment	Forever	Site RSO
Records of internal and external dose	Forever	Site RSO
Records for Planned Special Exposures	Forever	Site RSO
Records of Individual Monitoring results	Forever	Site RSO
Records of doses to individual members of the public	Forever	Site RSO
Records of Waste Disposal	Until License is terminated by Agency	Site RSO or Project File

6.0 Attachments

6.1 S3AM-120-ATT1 Bioassays Procedure

6.2 S3AM-120-FM1 ALARA Evaluation

6.3 S3AM-120-FM2 Radiation Work Permit

6.4 S3AM-120-FM3 Hazardous Work Permit

6.5 S3AM-120-FM4 Declaration of Pregnancy Form

6.6 S3AM-120-FM5 Embryo/Fetus Initial Dose Calculation

6.7 S3AM-120-FM6 Withdrawal of Declaration of Pregnancy

Americas

Personal Protective Equipment

S3NA-208-PR1

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 Americas-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 **ANSI** – American National Standards Institute

2.2 **CSA** – Canadian Standards Association

2.3 **PPE** – Personal Protective Equipment

2.4 **SDS** – Safety Data Sheets

2.5 **THA –** Task Hazard Assessment

3.0 References

3.1 S3NA-123-PR1 Respiratory Protection

3.2 S3NA-209-PR1 Risk Assessment & Management

3.3 S3NA-301-PR1 Confined Spaces

3.4 S3NA-304-PR1 Fall Protection

3.5 S3NA-315-PR1 Working On & Near Water

3.6 S3NA-317-PR1 Hand Safety

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Managers** or **Supervisors**

- Confirm the location specific SH&E Plan documents required hazard controls.
- Confirm Task Hazard Assessments (THAs) are conducted and hazards identified are eliminated through substitution, engineering, or administrative controls first before assigning PPE for hazard mitigation.
- Confirm appropriate subject matter experts, manufacturer's specifications, and regulatory requirements are consulted as necessary to assist with proper PPE selection.
- Match the appropriate PPE to those hazards that cannot be eliminated; support employees in exercising Stop Work Authority if the task is too hazardous to be mitigated
- Provide and document employee training on use and care of PPE.
- Determine which staff requires employee-issued PPE.

- If applicable, manage medical monitoring of employees using PPE (e.g. respirators, hearing protection, radiation, etc.).
- Approve the purchase of company-issued PPE.
- Confirm that appropriate PPE is utilized by employees when required or necessary. This may periodically be documented using *S3NA-208-FM2 Personal Protective Equipment Inspection*.
- Exercise Stop Work Authority if PPE is inadequate to address hazards

4.1.2 **SH&E Managers**

- Provide guidance to Managers, Supervisors, and staff on the assessment of hazards and the selection of PPE.
- Provide training materials to Managers and Supervisors for employee training

4.1.3 **Employee**

- Review all relevant SH&E Plans, THAs and applicable SDS prior to commencing work.
- Exercise Stop Work Authority if the task is too hazardous.
- In accordance with training and instructions, utilize appropriate PPE that has been issued when required or necessary.
- Inspect PPE prior to and after use to confirm that it is functional, and maintain PPE in a clean and functional condition.
- Follow instructions and manufacturers' guidance on the care, use, and storage of PPE.
- Replace PPE when worn out, expired or damaged.
- 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

4.2.1 The location specific SH&E plan and THA shall assess the hazards and identify the necessary control measures. Refer to *S3NA-209-PR1Risk Assessment & Management.*

4.2.2 These control measures shall include direction and guidance concerning the appropriate PPE required as the last line of defense to the anticipated hazards of the specific operations and tasks. A PPE specific assessment may assist in identifying PPE requirements. *S3NA-208-FM1 Personal Protective Equipment Assessment* may be completed and included in the SH&E Plan.

4.2.3 Various tasks and operations, including but not limited to, demolition, remediation, spill response, asbestos abatement, and lead removal, may require additional direction concerning selection, use, care, and disposal of PPE from a subject matter expert (e.g. protector manufacturer, industrial hygienist, asbestos professional, etc.).

- Obtained direction shall be included in the SH&E Plan.
- Consultation with subject matters may be limited to the planning phase or they may be retained to provide technical assistance for a portion of or duration of the project.

4.3 Training

4.3.1 All employees shall be informed of their right to Stop Work if the task is too hazardous to mitigate through use of elimination, substitution, engineering controls, administrative controls, and PPE.

4.3.2 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.

4.3.3 Staff are responsible for confirming that they have reviewed the operation manual/instructions for the PPE before work commences.

4.3.4 All staff will receive a location specific orientation to the hazards on the job site as well as appropriate PPE requirements.

4.4 Determining the Need for PPE

4.4.1 Prior to beginning work, the SH&E plan shall be consulted and THAs developed to identify the PPE requirements.

4.4.2 After the hazard assessments have been completed, the manager and/or employee shall select the appropriate PPE for each job category or task, as necessary. PPE will be provided to each employee appropriate for the hazards present. All PPE selected, purchased and used by AECOM will meet or exceed the appropriate ANSI/CSA standards or other standards as determined by federal, provincial, territorial, or state legislation

4.4.3 If the hazard can be mitigated through using appropriate PPE shall:

- Properly fit the employee's body.
- Be selected and used in accordance with recognized standards and provide effective protection.
- Not in itself create a hazard to the wearer (e.g., scratched safety glasses which could cause impaired vision should be replaced with clear safety glasses).
- Be compatible so that one item of PPE does not interfere with other PPE.
- Be maintained in good working order and in a sanitary condition.
- Not be altered in any way.

4.4.4 Prior to entering any controlled or restricted work area, employees shall review the SH&E plan and corresponding THA(s) to confirm that they are equipped with the applicable ANSI/CSA-approved PPE, appropriate to the specific work area's hazards.

4.5 Eye and Face Protection

4.5.1 AECOM employees shall use appropriate eye and face protection when eye or face hazards are present or potential from flying particles, molten metal, liquid chemicals, acid and caustic liquids, chemical gases or vapors, or injurious light radiation.

4.5.2 Safety glasses with side protection is the minimum eye protection requirement. Additional eye protection shall be suitable to the anticipated hazards (e.g. goggles, safety glasses with a face-shield, welder's helmet, etc.). Refer to *SN3NA-208-ATT1 Eye & Face Protection*.

4.6 Head Protection

4.6.1 Appropriate protective hardhats are required when employees are working in areas where there is any potential for injury to the head.

4.6.2 Head protection shall be suitable to the anticipated hazards (e.g. working near exposed electrical conductors requires hardhats designed to reduce electrical shock). Refer to *S3NA-208-ATT2 Head Protection.*

4.7 Foot Protection

4.7.1 AECOM employees shall use appropriate foot protection when hazards to feet are present or potential; including impact, puncture, cut, electrical, thermal or chemical hazards.

4.7.2 Refer to *S3NA-208-ATT3 Foot Protection.*

4.8 Hand Protection

4.8.1 Appropriate hand protection is required when employee's hands are exposed to hazards such as those from skin absorption of harmful substances, cuts and lacerations, abrasions, punctures, chemical burns, thermal burns, electricity, or harmful temperature extremes.

4.8.2 Refer to *S3NA-208-ATT4 Hand Protection* and *S3NA-317-PR1 Hand Safety*.

4.9 Chemically Resistant Clothing

4.9.1 Chemically resistant clothing is required when there is significant potential for the employee to come in direct contact with the chemicals being handled. Tasks that involve chemical handling will be evaluated for potential splashing or spilling. Refer to *S3NA-208-ATT5 Limb & Body Protection*.

4.9.2 The process for selecting chemical resistant clothing will be similar for the selection of chemical resistant gloves (refer to *S3NA-208-ATT4-Hand Protection* and *S3NA-317-PR1 Hand Safety*).

4.10 High-Visibility Apparel

4.10.1 “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 ANSI/CSA standards. Refer to *S3NA-208-ATT6 High Visibility Safety Apparel.*

4.10.2 Color of apparel (orange or lime) may be client/project-specific. 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).

4.10.3 Work conducted at night may require that the minimum level of apparel worn be, at minimum, ANSI/CSA Class III, and in accordance with the governing legislation.

4.11 Personal Clothing

4.11.1 Employees on a project site shall wear full length trousers and shirts that cover shoulders.

4.11.2 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; or
- Torn or ragged clothing.
- Jewelry (e.g. rings, bracelets, neck chains) when working with moving parts or there is a risk or entanglement.

4.11.3 Long hair shall be tied back or otherwise confined when working with moving parts or there is a risk of entanglement.

4.11.4 Clothing made of synthetic fibers can be readily ignited and melted by electric flash or extreme heat sources. Cotton or wool fabrics are recommended for general use.

4.11.5 Footwear shall be suitable for the site conditions and task requirements. No athletic shoes, sandals, flip flops, permitted on active job sites.

4.11.6 It is recommended to use clothing with sun protection properties when working in high sun uv exposure

4.12 Specialized PPE

4.12.1 In addition to basic PPE, additional specialized PPE may be required to provide appropriate protection to the employee. Refer to applicable legislation and related SH&E procedures for additional information on PPE requirements.

- Fall Protection – Only full-body harnesses with shock-absorbing lanyards will be used for personal fall arrest. Refer to *S3NA-304-PR1 Fall Protection*.
- Respiratory Protection – Respiratory protection shall be selected based on the contaminant and concentration to which the employee will be exposed. Refer to *S3NA-123 PR1 Respiratory Protection*, the task- or project-specific hazard assessments and the applicable SDSs for specific requirements.
- Fire Resistant Clothing (FRC) – Approved fire-resistant outer clothing may be required at work locations with flammable or explosive materials or environments. Refer to *S3NA-208-ATT5 Limb & Body Protection.*
- Other Head Protection – Operators and passengers (if trained and permitted) of all-terrain vehicles and snowmobiles will wear approved helmets. Refer to *S3NA-208-ATT2 Head Protection.*
- Protection from Drowning – Appropriate personal floatation devices shall be worn when work working over and near water. Refer to *S3NA-315 Working On & Near Water*.
- Temperature Extremes – Work in cold environments may require additional layers and insulated clothing, gloves, boots and accessories such as balaclavas, hardhat liners. Confirm these items are approved and do not introduce additional unacceptable hazards (e.g. insufficient visibility, conductivity, etc.).
- Hearing Protection – Noise levels in the work environment that cannot be eliminated or reduced to acceptable levels requires worker be protected from exposure. Refer to *S3NA-118-PR1 Hearing Conservation.*
- Traction Devices – Traction devices applied to the base of work boots may be necessary if the employee may be walking on icy surfaces. Refer to *S3NA-208-ATT3 Foot Protection*.
- Rescue – Confined spaces hazards may necessitate the use of specific harnesses attached to retrieval lines to facilitate rescue. Refer to *S3NA-301-PR1 Confined Spaces*.

4.13 Maintaining PPE Supplies

4.13.1 Employees shall inspect their required PPE prior to use. Defective equipment shall be removed from service and replaced.

4.13.2 Each AECOM location will maintain a supply of safety equipment of appropriate types and sizes, including hard hats, high visibility vests, safety glasses, gloves, hearing protection and chemically resistant clothing based on the nature of their field activities. The Manager or designee will be responsible for maintaining this inventory.

4.13.3 Use of PPE by employees and adequacy of protection should be evaluated on a routine basis. This may periodically be documented using *S3NA-208-FM2 Personal Protective Equipment Inspection.*

4.13.4 At a minimum, locations will review their PPE program annually.

4.14 Obtaining Personalized Safety Gear

4.14.1 Employees are not expected to provide their own general PPE. Most basic PPE will be provided to the employee at no charge (e.g. safety glasses, hard hat, gloves, hearing protection, etc.) with the exception of the below personalized safety equipment (prescription safety glasses, safety-toed boots, any washable coveralls).

4.14.2 Certain personalized safety gear such as prescription safety glasses, safety-toed (capped) boots, and any washable coveralls will be ordered and sized specifically by the user. A partial cost reimbursement to the employee may be made if their location provides a specialized PPE purchase program.

4.14.3 All specialized PPE (e.g. fall protection equipment, respirators, helmets, etc.) will be provided by AECOM for employee use at no charge to the employee, with the exception of the above personalized safety equipment (prescription safety glasses, safety-toed boots, any washable coveralls).

5.0 Records

5.1 Completed SH&E plans, THAs documenting PPE requirements, and as applicable, PPE assessments and PPE inspections, will be maintained in the location's safety files.

6.0 Attachments

6.1	S3NA-208-ATT1	Eye & Face Protection
6.2	S3NA-208-ATT2	Head Protection
6.3	S3NA-208-ATT3	Foot Protection
6.4	S3NA-208-ATT4	Hand Protection
6.5	S3NA-208-ATT5	Limb & Body Protection
6.6	S3NA-208-ATT6	High Visibility Safety Apparel
6.7	S3NA-208-FM1	Personal Protective Equipment Assessment
6.8	S3NA-208-FM2	Personal Protective Equipment Inspection

Americas

Hand & Power Tools

S3AM-305-PR1

1.0 Purpose and Scope

1.1 This procedure provides the AECOM requirements for all manually operated hand and power tools and associated use, handling and storage. These requirements apply to tools provided by AECOM for employee use as well as tools provided by employees for use on AECOM work sites.

1.2 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

2.1 None

3.0 References

3.1 S3AM-003-PR1 SH&E Training

3.2 S3AM-118-PR1 Hearing Conservation

3.3 S3AM-208-PR1 Personal Protective Equipment

3.4 S3AM-302-PR1 Electrical Safety

3.5 S3AM-325-PR1 Lockout Tagout

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Managers/Supervisors**

- 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 the work instructions related to this procedure, appropriate guidelines shall be established prior to work associated with that tool, including following manufacturer's recommendations.
- Ensure compliance with applicable client requirements and restrictions regarding hand or power tools.

4.1.2 **Safety, Health and Environment (SH&E) Manager**

- Provide technical guidance and support as to this procedure and associated work instructions.

4.1.3 **Employees**

- Work only with tools for which they are appropriately trained and familiar with.
- Follow manufacturer's recommendations for its use and never modify the equipment without first obtaining authorization from the manufacturer.
- Comply with applicable client requirements and restrictions regarding hand or power tools.

4.2 Requirements

4.2.1 Always conduct a task hazard assessment (THA) prior to work commencing and include the identified hazards associated with the anticipated tool use.

4.2.2 No employee shall use any hand or power tool, unless they are familiar with the use and operation of the equipment or have received specific instruction on its use and operation.

4.2.3 All tools will be used for which they were designed and in accordance with manufacturer's specifications. Do not use tools for jobs they are not intended for. For example, do not use a slot screw driver as a chisel, pry bar, wedge or punch or wrenches as hammers.

4.2.4 Use approved tools only. Never modify or use makeshift tools.

4.2.5 Do not apply excessive force or pressure on tools unless permitted by the manufacturer's specifications. This includes additional force by hammering with body weight, foot or other tools.

4.2.6 Keep surfaces and handles clean and free of excess oil and grease to prevent slipping.

4.2.7 Do not carry sharp tools (e.g. knife, chisel, screwdriver, etc.) in pockets; this practice may cause puncture wounds.

4.2.8 All tools shall be properly maintained. Clean, dry, lubricate and repair tools as applicable, and return to a suitable toolbox, room, rack, or other storage area upon completion of a job.

4.2.9 Ensure proper ergonomics principles are observed when using hand and power tools, such as but not limited to:

- Avoid static and awkward positions when possible.
    - Move at intervals to reduce muscle fatigue.
    - Consider tools with a trigger strip, rather than a trigger button. This strip will allow the exertion of more force over a greater area of the hand that, in turn, will reduce muscle fatigue
- Do not apply excessive force or pressure on tools.
- If possible use tools with comfortable grips that are designed to allow the wrist to stay straight. Avoid using a bent wrist.
- Choose hand tools that have a centre of gravity within or close to the handle.
- Frequently used tools that weigh more than 1 pound (0.45 kilograms) should be counter-balanced.
- Ensure proper body positioning when using a tool to prevent slips or falls in the event of unanticipated tool behaviour (slip, kickback, etc.). Avoid over-reaching.
- Pull on tools such as a wrench or pliers whenever possible. Loss of balance is more likely when pushing if the tool slips. If pushing is necessary, hold the tool with an open palm.
- Hand-arm vibration exposure is associated with the use of hand tools.
    - Reduce power to the lowest setting that can complete the job safely. This action reduces tool vibration at the source.
    - Consider the need for controls such as limiting time of use.
    - If safe to do so, adjust to a looser but stable grip, and use anti-vibration gloves.
- Use of heavy tools such as jackhammers can cause fatigue and strains. Heavy rubber grips can reduce these effects by providing a secure handhold.
- Do not increase a tool's leverage by adding sleeved additions (e.g. a pipe or snipe) to increase tool handle length.

4.2.10 Avoid placing fingers and hands in danger zones:

- Ensure hands and fingers have sufficient clearance in the event the tool slips.
- Ensure stability of the work-piece. Use work-piece holders (e.g. vise, chisel holder, etc.) whenever possible to prevent injury to hands or deflection of tool or work-piece.
- Use push sticks or guides when cutting or machining smaller material.

4.2.11 Secure tools when working from heights to prevent them from falling. Never leave tools on ladders, scaffolds, or overhead work areas when they are not in use.

4.2.12 Utilize good housekeeping practices to ensure tools do not present a tripping hazard.

4.2.13 Ensure no part of a tool extends over the edge of the bench top. Place sharp tools (e.g., saws, chisels, knives) on benches so that sharp points or edges face away from the edge.

4.2.14 When using saw blades, knives, or other tools, if possible direct the tools away from aisle areas and away from other employees working in close proximity.

4.2.15 Do not throw tools from place to place or from person to person, or drop tools from heights. Hand them, handle first, directly to other workers.

4.2.16 Use non-sparking and intrinsically safe tools in atmospheres with flammable or explosive characteristics and where highly volatile liquids, and other explosive substances are stored or used.

- 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 shall be used.
- Electrical tools shall be identified as intrinsically safe.

4.2.17 If the task presents electrical hazards, worker must be competent and use the appropriate insulated tools to perform work that includes the risk of electrical shock. Cushioned grip handles do not protect against electrical shock.

4.2.18 The fluid used in hydraulic power tools must be an approved fire-resistant 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.

4.2.19 All tools designed to accommodate guards must have the guard(s) in place when the tool is in use. Do not modify, remove, or disable any machine guards.

4.2.20 Do not allow loose clothing, long hair, loose jewelry, rings, and chains to be worn while working with power tools.

4.2.21 Make provisions to prevent tools from automatically restarting upon restoration of power. Refer to *S3AM-325-PR Lockout Tagout*.

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.

- Assess the employee's training needs as per *S3AM-003-PR1 SH&E Training* procedure.
- Refer to the applicable work instructions associated with this procedure for any additional training specifics.
- Training shall include applicable manufacturer's recommendations and guidelines.

4.3.2 Employees shall demonstrate knowledge and competency in the use, safe handling and maintenance of the applicable tool prior to operation.

4.4 Personal Protective Equipment (PPE)

4.4.1 Utilize basic PPE appropriate to the task; gloves, safety-toed boots, hard hats and safety glasses with side shields. Refer to *S3AM-208-PR1 Personal Protective Equipment*.

4.4.2 Ensure lockout devices (padlocks, multiple lock hasps, tags) are utilized as necessary. Refer to *S3AM-325-PR Lockout Tagout*.

4.4.3 Ensure PPE is appropriate to the work and use additional PPE as required (e.g. mono-goggles, hearing protection, respiratory protection, etc.).

- Dual eye protection is required to be worn by any employee undertaking or within 3 ½ feet (1 meter) of a task that produces projected particles or material.
- Head and face protection is recommended for employees working with pneumatic tools.
- Noise hazard is associated with pneumatic and many other tools. Working with noisy tools such as jackhammers requires proper, effective use of appropriate hearing protection.

4.4.4 Screens shall also be set up to protect nearby workers from being struck by flying fragments around chippers, riveting guns, staplers, or air drills.

4.4.5 Refer to the applicable work instructions associated with this procedure for any additional specialized PPE.

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 ‘out of service’ or ‘do not use’ and immediately removed from service.
- Tagged tools will be returned to the supervisor for repair or replacement.

4.5.2 All tools must be inspected to manufacture’s specifications and according to tool rests and guard adjustment tolerances. All tools will be inspected to ascertain that all safety devices are present and functioning properly. Refer to *S3AM-305-FM1 Hand & Power Tool Maintenance Inventory* and *S3AM-305-FM2 Hand & Power Tool Inspection Report*.

5.0 Records

5.1 None

6.0 Attachments

6.1 S3AM-305-ATT1 Chainsaw

6.2 S3AM-305-ATT2 Circular Saw

6.3 S3AM-305-ATT3 Cut Off Saw

6.4 S3AM-305-ATT4 Handheld Grinder

6.5 S3AM-305-ATT5 Impact Wrench

6.6 S3AM-305-ATT6 Nail Gun

6.7 S3AM-305-ATT7 Dustless Vacuum

6.8 S3AM-305-ATT8 Power Drill

6.9 S3AM-305-ATT9 Pressure Washer

6.10 S3AM-305-ATT10 Reciprocating Saw

6.11 S3AM-305-ATT11 Sander

6.12 S3AM-305-ATT12 Knives

6.13 S3AM-305-ATT13 Clearing & Grubbing Equipment

6.14 S3AM-305-ATT14 Pneumatic Tools

6.15 S3AM-305-ATT15 Manual Hand Tools

6.16 S3AM-305-ATT16 Small Engines

6.17 S3AM-305-ATT17 Electric & Battery Hand Tools

6.18 S3AM-305-FM1 Hand & Power Tool Maintenance Inventory

6.19 S3AM-305-FM2 Hand & Power Tool Inspection Report

Wildlife, Plants & 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 Americas-based employees and operations.

2.0 Terms and Definitions

2.1 **Field Work –** 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, 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 Comprehensive Environmental Response, Compensation, and Liability Act 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 References

3.1 RS2-001-PR1 Firearms Standard

3.2 S3AM-004-PR1 Incident Reporting, Notifications & Investigation

3.3 S3AM-008-PR1 Fitness for Duty

3.4 S3AM-113-PR1 Heat Stress

3.5 S3AM-208-PR1 Personal Protective Equipment

3.6 S3AM-209-PR1 Risk Assessment & Management

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Managers / Supervisors**

- Responsible for managing field work.
- Work with employees 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.

- Implement control measures at the location to reduce the potential for employees to be exposed to injuries and illnesses from biological hazards while working.
- If the exposures cannot be eliminated or managed with engineering controls, approve the use and cost of Personal Protective Equipment (PPE) and protective repellents and lotions and confirm that exposed employees have and use these products.

4.1.2 **SH&E Manager**

- Confirm training and guidance is provided to employees consistent with this procedure.
- During the performance of site visits, assess the precautions being taken against biological hazards for compliance with this procedure.
- Assist AECOM personnel in identifying hazards and selecting appropriate control measures.
- As applicable, review and approve relevant SH&E Plans for locations that have biological hazards.

4.1.3 **Employees**

- Participate in required training related this procedure.
- Participate in the development of THAs for the task, identify control measures to limit exposure and request PPE, repellents, and protective lotions identified by this procedure.
- Update the applicable THA when a new, unaccounted for biological hazard is identified. Employee shall stop work to identify appropriate elimination or control measures (and obtain any necessary guidance) before continuing work.
- Obtain approval from 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 (e.g. tick bites, skin irritations, etc.) as detailed within the procedure and attachments.

4.2 Training

4.2.1 Employees shall be trained to recognize organisms that represent a threat in the regions in which they work – experienced field staff shall provide on the job training to assist staff with hazard recognition.

4.2.2 Employees shall be properly trained to the anticipated tasks and the associated required PPE.

4.3 Overview

4.3.1 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. As part of the SH&E Plan and THA developed by the AECOM personnel, in accordance with *S3AM-209-PR1 Risk Assessment & Management*, additional consideration shall be given to other biological hazards.

4.3.2 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.

4.3.3 If additional biological hazards are identified, employees should stop work and contact the SH&E Manager to discuss the hazards and identify effective control measures. Those control measures shall be implemented at the location prior to restarting work.

4.4 Employee Sensitivity

4.4.1 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. Employees 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.

4.4.2 Employees also need to consider whether they are sensitive to the use of insect repellents.

4.5 Planning and Hazard Assessment

4.5.1 AECOM personnel shall confirm that the potential for exposure to specific biological hazards are assessed prior to the commencement of work and that the procedures specified by this procedure are integrated into the THA planning process and conveyed to employees conducting the field work. This information shall be communicated in the location-specific SH&E plan, the THA, pre-project kickoff meetings, and tailgate meetings at the location.

4.5.2 It is important to note that the precautions to be taken by 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 task-specific THA in accordance with *S3AM-511-PR1 Heat Stress.*

4.5.3 During the preparation of the location-specific SH&E plan and task specific THA, Managers, Supervisors, and employees shall determine what biological hazards might be encountered during the task or operations and shall 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.

4.5.4 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 degrees Fahrenheit (4.5 degrees Celsius) 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.

4.5.5 The hazard assessments shall 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.

4.5.6 Employees in the field where biological hazards exist shall 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 field staff shall stop work and not proceed until the THA has been amended and approved and protective measures implemented.

4.5.7 Employees who have severe allergic reactions are strongly recommended to notify their Manager, field Supervisor and co-workers of the potential for a reaction and demonstrate what medication they might need, where they keep it and how it is administered.

4.5.8 A decision flow chart and table for determining the potential for biological hazards in the Americas has been provided in *S3AM-313-ATT1 Biological Hazard Assessment Flow Chart.*

4.5.9 Restrictions:

- No firearms or weapons are allowed to be used without express permission by the Region Executive and Chief Resilience Officer, refer to the *RS2-001-PR1 Firearms Standard*.
- No weapons related work shall occur without an assessment that includes appropriate hazard control measures and training.
- 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. Refer to *S3AM-008-PR1 Fitness for Duty*.

4.5.10 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).
- Avoid wearing perfume and cologne and strong smelling deodorants, lotions, soaps, and shampoos.
- 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. Avoid reaching into areas where visibility is limited.

4.6 Wildlife Hazards (Wild Animals, Reptiles and Birds)

4.6.1 Employees shall not work alone in areas where the risk of an encounter with dangerous wildlife is high. Wildlife handling shall only be completed under direct supervision of an experienced individual. Refer to the following work instructions for more specifics:

- *S3AM-313-ATT13 Alligators*
- *S3AM-313-ATT9 Large Carnivores & Ungulates*
- *S3AM-313-ATT10 Bear Safety*
- *S3AM-313-ATT11 Small Mammals*
- *S3AM-313-ATT12 Snakes & Scorpions*

4.7 Ticks, Spiders and other Insects

4.7.1 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.

4.7.2 Employees with known allergies to insect stings should consult their personal physician for advice on any immediate medications that they should carry with them. Epi-pens[1] shall be carried at all times in the field by employees who are aware that anaphylactic shock is a possibility for 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.

4.7.3 Habitat Avoidance, Elimination and/or Control

- The most effective method to manage worker safety and health is to eliminate, avoid and/or control hazards. Clearing the location 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 and spiders during the clearing process.
- Projects such as subsurface environmental assessment or remediation are often candidates for brush and overgrown grass to be cleared. In these instances, the 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.
    - o It should be noted that vegetation clearance may unintentionally serve to spread noxious and poisonous plant materials around the site.
    - o As applicable, measures should be taken to prevent spread, such as but not limited to, confirming equipment and materials are not placed on affected areas, and equipment is decontaminated after use and before removal from site.

[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.*

- When work shall be conducted in areas that cannot or may not be cleared of foliage, personal precautions and protective measures shall be prescribed.
- Mosquitoes breed in stagnant water and typically only travel a quarter mile (less than half a kilometer) from their breeding site. Whenever possible, stagnant water should be drained to eliminate breeding areas. 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.

4.7.4 Ticks

- Ticks can be encountered when walking in tall grass or shrubs. They crawl up clothing searching for exposed skin where they will attach themselves. The most serious concern is a possibility of contracting a disease.
- 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. The use of permethrin is strongly advised.
- 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 *S3AM-313-ATT2 Ticks* along with a listing of CDC information resources and maps showing the distribution of common tick-borne diseases in the U.S.
- 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.
- To remove ticks that are embedded in skin, utilize a tick key. Alternatively 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. Follow AECOM incident reporting guidelines to report the tick bite within 4 hours and notify the Manager or Supervisor.
- Familiarize yourself with the characteristic bulls-eye pattern of Lyme disease infection surrounding the bite. If you notice this type of pattern or rash resulting from a tick bite, immediately report the issue to your supervisor and follow the incident reporting requirements for your business group.
- 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.

4.7.5 Chiggers

- Chiggers are mite larvae, approximately ½ millimeter 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.
- 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.

4.7.6 Spiders

- 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.
- Most spider bites produce wounds with localized inflammation and swelling. The Black Widow and Brown Recluse spiders in the U.S. and others outside the U.S. inject a toxin that causes extensive tissue damage and intense pain.
- Additional information on spider identification can be found in attachment *S3AM-313-ATT3 Poisonous Spider Identification*.

4.7.7 Mosquitoes

- 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.
- CDC data indicates that mosquito-borne illnesses, including the strains of encephalitis, are a health risk. 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
    - Western Equine encephalitis
    - West Nile Virus
    - St. Louis encephalitis
    - La Crosse encephalitis
- 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.
- 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. Other diseases including Dengue Fever and Malaria are spread by mosquitoes in the sub-tropic and tropical parts of the world. See *S3AM-313-ATT4 Mosquito Borne Diseases* for information on the locations where mosquito borne diseases are known to be present.

4.7.8 Bees, Wasps and Hornets

- 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.
- Bees, hornets, and wasps may be found in derelict buildings, sheltered areas, behind covers or lids and even on open ground. Other protective measures are not normally effective against aggressive, flying insects. Be aware of the potential areas for these types of insects, approach these locations cautiously. Avoid reaching into areas where visibility is limited.
- If you see a nest in the area you are working in stop work. Contact the Manager or Site Supervisor for procedures to have the nest removed.
- If stung by a wasp, 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. Follow AECOM incident reporting guidelines to report the sting within 4 hours and notify the Manager or Supervisor immediately. 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.

4.7.9 Fire Ants

- The fire ant (southern and western U.S.) and the European fire ant (northeastern U.S. 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.

4.7.10 Personal Protective Equipment (PPE)

- Chemically-treated field clothing, full-length clothing, or Tyvek® coveralls.
- Gloves shall also be worn consistent with the recommendations of the site-specific SWP and/or THA to minimize hand exposure.
- Where ticks, chiggers, and spiders are presumed to exist, the Tyvek® or chemically treated clothing will be taped to the work boots.
- See *S3AM-313-ATT2 Ticks* for configuration of clothing for protection against ticks and insects.
- Application of insect repellent to clothing and/or exposed skin. Oil of lemon eucalyptus, DEET, and Permethrin have been recommended by the CDC 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 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. If permethrin is unavailable employees can apply DEET to their skin and let dry prior to putting FRC on.
    - Oil of 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.
    - Permethrin is an insecticide with repellent properties registered with the Environmental Protection Agency and recommended by the CDC.
        - 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) manual treatment of their personal clothing using Permethrin spray in accordance with recommendations manufacturers recommendations. 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. 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 *S3AM-208-PR1 Personal Protective Equipment* and with the approval of your Supervisor or Manager.
        - 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 five 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 shall be applied directly to the skin. Supervisor or Manager approval is required prior to purchase.

- If the employee opts not to utilize chemically pre-treated clothing while potentially exposed to insects, spiders and/or ticks, they shall either: 1) wear Tyvek® coveralls taped to the boots, or 2) wear full-length clothing consisting of long-legged pants and long-sleeved shirts treated with an insect repellent containing Permethrin, DEET, or an oil of lemon eucalyptus to their work clothing.
- Safety Data Sheets (SDS) 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 SDS should be obtained for the products used and placed into the office SDS library and site-specific safety plan.

4.8 Poisonous Plants

4.8.1 Habitat Avoidance, Elimination and/or Control

- 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 Manager (and Client as appropriate) for 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 shall need to occur with the Manager (and Client as appropriate) to determine whether it is acceptable to apply herbicides at the work site. Application of herbicides may require a license.
- 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 SH&E Manager. The clearing procedure should be included in the SH&E Plan and THA and the required PPE specified.

4.8.2 Poisonous plants that employees 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. Refer to *S3AM-313-ATT5 Plants of Concern* for information on locations where some of these poisonous plants are found in the U.S.

- Of the toxic plants in the cashew family, poison ivy (*Rhus radicans*) is most widespread. It grows in a variety of forms such as a low sprawling shrub, dense ground cover, or a thick woody vine that grows high into the tree canopy. Poison oak (*Rhus diversiloba*) is typically a low shrub in drier soils. Both of these plants have leaves of three and white berries. Poison sumac (*Rhus vernix*) is a tall shrub that is less prolific in distribution. It grows in wet areas, has a compound leaf with a red leaf stem (rachis), and white berries. All of these plants possess urushiol oils in all parts of the plant. Touching the plant causes an itchy skin rash that can show up within 4-72 hours following contact. People have a wide range of reactions including swelling, itching, rash and bumps, patches or blisters.
- Uroshiol oil can also transfer onto clothing and equipment. The oil can remain active on surfaces for up to 5 years and can be transferred to your skin.
- 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 *S3AM-313-ATT6 Wild Parsnip Identification* for additional information and photos of wild parsnip.

[2] Phytodermatisi producer: keep skin covered and wash well after exposure

- 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 plant that is spreading in southern Ontario and is also present in southwestern British Columbia. The plant is enormous, attaining up to 16 feet (5 meters) 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.
- 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.
- Some plants contain abundant stiff spines that can present a safety hazard, particularly if one is to fall into them. These include the cactus (*Opuntia spp.*), devils club (*Oplopanax horridum*), and prickly-ash (*Zanthoxylon americanum*).

4.8.3 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 to not eat any berries or plants if you are unsure of their identity.

- Remember that in the fall and winter the hazard still exists in the form of stubble and roots.

4.8.4 Personal Protective Equipment (PPE)

- Employees conducting clearing, grubbing, or similarly disturbing work activities in areas where poisonous plants exist shall wear long-sleeve clothing or Tyvek® coveralls, and disposable cotton, leather or synthetic gloves. Employees shall not touch exposed skin (neck and face) with potentially contaminated gloves. Tyvek® and gloves worn to protect from exposure to poisonous plants shall 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.
- If foliage is being cleared and includes poisonous plants, exposed skin shall 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.

4.9 Bird Droppings and Biological Soil Hazards

4.9.1 Work in any area where pigeons or other flying animals (e.g. bats) may nest requires a written statement from the client which states the potential for, and extent of, accumulation of excrement on/in the structure from pigeons or other winged animals.

4.9.2 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 *S3AM-313-ATT8 Bird Droppings*.

4.9.3 Tularemia is a problem with contaminated soil in some locations. Tularemia is a disease of animals and humans caused by the bacterium *Francisella tularensis*. Rabbits, hares, and rodents are especially susceptible and often die in large numbers during outbreaks. Workers can contract Tularemia through tick and deer fly bites, but also through inhalation of contaminated aerosols or

agricultural dusts. Check work areas for carcasses before disturbing the ground (e.g. mowing, brushing, grubbing, excavation, etc.).

4.10 Personal Hygiene and Body Checks

4.10.1 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.

4.10.2 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.

4.10.3 Employees shall 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 *S3AM-313-ATT2 Ticks*.

4.11 Employees shall immediately notify their Manager or Supervisor of the presence of an imbedded tick, bee, wasp or hornet sting, other insect bite, rash, or any abnormal reaction. Reporting shall occur within 4 hours for a significant incident and 24 hours for all other SH&E incidents, and in accordance with *S3AM-004-PR Incident Reporting, Notifications & Investigation.*

4.12 The Manager or Supervisor shall forward the report to the SH&E Manager for follow up.

5.0 Records

None

6.0 Attachments

6.1 S3AM-313-ATT1 Biological Hazard Assessment Flow Chart

6.2 S3AM-313-ATT2 Ticks

6.3 S3AM-313-ATT3 Poisonous Spider Identification

6.4 S3AM-313-ATT4 Mosquito Borne Diseases

6.5 S3AM-313-ATT5 Plants of Concern

6.6 S3AM-313-ATT6 Wild Parsnip Identification

6.7 S3AM-313-ATT7 Alligators

6.8 S3AM-313-ATT8 Bird Droppings

6.9 S3AM-313-ATT9 Large Carnivores & Ungulates

6.10 S3AM-313-ATT10 Bear Safety

6.11 S3AM-313-ATT11 Small Mammals

6.12 S3AM-313-ATT12 Snakes & Scorpions

1.0 Purpose and Scope

1.1 This procedure applies to all AECOM Americas based employees and operations where the potential for hand injuries is present.

1.2 This procedure is intended to protect employees from activities that may expose them to hand injury. This procedure provides information on recognizing those conditions that require personal protective equipment (PPE) or specific work practices to reduce the risk of hand injury.

1.3 All personnel shall have gloves in their immediate possession 100% of the time when in a shop or on a work site. Appropriate gloves shall be worn when employees work with or near any materials or equipment that present the potential for hand injury due to sharp edges, corrosives, flammable and irritating materials, extreme temperatures, splinters, etc.

2.0 Terms and Definitions

2.1 None

3.0 References

3.1 S3NA-003-PR1 SH&E Training

3.2 S3NA-208-PR1 – Personal Protective Equipment

3.3 S3NA-209-PR1 – Risk Assessment & Management

3.4 S3NA-325-PR1 – Lockout Tagout

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Manager / Supervisor**

- Implementation of this standard for the applicable facility, site, or project location.
- Confirm employees are familiar with this procedure and have appropriate training.
- Confirm the appropriate hand protection is available on site as necessary.

4.1.2 **Employees**

- Recognize hazards to hands.
- Comply with this procedure as well as client or work location requirements.

4.1.3 **SH&E Manager**

- Advise supervisors and site personnel on matters relating to hand safety.
- Work with the manager / supervisor to confirm that sufficient PPE and equipment are available.
- Maintain contact with manager / supervisor to regularly evaluate site conditions and new information that might require modifications to this procedure.
- Conduct training or briefings, when necessary, and to explain the content of this procedure and site hazards to employees.
- Assist in investigation of incidents that resulted or could have resulted in an injury.

4.2 Hazard Assessment

4.2.1 Perform hazard assessments for those work activities likely to require Personal Protective Equipment (PPE).

- Use the Task Hazard Assessment (THA) to perform the hazard assessment (in accordance with *S3NA-209-PR1 Risk Assessment & Management*). The THA will accompany AECOM personnel at jobsites for use in the event of a job or task change, or
- Use the *Gloves Needs Assessment – S3NA-317-FM1* or equivalent to perform the assessment.
- Re-evaluate completed hazard assessments when the job or task changes.

4.2.2 The hierarchy of controls should be considered during the THA process to minimize or eliminate the need for hand protection PPE or material handling tools. Examples of controls are chemical substitution, machine guarding, and use of different tools.

4.2.3 Select PPE that will protect employees if hazards cannot be eliminated.

- Review Safety Data Sheets for project or task-specific chemicals to determine appropriate PPE. If needed, consult with a SH&E Manager for assistance.
- Review glove manufacturer recommendations for both physical and chemical protection.
- Obtain gloves of the correct size for the employees.
- When both chemical and physical protection is of concern, wear the chemical protection gloves (e.g., nitrile) inside the physical protection gloves (e.g., leather, Kevlar®).
- Nitrile gloves or equivalent chemical resistant shall always be used for protection from hazardous fluids or non-corrosive chemicals.
- Do not wear metal or metal-reinforced gloves when working with electrical equipment or on electrical services. Proper leather and/or rubber gloves designed and tested for this purpose shall be used.
- Refer to *S3NA-208-PR1 – Personal Protective Equipment* for additional information.

4.2.4 Follow glove requirements in the applicable SH&E plan.

4.3 Guidelines for Working With and Around Equipment (Hand Tools, Portable Powered Equipment)

4.3.1 General

- As applicable, employees shall be trained in the use of all tools. Refer to *S3NA-003-PR1 SH&E Training*.
- Keep hand and power tools in good repair and use them only for the task for which they were designed.
- Inspect tools before use and remove damaged or defective tools from service.
- Operate tools in accordance with manufacturer's instructions.
- Do not remove or bypass a guarding device for any reason.
- Keep surfaces and handles clean and free of excess oil to prevent slipping.
- Do not carry sharp tools in pockets.
- Clean tools and return to the toolbox or storage area upon completion of a job.
- Confirm that the wrench is in full contact (fully seated, "flat", not tilted) with the nut or bolt before applying pressure.

- Place the body in the proper position for optimal balance and bracing to prevent falls if the tool slips.
- Make sure hands and fingers have sufficient clearance in the event the tool slips.
- Whenever possible, pull on a wrench and avoid pushing.

- When working with tools overhead, place tools in a holding receptacle when not in use.
- Do not throw tools from place to place or from person to person, or drop tools from heights.
- Inspect all tools prior to start-up or use to identify any defects.
- Powered hand tools shall not be capable of being locked in the ON position.
- Require that all power-fastening devices be equipped with a safety interlock capable of activation only when in contact with the work surface.
- Do not allow loose clothing, long hair, loose jewelry, rings, and chains to be worn while working with power tools or rotating equipment.
- Do not increase the leverage by adding sleeved additions (e.g. a pipe or snipe) to increase tool handle length.
- Make provisions to prevent machines from restarting through proper lockout/tagout (refer to *S3NA-325-PR1 – Lockout Tagout*).

4.3.2 Cutting Tools

- Always use the specific tool designed for the task. Tubing cutters, snips, self-retracting knives, concealed blade cutters, and related tools are task specific and minimize the risk of hand injury. For more information about cutting tools, see *S3NA-317-ATT1 Safe Alternative Tools.*
- Fixed open-blade knives (FOBK) are prohibited from use during the course of AECOM work.
  - Examples of fixed open-blade knives include pocket knives, multi-tools, hunting knives, and standard utility knives.
  - Any exception to this requirement shall require approval of the Manager / Supervisor and SH&E Manager.
- When utilizing cutting tools, personnel will observe the following precautions to the fullest extent possible:
  - Use the correct tool and correct size tool for the job.
  - Cut in a direction away from yourself and not toward other workers in the area.
  - Maintain the noncutting hand and arm toward the body and out of the direction of the cutting tool if it were to slip out of the material being cut.
  - Ensure that the tool is sharp and clean; dirty and dull tools typically cause poor cuts and more hazard than a sharp, clean cutting tool.
  - Store these tools correctly with covers in place or blades retracted, as provided by the manufacturer.
  - On tasks where cutting may be very frequent or last all day (e.g., liner samples), consider Kevlar® gloves in the PPE evaluation for the project.
  - Do not remove guards on paper cutters.
  - In office locations, paper cutters must always be kept in a locked position when not in use.

4.3.3 Moving/Rotating Equipment

- General Requirements for Rotating Equipment (feed augers, chippers, conveyors, etc.)
  - Never place hands, fingers, or extremities near hoppers and operational areas of machinery.

- When the equipment is rotating, stay clear of the rotating components and only operate equipment with proper machine guarding in place.
- Never clean a jammed piece of equipment unless the transmission is in neutral and the power source or the engine is off, locked out, and the moving parts of the equipment have stopped rotating. Refer to *S3NA-325-PR1 – Lockout Tagout*.

4.3.4 Other Physical Hazards

- Activities such as drum handling, fencing, work near razor wire, manhole cover removal, and demolition also pose hazards to hands. Use tools instead of hands for high hazard tasks whenever possible.
- Plan work to avoid pinch points for hands when moving drums, moving manhole covers into position, and handling other heavy objects.
- Work handling scrap metal, glass or other sharp edges requires proper hand PPE (Kevlar® or leather gloves).
- Activities involving hoisting, lifting and landing of a load shall be done "hands-free" when possible. Refer to *S3NA-317-ATT2 – Safe Hands-Free Lifting Guidelines*.

4.4 Ergonomics – Hand and Wrist Care

4.4.1 Keep your wrist in neutral. Avoid using your wrist in a bent (flexed), extended, or twisted position for long periods of time. Instead try to maintain a neutral (straight) wrist position. Ergonomic tools may be needed for long-term work.

4.4.2 Watch your grip. Gripping, grasping, or lifting with the thumb and index finger can put stress on your wrist. When practical, use the whole hand and all the fingers to grasp an object.

4.4.3 Minimize repetition. Even simple, light tasks may eventually cause injury. If possible, avoid repetitive movements or holding an object in the same way for extended periods of time.

4.4.4 Reduce speed and force. Reducing the speed with which you do a forceful, repetitive movement gives your wrist time to recover from the effort. Using power tools helps reduce the force.

4.4.5 Rest your hands. Periodically give your hands a break by letting them rest briefly. Or you may be able to alternate easy and hard tasks, switch hands, or rotate work activities.

4.4.6 Consider low vibration or anti- vibration hand power tools when possible.

4.5 Cleaning Hands

4.5.1 Avoid contamination of hands by proper use of gloves when contact with physical, chemical, or biological hazards is possible.

4.5.2 Use soap and water for normal hand cleaning. Do not use solvents for cleaning as they remove essential oils in the skin and may cause dermatitis. Do not use pressure washers for hand cleaning.

4.5.3 If the hands contact a corrosive (e.g., nitric acid), wash the area with water for fifteen minutes and then seek medical attention.

4.5.4 Use antibiotic ointment and skin protection on minor breaks/scratches of the skin.

4.5.5 In some cases barrier creams may be used to provide limited protection for hands exposed to greases and oils.

4.6 Safe Hands Observation Tool

4.6.1 The *Safe Hand Task Review Card S3NA-317-FM2* may be used to supplement and reinforce safe work practices and the requirements of this procedure.

4.6.2 The observer's responsibilities include:

- Two-way conversation with the employees being observed.
- Completing the card and mark the applicable fields on the back of the card.
- Submitting the completed cards to the supervisor.

4.6.3 The supervisor's responsibilities include:

- Reviewing the completed cards.
- Identifying best work practices and any improvements.
- Communicating any changes back the employee(s).

5.0 Records

The following documentation will be maintained:

5.1 Hand tool training records, as applicable.

6.0 Attachments

6.1	S3NA-317-FM1	Glove Needs Assessment
6.2	S3NA-317-FM2	Safe Hands Task Review Card
6.3	S3NA-317-ATT1	Safe Alternative Tools
6.4	S3NA-317-ATT2	Safe Hands-Free Lifting Guidelines

Appendix C

Rights of Entry

DEPARTMENT OF THE ARMY
RIGHT-OF-ENTRY FOR REMEDIAL INVESTIGATION
ON
NON-FEDERAL PUBLIC LANDS

Site-AEDB-R #: MEHQ-002-R-01
Project: Bangor Range Maneuver Area
Property I.D. #: Assessor Parcel Number (APN)-R08-012

The undersigned, herein referred to as the **"Local Government,"** in consideration for the mutual benefits of the work described below, hereby grants the **UNITED STATES OF AMERICA**, hereinafter called the **"Federal Government,"** a right-of-entry upon the following terms and conditions:

1. The **Local Government** hereby grants to the **Federal Government** an irrevocable and assignable right to enter in, on, over and across the land described below in APN-R08-012, ***for a period not to exceed twenty-four (24) months,*** commencing with the execution of the instrument by the **Federal Government**, and terminating with either the completion of the inspection or the expiration of the twenty-four (24) month term, whichever should occur first in time, for use by the **Federal Government**, its representatives, agents, contractors and assigns, as a work area for a Military Munitions Response Program (MMRP) Remedial Investigation, including the right to investigate, collect samples and perform any other such work which may be necessary and incident to the **Federal Government's** use for the investigation and response on said lands.

2. The **Local Government** also grants the right to enter and exit over and across any other lands of the **Local Government** as necessary to use the described lands for the purposes referenced above.

3. If any action of the **Federal Government's** employees, agents, contractors or assigns, in the exercise of this right-of-entry result in damage to the real property, the **Federal Government** shall, at its sole discretion, either repair such damage or make an appropriate settlement with the **Local Government**. In no event shall such repair or settlement exceed the fair market value of the fee title to the real property at the time immediately preceding such damage. The **Federal Government's** liability under this clause is subject to the availability of appropriations for such payment, and nothing contained in this agreement may be considered as implying that Congress will at a later date appropriate funds sufficient to meet deficiencies. The provisions of this clause are without prejudice to any rights the **Local Government** may have to make a claim under any applicable laws for any damages other than those provided for herein.

4. The land affected by this right-of-entry is located in Bangor, Penobscot County, ME, and is described as follows: APN-R08-012, as shown on **EXHIBIT "A"** attached hereto.

5. We will attempt to telephone you at least ten (10) days prior to commencing any activities at 207-992-4204 (telephone number) if you provide us with that information.

Dated this 25th day of July, 2018.

CITY OF BANGOR

Catherine M. Conlow

Catherine M. Conlow, City Manager

THE UNITED STATES OF AMERICA

Maureen B. Davi

Maureen B. Davi
Realty Specialist
Real Estate Contracting Officer

ROE: DACA33-9-18-062
Site-AEDB-R #: MEHQ-002-R-01

CERTIFICATE OF AUTHORITY

I, Norman S. Heitmann III certify that I am City Solicitor of the
(Name) *(Title)*

City of Bangor, ME, and that Catherine M. Conlow, who signed
(Name of person who signed above)

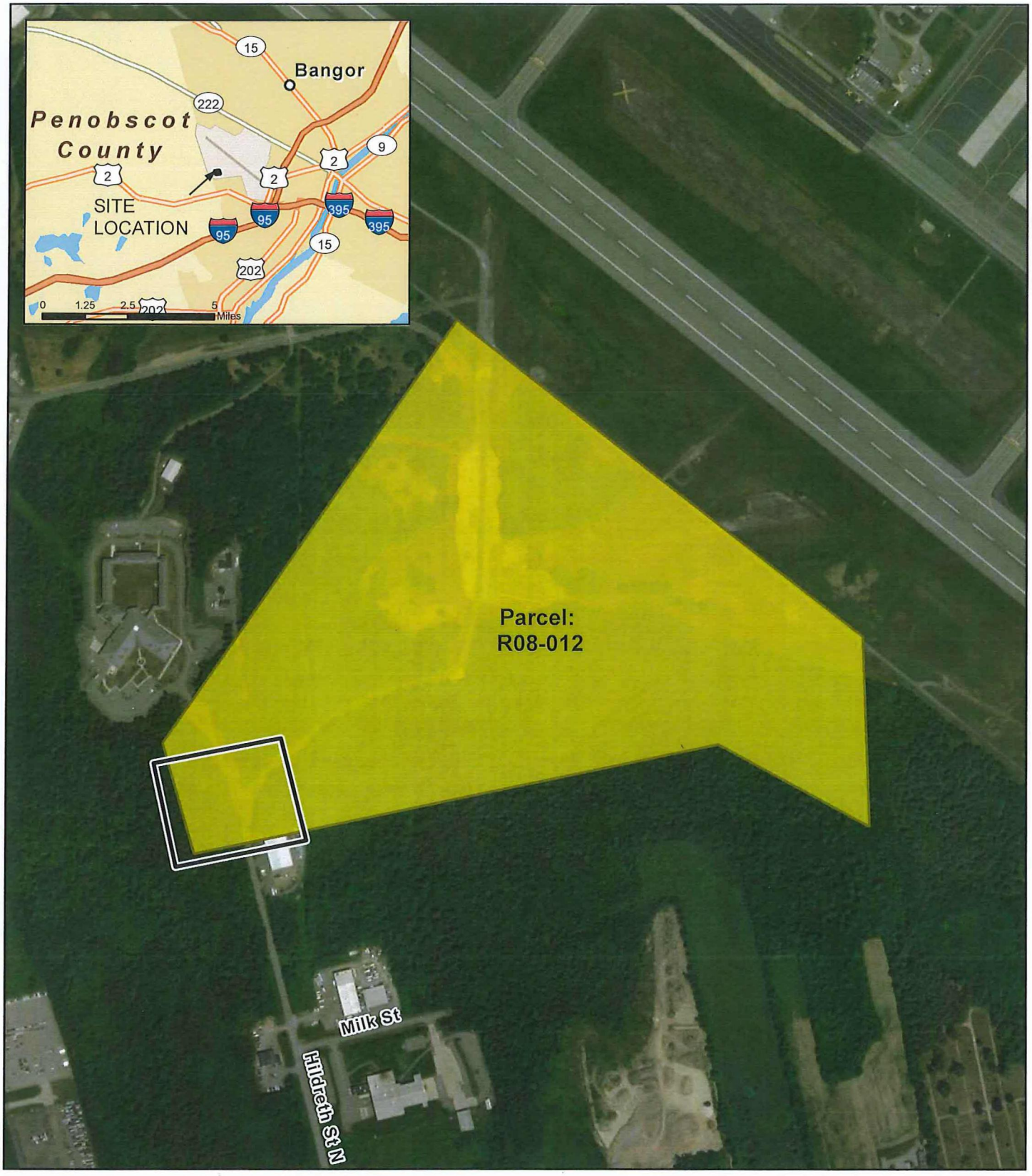
the foregoing instrument on behalf of the City of Bangor, ME, was then the

City Manager of the City of Bangor, ME. I further certify that
(Title of person who signed above)

said Catherine M. Conlow was acting with the scope of powers
(Name of person who signed above)

delegated to him/her in executing the said instrument.

Date: July 25, 2018 Signature: _____



Legend

- Munitions Response Site
- Parcels

Bangor Range Munitions Response Site

MEHQ-002-R-01

Owner: City of Bangor

N

750 0 750 1,500 Feet

US Army Corps of Engineers
Omaha District

Production Date:
15 May 2018

File Location:
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Exhibit A

DEPARTMENT OF THE ARMY
RIGHT-OF-ENTRY
FOR
Remedial Investigation
Military Munitions Response Program (MMRP)

Site-AEDB-R #: MEHQ-002-R-01
Project: Bangor Range
Property I.D. #: Assessor Parcel Number (APN)-R08-001

The undersigned, herein called the **"Owner"**, in consideration for the mutual benefits of the work described below, hereby grants the **UNITED STATES OF AMERICA**, hereinafter called the "Government", a right-of-entry upon the following terms and conditions:

1. The Owner hereby grants to the Government an irrevocable and assignable right to enter in, on, over and across the land described below in APN-R08-001, ***for a period not to exceed twenty-four (24) months***, beginning with the date of the signing of this instrument, and terminating with the earlier of the completion of the inspection or the expiration of the term; for use by the United States, its representatives, agents, and contractors, and assigns, as a work area for MMRP Remedial Investigation; including the right to investigate and collect samples; and perform any other such work which may be necessary and incident to the Government's use for the investigation and response on said lands.

2. The Owner also grants the right to enter and exit over and across any other lands of the Owner as necessary to use the described lands for the purposes listed above.

3. If any action of the Government's employees or agents in the exercise of this right-of-entry result in damage to the real property, the Government will, in its sole discretion, either repair such damage or make an appropriate settlement with the Owner. In no event shall such repair or settlement exceed the fair market value of the fee title to the real property at the time immediately preceding such damage. The Government's liability under this clause is subject to the availability of appropriations for such payment, and nothing contained in this agreement may be considered as implying that Congress will at a later date appropriate funds sufficient to meet deficiencies. The provisions of this clause are without prejudice to any rights the Owner may have to make a claim under applicable laws for any damages other than those provided for herein.

4. The land affected by this right-of-entry is located in Bangor, Penobscot County, ME, and is described as follows: APN-R08-001, as shown on **EXHIBIT "A"** attached hereto.

5. We will attempt to telephone you at least ten (10) days prior to commencing any activities at 207-570-7282 (telephone number) if you provide us with that information.

Dated this 30th day of July, 20 18.

HARDY ASSOCIATES, INC.

Todd A. Hardy

Todd Hardy, ~~Owner~~
Treasurer

THE UNITED STATES OF AMERICA

Maureen B. Davi

Maureen B. Davi
Realty Specialist
Real Estate Contracting Officer

ROE: DACA33-9-18-061
Site-AEDB-R #: MEHQ-002-R-01

CERTIFICATE OF AUTHORITY

I, Todd A. Hardy (Name) certify that I am Treasurer (Title) of Hardy Associates, Inc., and that Todd A. Hardy (Name of person who signed above), who signed the foregoing instrument on behalf of Hardy Associates, Inc., was then the Treasurer (Title of person who signed above) of Hardy Associates, Inc. I further certify that said Todd A. Hardy (Name of person who signed above) was acting with the scope of powers delegated to him/her in executing the said instrument.

Date: 7/30/18 Signature: Todd A. Hardy

Legend

- Munitions Response Site
- Parcels

Bangor Range Munitions Response Site

MEHQ-002-R-01

Owner: Hardy Associates Inc

750 0 750 1,500 Feet

N

US Army Corps of Engineers
Omaha District

Production Date:
15 May 2018

File Location:
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Exhibit A