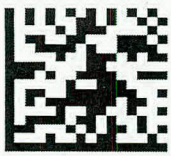

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Final Remedial Action Work Plan for Site 15 Hancock Air National Guard Base

174TH FIGHTER WING
New York Air National Guard
Hancock Field
SYRACUSE, NEW YORK

INSTALLATION RESTORATION PROGRAM
NGB/A7OR
SHEPPERD HALL
3501 FETCHET AVENUE
JOINT BASE ANDREWS, MARYLAND 20762–5157

SEPTEMBER 2011

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September 20, 2011

Mr. Robert Corcoran, P.E.
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Remedial Bureau A, Section C
625 Broadway, 11th Floor
Albany, NY 12233-7015

Reference: Final Remedial Action Work plan for Site 15 Hancock Air National Guard Base, Syracuse, New York

Dear Robert:

I have enclosed One (1) copy of the Final Remedial Action Work plan for Site 15 Hancock Air National Guard Base, Syracuse, New York. Please contact me at (703) 706-9410 if you require any additional information.

Yours truly,

AECOM

Aklile Gessesse
Senior Project manager
(703) 627-0157

Enclosure

cc: Ms. Jody Murata, NGB/A7OR
Sec Lt. Brent Lynch, NYANG
Ms. Veronica Allen, BB&E

Remedial Action Work Plan
For Site 15
Hancock Air National Guard Base

Final

Site:

Hancock Air National Guard Base
Syracuse, New York

Prepared for:

NGB/A7OR
Shepperd Hall
3501 Fetchet Avenue
Joint Base Andrews, MD 20762-5157

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List of Acronyms

°C	Degrees Celsius
ANG	Air National Guard
ARAR	Applicable or Relevant and Appropriate Requirements
ASP	Analytical Services Protocol
ASTM	American Society for Testing and Materials
AWQS	Ambient Water Quality Standards
BEX	Benzene, Ethylbenzene, Xylenes
bgs	Below Ground Surface
CaO2	Calcium Peroxide
CES	Civil Engineering Squadron
cfm	Cubic feet per minute
COC	Constituent of Concern
DO	Dissolved Oxygen
DPT	Direct-Push Technology
DQO	Data Quality Objective
DTW	Depth to Water
EDD	Electronic Data Deliverable
EISB	Enhanced in-Situ Bioremediation
ELAP	Environmental Laboratory Accreditation Program
EPA	Environmental Protection Agency
ERP	Environmental Restoration Program
ERPIMS	Environmental Restoration Information Management System
FFS	Focused Feasibility Stucy
FSP	Field Sampling Plan
feet bgs	Feet Below Ground Surface
g/mL	Grams per Milliliter
HANGB	Hancock Air National Guard Base
HDPE	High Density Polyethylene
IRA	Interim Remedial Action
IRM	Interim Remedial Measure
JP	Jet Propulsion
lbs	Pounds
lbs/gal	Pounds per Gallon
LPM	Liters per Minute
LTM	Long-Term Monitoring
mg/kg	Milligrams per kilogram
mg/L	Milligram per liter
µg/kg	Micrograms per Kilogram
µg/L	Micrograms per Liter
µS/cm	MicroSiemans per Centimeter
MNA	Monitored Natural Attenuation
MS/MSD	Matrix Spike/Matrix Spike Duplicate
mV	Millivolts
MW	Monitoring Well
NGB	National Guard Bureau
NTU	Nephelometric Turbidity Units
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation

Table of Contents

O&M	Operations and Maintenance
ORP	Oxidation Reduction Potential
OVM	Organic Vapor Analyzer
PCB	Polychlorinated Biphenyls
pH	Pondus Hydrogenii
PID	Photoionization Detector
PPE	Personal Protection Equipment
psi	Pounds per square inch
psig	Pounds per square inch gauge
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
ROI	Radius of Influence
RPD	Relative Percent Difference
RSCO	Recommended Soil Cleanup Objective
SSO	Site Safety Officer
TOC	Total Organic Carbon
U.S.	United States
UIC	Underground Injection Control
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1 Introduction

This Remedial Action Work Plan (RAWP) provides information on the remedial activities intended to remediate the petroleum hydrocarbon groundwater plume associated with Environmental Restoration Program (ERP) Site 15 at the 174th Fighter Wing, New York Air National Guard (ANG), Hancock Air National Guard Base (HANGB), Syracuse, New York. A Final Record of Decision (ROD) was issued by the ANG in April 2011 for the remediation of groundwater at Site 15. The remedy selected in the ROD includes the injection of calcium peroxide to enhance aerobic biodegradation of the dissolved phase groundwater plume. Additionally there are residual petroleum hydrocarbon impacts to the smear zone in the former source area which will be remediated with a biosparge system to prevent ongoing dissolved phase impacts.

This RAWP has been prepared in accordance with the New York State Department of Environmental Conservation (NYSDEC) Program Policy, DER-10; Chapter 5, Section 5.3. It is anticipated that ERP Site 15 will meet the Remedial Action Objectives as outlined in the ROD.

1.1 Site Description

The HANGB is located in Syracuse, New York and ERP Site 15 is approximately 2.5 acres in area and formerly consisted of brush and wooded vegetation, a large concrete pad, and a bermed area where a 215,000-gallon aboveground tank was located. Site 15 was formerly used as a pump house and sustained spills of mainly jet propulsion (JP)-4 and JP-8 military aviation fuels and polychlorinated biphenyls (PCBs) over the years of operation. Site 15 was listed as a Class 2 site on the NYS Inactive Hazardous Waste Disposal Site Registry in 1994 as Site Number 734054. PCBs identified at the site have been successfully remediated. A map illustrating the location of the HANGB is provided as **Figure 1-1**.

The groundwater plume associated with Site 15 is approximately 1,000 feet long and 150 feet wide extending from the source area (i.e., defined by MW-101) and terminating at the General Electric property (i.e., MW-112, last impacted well). Concentrations of dissolved petroleum related volatile organic BEX have been as high as 1,500 micrograms per liter (µg/L) (MW-19 in September 2005). The most recent sampling results from October 2010 indicated that only 6 of the 30 monitoring wells sampled exceeded cleanup criteria, with only two wells having total BEX concentrations over 100 µg/L: MW-19 at 118 µg/L and MW-105 at 189 µg/L. The extent of the plume and the monitoring well network is depicted on **Figure 1-2**.

1.1.1 Site Geology

The surficial geology at Site 15 consists of glaciofluvial sediments deposited by glacial meltwater underlying by poorly sorted till deposited directly by glaciers. The glaciofluvial sediments include clayey silts, sands, and gravels, with thickness ranging from 45 to 55 feet. The underlying till consists of gravel, cobbles, and boulders entrained in a clayey silt matrix and ranges in thickness from 30 to 100 feet (Lockheed, 1997).

Bedrock is encountered at depths ranging from 75 to 109 feet below ground surface (bgs), and is part of the Upper Silurian Vernon Formation. This formation consists of thinly bedded soft red shale with thin beds of green shale, gypsum, halite, and dolomite. Competence varies from soft and crumbly to dense and hard. The degree of competence appears to be proportional to the density of the fractures in the shale. The shale is characterized by enlarged fractures, joints, and bedding planes (Lockheed, 1997).

1.1.2 Site Hydrogeology

The overburden at Site 15 consists of fine-grained sediments. The subgrade soils are fairly uniform, with the upper 10 to 15 feet of the soil characterized by relatively soft, dark yellowish-brown silt and clayey silt. Towards the southeast the interval thins to approximately 5 feet. Beneath the clayey silt are fine to medium-grained sands,

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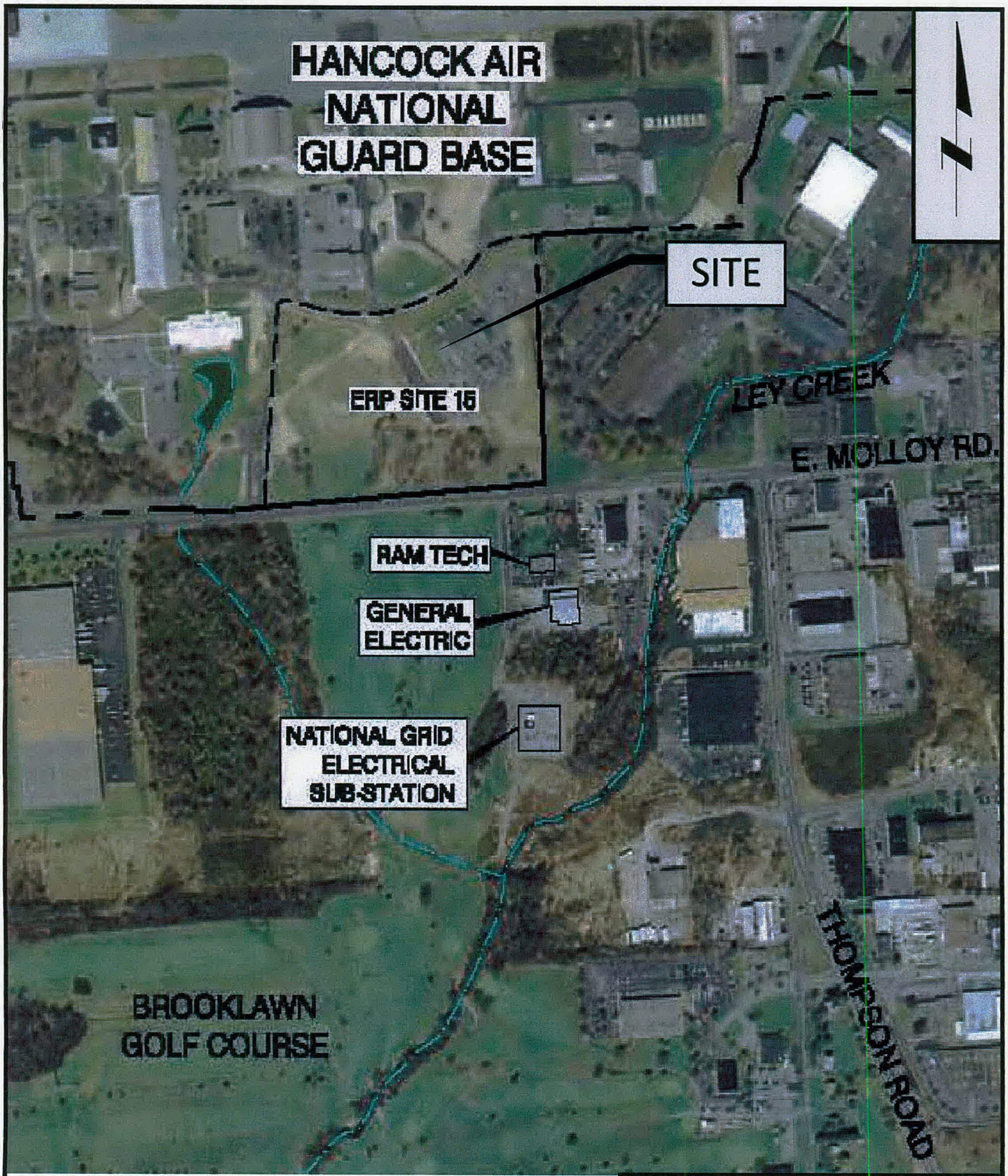

PLAN

0' 250' 500' 1000'

AECOM

FIGURE 1-1

SITE LOCATION MAP

174 TH FIGHTER WING - HANCOCK AIR NATIONAL GAURD
SYRACUSE, NEW YORK

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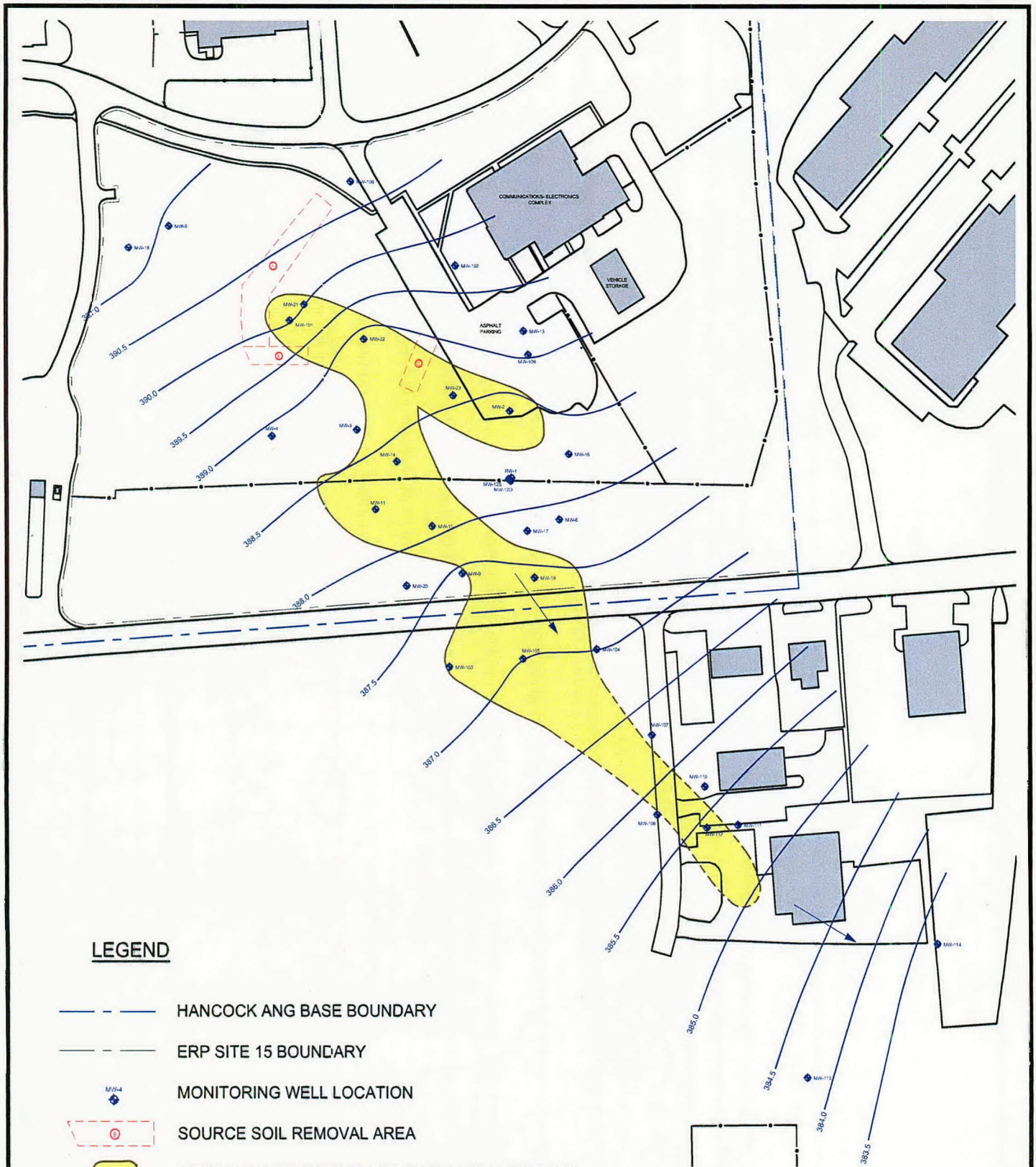

LEGEND

- HANCOCK ANG BASE BOUNDARY
- ERP SITE 15 BOUNDARY
- MW-4 MONITORING WELL LOCATION
- SOURCE SOIL REMOVAL AREA
- APPROXIMATE EXTENT OF BEX PLUME (OCT. 2009)
- GROUNDWATER CONTOUR (OCTOBER 6, 2009) (INTERVAL 0.5 FT)
- APPROXIMATE DIRECTION OF GROUNDWATER FLOW

MAP REFERENCE:

1) BASE MAPPING PROVIDED BY ANG.

2) INFORMATION SHOWN ADOPTED FROM ENVIRONMENTAL RESTORATION PROGRAM FINAL RECORD OF DECISION FOR SITE 15, PREPARED BY AIR NATIONAL GUARD APRIL 2011

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FIGURE 1-2
SITE FEATURES

174 TH FIGHTER WING - HANCOCK AIR NATIONAL GAURD
SYRACUSE, NEW YORK

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yellowish brown to dark brown with silt, and trace amounts of clay down to a depth of approximately 20 feet. Underlying these silty sands is a lens of stiff clayey silts (often called glacial till). Till was encountered at as much as 15 feet thick (Lockheed, 1997).

Groundwater was generally encountered at depths of 2 to 10 feet below ground surface and as previously discussed generally flows in a south to southeasterly direction towards Ley Creek and eventually into Onondaga Lake. Groundwater contours are presented on **Figure 1-2**.

1.1.3 Previous Remedial Activities

Environmental studies performed from 1990 to 2009 indentified Site 15 and down-gradient off-site areas as having soil and groundwater impacted with petroleum hydrocarbons. A Focused Feasibility Study (FFS) recommended excavation and off-site disposal of the source areas (these were completed in 2003 and 2008) and focused enhanced aerobic bioremediation with monitored natural attenuation (MNA). Two vadose zone source area removals have occurred as interim remedial measures IRMs:

- **Year 2003:** 5,360 tons of petroleum-impacted soil from the vadose zone, steel tanks and associated piping.
- **Year 2008:** 2,890 tons of petroleum-impacted soil from the vadose zone source area followed by application of 4,800 pounds of an oxygen-releasing product (calcium peroxide) within the bottom of the excavation areas.

The location of the IRM soil excavations is presented on **Figure 1-3.**

A pilot test was completed in 2009 to evaluate the effectiveness of enhanced natural attenuation in treating the dissolved benzene, ethyl-benzene, and xylene (BEX) in groundwater with calcium peroxide. Results of the pilot test indicate that the injection of calcium peroxide was effective in enhancing natural attenuation. The location of the pilot study injection points is presented on **Figure 1-3**.

1.2 Remedial Action Objectives

Based on an evaluation of the site conditions, the constituents of concern, and an analysis of applicable or relevant and appropriate requirements (ARARs), the following remedial action objectives (RAOs) were developed for groundwater contaminated with BEX at ERP Site 15:

- Prevent exposure to contaminated groundwater containing BEX concentrations above the NYSDEC Ambient Water Quality Standards (AWQS) and Guidance;
- Prevent or minimize further off-site migration of the contaminant plume (plume containment);
- Prevent or minimize further migration of contaminants from source materials to groundwater (source control); and
- Enhance the natural process for the attenuation of BEX compounds on-site and off-site.

Achievement of RAOs will be quantitatively measured by the achievement of cleanup criteria during the implementation of the remedial actions. Cleanup criteria for ERP Site 15 were set to NYSDEC AWQS included in *NYS Division of Water Technical and Operational Guidance Series (1.1.1) 1998.* The AWQS for BEX are listed in **Table 1-1**.

Table 1-1: Preliminary Remediation Goals for BEX in ERP Site 15 Groundwater

Constituent of Concern	NYSDEC AWQS*	Units**
Benzene	1	µg/L
Ethylbenzene	5	µg/L
Xylene	5	µg/L

Notes: *NYS Division of Water Technical and Operational Guidance Series (1.1.1) 1998
**µg/kg = micrograms per kilogram

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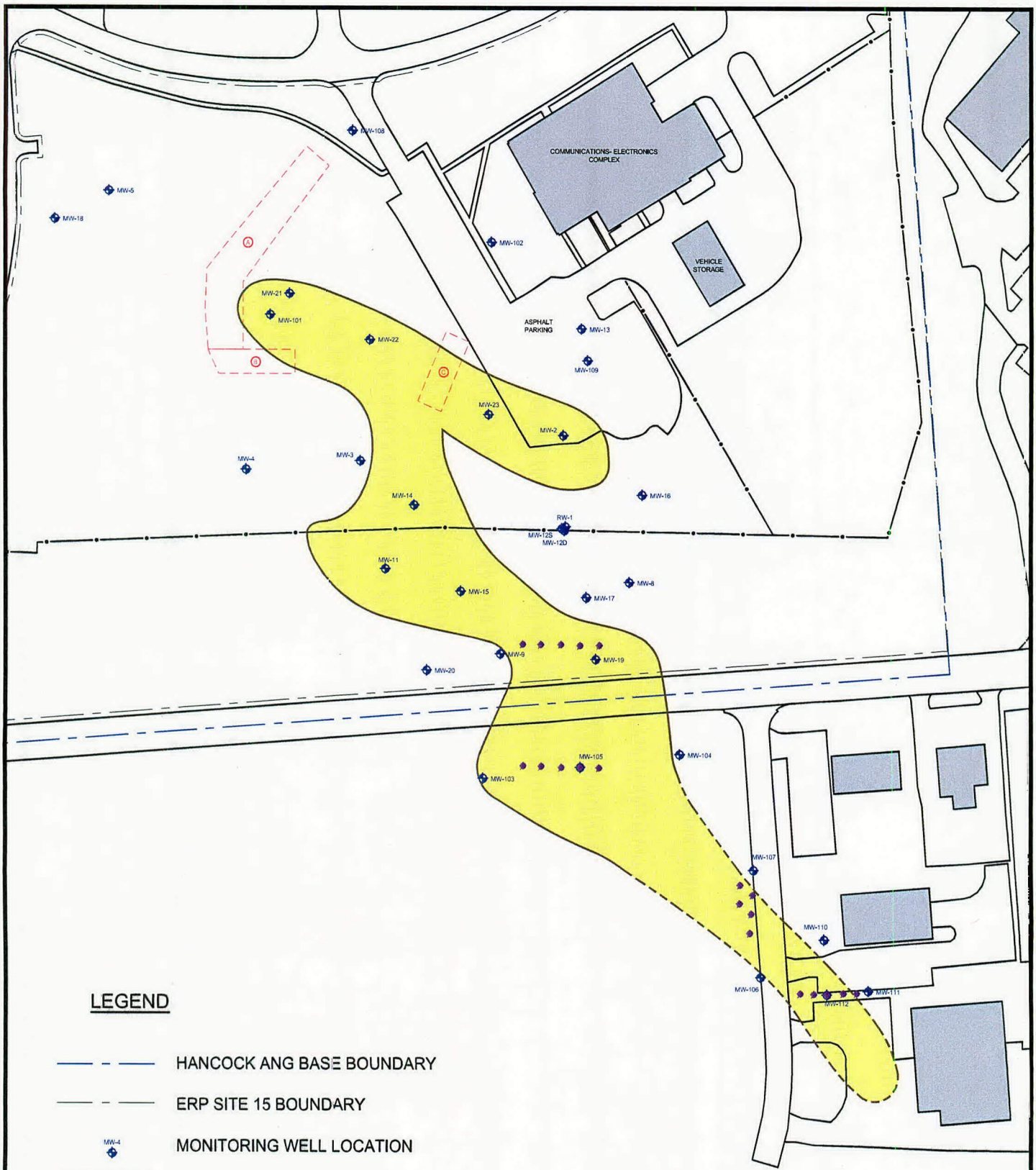

LEGEND

- HANCOCK ANG BASE BOUNDARY
- ERP SITE 15 BOUNDARY
- MW-4 MONITORING WELL LOCATION
- B SOURCE SOIL REMOVAL AREA
- APPROXIMATE EXTENT OF BEX PLUME (OCT. 2009)
- APPROXIMATE INJECTION LOCATION

MAP REFERENCE:

1) BASE MAPPING PROVIDED BY ANG.

2) INFORMATION SHOWN ADOPTED FROM ENVIRONMENTAL RESTORATION PROGRAM FINAL RECORD OF DECISION FOR SITE 15, PREPARED BY AIR NATIONAL GUARD APRIL 2011

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FIGURE 1-3

PILOT TEST AND INTERIM REMEDIAL ACTION LOCATIONS

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SYRACUSE, NEW YORK

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2 Components of Remedial Actions

The ROD presents in-situ biodegradation with MNA as the remedial alternative for the ERP Site 15 BEX plume. The following sections describe the components of the selected remedial actions for soil and groundwater.

2.1 Residual Source Area Baseline Sampling and Biosparge Installation

Two soil removal IRMs have effectively removed all petroleum contamination above the water table (with the exception of one sidewall sample SC-16 from the 2008 IRA that exceeded cleanup objectives) from the perceived source area. Base Confirmation soil samples from the bottom of the excavations and soil boring sampling results indicate that petroleum-related contamination may still exists below the water table, primarily in the smear zone. This is evident from 2008 post-excavation confirmation sampling (four of the excavation bottom samples exceeded the cleanup goal) and PID/visual observations made during the direct-push borings performed in August 2007. Calcium peroxide was applied directly to the bottom of the excavations prior to backfilling with crushed concrete. Groundwater results from monitoring wells adjacent to the excavations suggest that the residual petroleum-impacted soil may be an ongoing source for the dissolved phase plume. The data from MW-2 located near the 2008 excavation C is presented in **Table 2-1**. The dissolved oxygen (DO) data from MW-2 suggests that there is a lack of oxygen available in this portion of the aquifer which may be limiting the biodegradation of the residual petroleum impacted soil. The fluctuation in BEX concentrations seen in this well is indicative of residual petroleum impacts in the smear zone.

Table 2-1: Total BEX Concentrations in MW-2

Sample Date	BEX Concentration (µg/L)	Groundwater Elevation (feet msl)	Dissolved Oxygen (mg/L)	Sulfate (mg/L)
Jan-01	1,270	Not available	Not available	Not available
Oct-01	520	Not available	Not available	Not available
Apr-05	5	391.17	0.0	67
Sep-05	181	388.33	0.0	7.5
Nov-06	96	390.02	0.3	37
Feb-08	--	390.04	2.3	98
Oct-09	570	388.22	0.2	2.8
Oct-10	--	Not Available	Not Available	134

Up to 30 biosparge wells will be installed near the perimeter and adjacent to the IRM soil excavation areas. Prior to setting the biosparge wells, the soil at each point will be sampled for field screening with a photo ionization detector (PID). A biosparge well will be installed if PID readings greater than 500 parts-per-million are detected or characteristic petroleum impacts (stain, odor, or sheen) are observed. If evidence of impacts are noted a sample will be collected for laboratory analysis of BEX by EPA Method 8260B.

A biosparge remediation system will be installed at the site to provide oxygen to support the biodegradation of the residual source area impacts. Enhanced biodegradation has been selected in the ROD for the treatment of the dissolved phase plume and the use of biosparge to treat source area will be complementary to the plume remediation. Although this treatment is not required in the ROD, the remediation of the residual source area will allow for an accelerated remediation of the groundwater plume.

2.2 Enhanced in-situ Bioremediation Utilizing Calcium Peroxide

In conjunction with the residual source area remediation, the technical approach for remediation of BEX impacted groundwater is through enhanced biodegradation utilizing calcium peroxide injection. Enhanced bioremediation with the use of calcium peroxide is achieved through using extended release of oxygen into the subsurface to supplement the [rate limiting] oxygen required by aerobic microorganisms. In other words, injection of the calcium peroxide slurry will help maintain an aerobic environment, allowing microorganisms to continue to breakdown the petroleum impacts. The remedy also includes groundwater monitoring before, during, and following injections to confirm that RAOs are met.

3 Biosparge System Design

This section presents the basic design of the biosparge system for the treatment of residual petroleum impacts in the smear zone soil near the former source areas at ERP Site 15. It documents the technical approach, describes the system to be installed, and presents the general engineering specifications for the major system components. The treatment system will primarily consist of biosparge wells, piping networks connecting the wells to the biosparge system, a manifold to control flow to each sparge well, and a compressor/blower for the injection of air to support the biodegradation of residual petroleum impacts.

3.1 Technical Approach

Groundwater monitoring data has demonstrated that historical jet fuel spills at Site 15 have impacted both on-Base and off-Base groundwater. Soil data collected during the IRM soil removal and preceding remedial investigations confirms the presence of elevated petroleum hydrocarbon concentrations within the smear zone in the source area. The biosparge system will be installed to inject air into the saturated zone to provide oxygen required for the biodegradation of the residual source area impacts. Previous studies conducted at the Site have demonstrated that the petroleum related impacts are amenable to aerobic biodegradation. Aerobic bioremediation of petroleum hydrocarbons is a presumptive remedy as indicated in NYSDEC DER-15.

A process flow diagram for the biosparge application is provided as **Figure 3-1**.

3.2 Basis of Design

As described in the technical approach (Section 3.1), the residual petroleum impacts in the smear zone near the former source areas will be remediated using a biosparge system. This biosparge system is designed to achieve the following objectives:

- **Remedial Action Objectives.** The implementation of the biosparge system will prevent further off-site migration of the contaminant plume by remediating the residual source for the dissolved phase plume. The additional oxygen will also aid in the remediation of the impacted groundwater plume.
- **Reasonable Cleanup Timetable.** Implementation of the biosparge system will limit the ongoing release of dissolved phase BEX and will allow for unrestricted closure of the site within a reasonable timetable of 3 to 4 years.
- **Acceptable Cost Estimation.** The biosparge system will provide a cost-effective remedy to address residual source area impacts and will allow for the accelerated remediation of the dissolved phase plume. All the factors that will affect the costs in remedial action such as site construction, well installation, system construction, operation and maintenance (O&M), and sampling and monitoring, will be taken into account when implementing this remedial technology.

The design of the biosparge system is based on an evaluation of site conditions, an understanding of the contaminants, the physical properties of the site soil, the results of previous investigations, and previous experience with biosparging remediation systems at similar sites. It assumes that the information from previous investigations regarding geologic conditions at ERP Site 15 and contaminant concentrations and distributions are accurate. If any of these factors are found to be significantly different during the remedial action, the design will be modified accordingly.

Petroleum-related contamination may still exist in the smear zone near the former source area excavations. This is evident from 2008 post-excavation confirmation sampling (four of the excavation bottom samples exceeded the cleanup criteria) and PID/visual observations made during the direct-push borings performed in August 2007. Out of the 26 borings that were advanced to a depth of 15 feet bgs, one-half (13) had PID readings greater than 628 ppm in the saturated soil. The area of residual soil contamination is shown in **Figure 3-2.**

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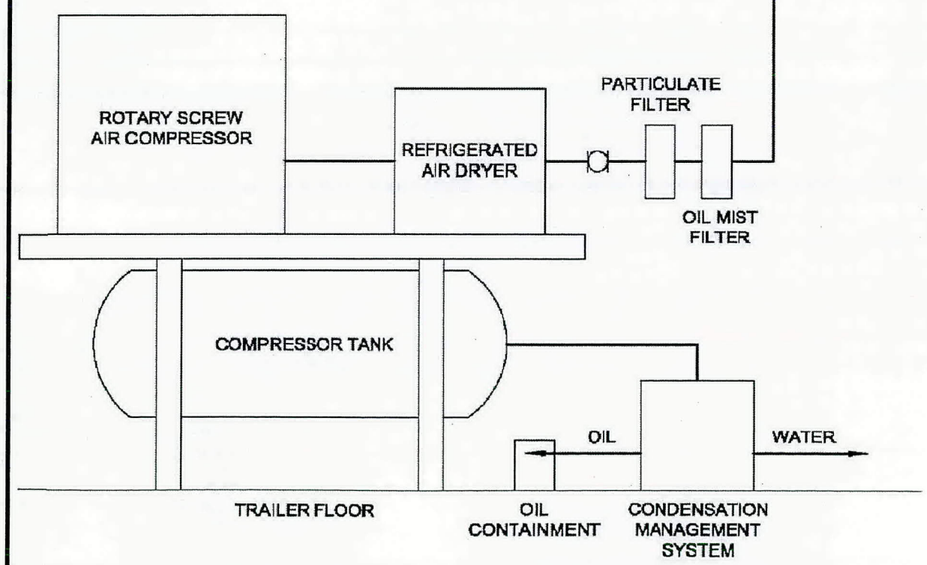
LEGEND

- BALL VALVE
- CHECK VALVE
- (F) FLOW METER
- (PI) PRESSURE GUAGE
- A/S S — AIR ACTUATED SOLENOID VALVE
- PRESSURE REGULATOR
- (PV) PRESSURE RELIEF OR SAFETY VALVE



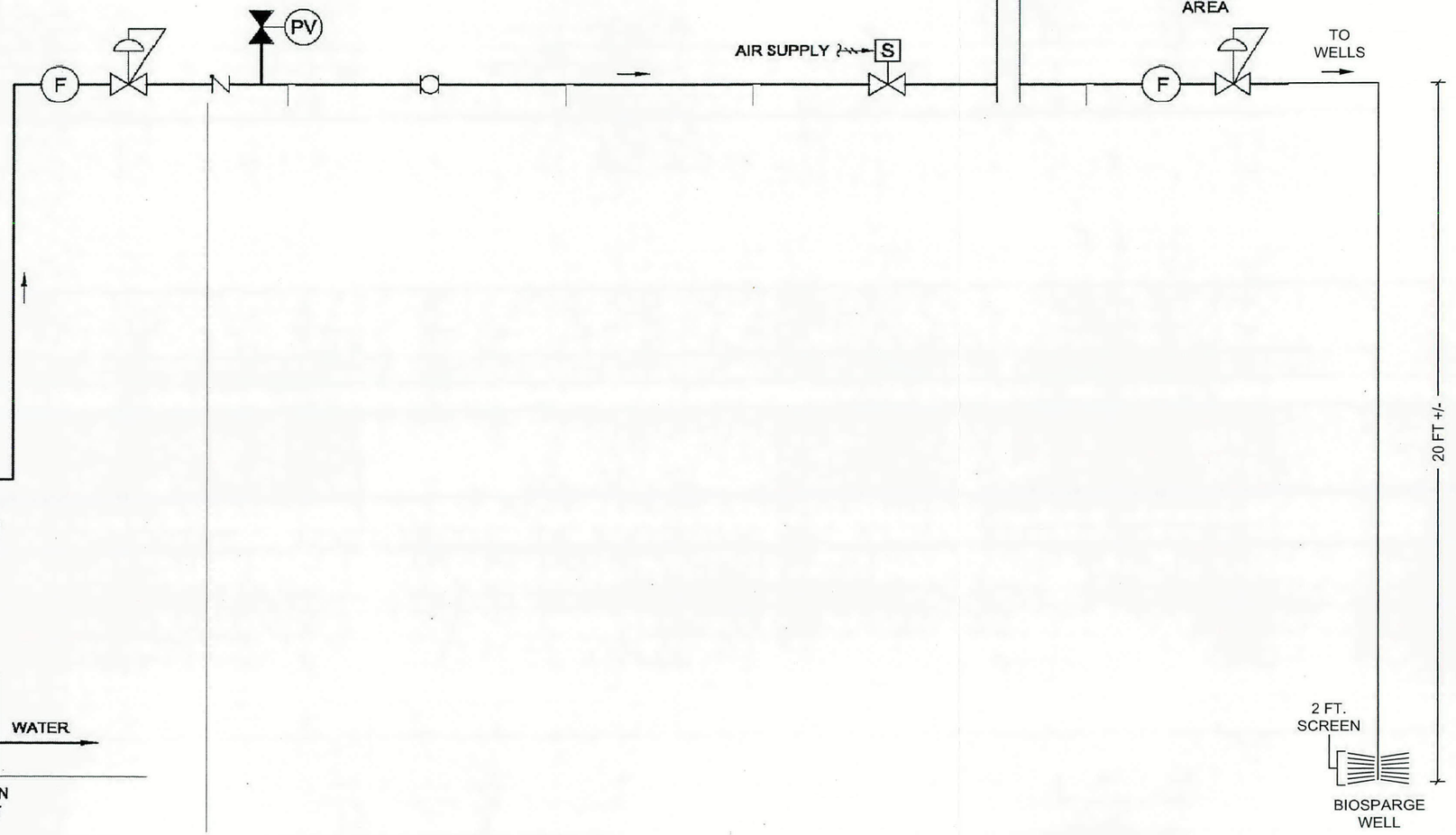


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FIGURE 3-1

BIOSPARGE PROCESS FLOW DIAGRAM

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SYRACUSE, NEW YORK

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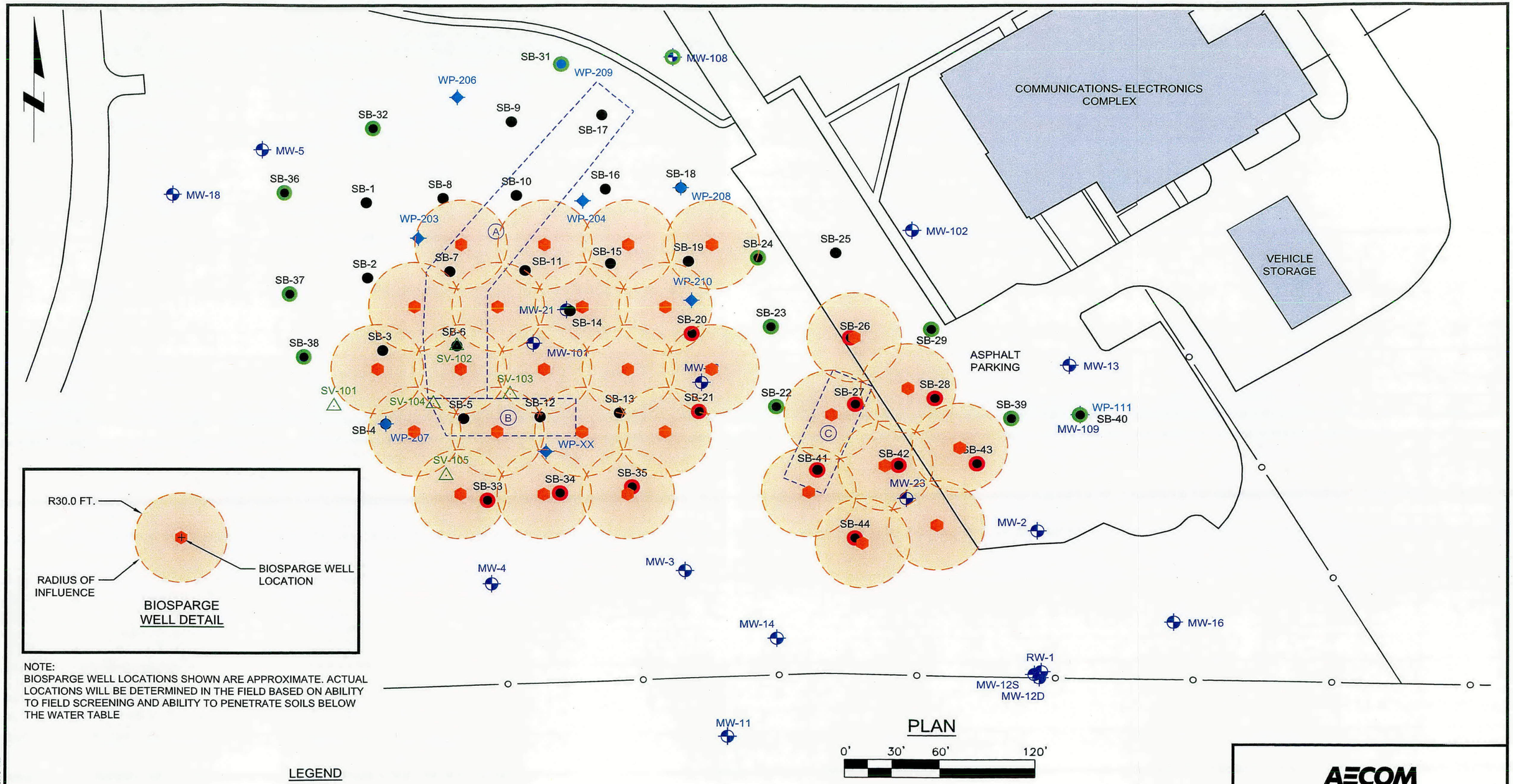

NOTE:
BIOSPARGE WELL LOCATIONS SHOWN ARE APPROXIMATE. ACTUAL LOCATIONS WILL BE DETERMINED IN THE FIELD BASED ON ABILITY TO FIELD SCREENING AND ABILITY TO PENETRATE SOILS BELOW THE WATER TABLE

PLAN

0' 30' 60' 120'

LEGEND

- MONITORING / RECOVERY WELL LOCATION
- WATER PROFILE SAMPLE LOCATION
- SOIL BORING LOCATION
- SOIL VAPOR SAMPLE LOCATION
- SOURCE SOIL REMOVAL AREA
- PROPOSED BIOSPARGE WELL LOCATION

KEY

- SOIL BORING PID READINGS > 600 ppm IN SOIL BELOW WATER TABLE
- SOIL BORING PID READINGS < 600 ppm IN SOIL BELOW WATER TABLE

MAP REFERENCE:

1)BASE MAPPING PROVIDED BY ANG.

2) SAMPLE LOCATIONS TAKEN FROM FIGURE 1-10, ERP SITE 15 SOURCE AREA SOIL REMOVAL, BY ERM, DATED 11/09.

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FIGURE 3-2
APPROXIMATE LIMITS OF RESIDUAL IMPACTS AND BIOSPARGE WELL LOCATIONS
174 TH FIGHTER WING - HANCOCK AIR NATIONAL GAURD
SYRACUSE, NEW YORK

FILE NAME:	DRN	PROJECT NO.	DATE	FIGURE NO.
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The mass of BEX in the petroleum-impacted soils in the source area is estimated to be 270 lbs (using a concentration of BEX of 10 mg/kg in the soil based on confirmation sampling results and a volume of soil 150 feet by 300 feet by 5 feet thick). This mass will be targeted by the biosparge system. Aerobic degradation of BEX typically requires an oxygen demand of 3 to 3.5 times the mass of BEX targeted for treatment. The oxygen demand required for remediation of the residual BEX in Site 15 soil is estimated at approximately 935 pounds. The BEX mass calculations and oxygen demand calculations are presented in Appendix E.

While assuming a total maximum of 30 cfm flow rate of the biosparge system (1-cfm/well), and 20.9% oxygen in air, approximately 730 lbs of oxygen can be introduced to the subsurface in a day. The biosparge system will operate for up to 12 months, during which time nearly 140 tons of oxygen will be injected in the subsurface. Based on these calculations, biosparging is selected for the source area for accelerated biodegradation of the COCs. Also the presence of petroleum hydrocarbons adsorbed to soil in the saturated region at the depths ranging from 8 to 15 feet bgs can act as a continuous source of BEX contamination to the groundwater, making just the calcium peroxide treatment insufficient to meet the groundwater standards in time and without requiring a significantly more rounds of injections. Hence, by injecting ambient air into the saturated soils in the source area, this risk will be mitigated. Oxygen supply calculations are presented in Appendix E.

3.3 Layout of Biosparge System

The biosparge system will be installed to target the remaining residual petroleum impacted smear zone soil in the former source area as shown in **Figure 3-1**. The area is divided into two sub-areas due to presence of clean soil in between them. Up to 30 biosparge wells will be installed in the area covering former excavations A, B, and C. Based on the historic sampling results and soil boring logs there is a silty clay layer below the upper silty sand layer in the upper most portion of the biosparge area. The soil formation is not very tight and acts as a semi-confining layer for the aquifer. There is a silty sand layer below this silty clay layer in this portion of the site, followed by a sand layer. More influence is common in the layers below a semi-confining layer and when the well is screened in more permeable layer. Based on this information, the biosparge wells will be spaced at approximately 60 feet from each other with the assumption of achieving a 30-foot radius of influence (ROI). The biosparging system has been designed to deliver oxygen to the subsurface at levels in excess of those required to remediate the BEX remaining in the smear zone. The high loadings of oxygen will provide for diffusion of oxygen in groundwater beyond the ROI generated by the air compressor. Dissolved oxygen readings will be taken from surrounding monitoring wells to monitor the effect of the biosparge system.

The wells will be installed to 18 to 20 feet bgs and will be screened in the bottom 2 feet. This will emplace the injected air approximately 5 to 10 feet below the impacted smear zone. The location of the biosparge treatment unit, which houses the air compressor, particulate filter, refrigerant dryer, membrane air dryer, drain to remove condensate, filer for condensate, and manifolds, will be placed in the parking area west of the former source area. One dedicated flow meter and pressure gauge will be provided at the remediation unit for every two biosparge well legs to allow for independent flow measurement and modifications.

The biosparge system will be constructed with a compressor of sufficient size to increase the array of sparge wells by up to 50% if screening/monitoring data indicates that remediation is required over a wider area or if operational data indicates that the effective ROI is less than 30 feet and additional wells are necessary to provide adequate coverage of the proposed treatment area.

The biosparge wells will be installed by direct push methods. Prior to setting the biosparge wells the soil at each point will be screened with a PID. A biosparge well will be installed if PID readings greater than 500 parts-per-million are detected or characteristic petroleum impacts (stain, odor, or sheen) are observed.

3.4 Biosparge System Design Calculations

The biosparge system will be installed to accelerate the remediation of the groundwater by enhancing the biodegradation of the BEX sorbed on the soils of the source area which may otherwise continue to leach into the groundwater.

The hydraulic conductivity of the site is reported to be 10 feet/year. This value is believed to be inaccurate based on the soil types and spread of the plume. If this value is used, the intrinsic permeability of saturated zone soils was calculated to be 9.85 E-11 cm^2, which is usual for glacial till. For this reason the permeability value was taken

from the exhibit of the EPA guidance document. Since the biosparge wells will be installed in more permeable layer (sand layer), the intrinsic permeability of 1.0 E-07 cm^2 is assumed. Air injected into the permeable soil layer at a flow rate of 1 cfm is expected to result in a 30 foot radius of influence (ROI) as the air will be injected into a permeable layer that is overlain by a less permeable layer (a condition that is favorable to an increased ROI).

A blower capable delivering at least 1 cfm per biosparge well will be used in with a compressor to generate and distribute the air at desired pressure to the biosparge wells. Injection of air below the water table requires pressure greater than the static water pressure (1 psig for every 2.3 feet of hydraulic head) and the head necessary to overcome capillary forces of the water in the soil pores near the injection point. A typical system operates at approximately 10 to 15 psig. Excessive pressure may cause fracturing of the soils and create permanent air channels that can significantly reduce biosparging effectiveness. Approximately 12 feet of hydraulic head is assumed at the site, which is approximately 5.5 psi. A blower capable of delivering at least 5.5 psi will be utilized in the system.

3.5 Biosparge System Design

The components of the biosparge system are: biosparge wells, manifold piping, flow meters, flow valves, compressed air equipment, and monitoring and control equipment. The components of the biosparge system are described in more detail in the following sections.

3.5.1 Biosparge Wells

Biosparge wells are generally constructed of 1- to 5-inch PVC, galvanized steel, or stainless steel pipe. Since low flow rate is required for each well at the site, 1-inch PVC wells will be installed. The screened interval is normally 1 to 3 feet in length and is generally set 5 to 15 feet below the deepest extent of adsorbed contaminants. Setting the screen at a deeper interval requires higher pressures on the system, but generally does not achieve higher sparge rates. The deepest adsorbed contamination in the area was observed at approximately 16 feet bgs, and the wells will be installed to 20 feet bgs, with 2 feet of screen with a 3-foot sand pack. To prevent short-circuiting of the injected air, a hydrated bentonite seal will be installed above the sand pack and the remaining annulus will be grouted to the ground surface.

3.5.2 Manifold piping

Manifold piping connects sparging wells to an air compressor. A chain trencher will be used to make shallow trenches for the placing of piping to the sparge points. 1-inch HDPE piping will be used to connect the manifold and the wells. The piping from two biosparge wells will be combined and then manifolded in the treatment unit. Piping to the well locations will be sloped toward the well so that condensate or entrained groundwater flows back toward the well. Connections at the well heads will be made with barbed fittings and clamps.

The pressurized air distribution system will be made of metal pipe or rubber-reinforced air hose. PVC pipe will not be connected directly to the compressor because of the high temperatures of air leaving the compressor which can diminish the integrity of the PVC. The connections will be checked for leaks after installation.

3.5.3 Compressed Air Equipment

An oil-free compressor or a standard compressor equipped with downstream coalescing and particulate filter will be used to ensure that no contaminants are injected into the saturated zone. A compressor that is rated for continuous duty at the maximum 30 cfm flow rate and 10 psi pressure will be used to provide adequate flexibility during operations. The actual compressor selected for the system will be based on the number of wells.

The system will be housed in an enclosed trailer, which may contain an exhaust fan, heater and vents.

3.5.4 Monitoring and Control Equipment

Pressure, airflow rate, carbon dioxide and oxygen in groundwater and BEX in groundwater are typically monitored in a biosparging system. The equipments used to monitor these parameters will provide the information necessary to make appropriate system adjustments and track remedial progress. The control equipment in a sparging system will allow the flow and sparge pressure to be adjusted at each sparging well within the system as

necessary. Control equipment will include flow control valves, flow meters, and pressure gauges at the manifold in the treatment unit.

3.5.5 Treatment Trailer

The compressor, piping manifolds, and electrical panels for the biosparge system will be housed in a prefabricated enclosed trailer. The treatment trailer will be constructed at the AECOM office in Mechanicsburg, Pennsylvania. Personnel at the Mechanicsburg office have extensive experience designing and constructing treatment systems for soil and groundwater remediation. System assembly in Mechanicsburg will consist of installation of the compressor, piping manifolds, and electric panel. Once the trailer is in place at ERP Site 15, an electrical subcontractor will provide a power drop to the trailer and energize the electrical panel and equipment for the system. It is assumed that a power drop from the nearby electrical line will provide 208/120V, 100 AMP service to the system.

3.5.6 Biosparge System Startup

System startup will involve testing to check that all components are operating properly and safely prior to formal startup. Formal startup of the system will be accomplished with no pressure load on the blower. Pressure will be slowly applied on a well pair basis to quickly evaluate airflow. Once all wells are individually tested and logged, the full network will be brought on line and balanced accordingly to ensure adequate flow is being applied across the entire extraction well network. The shakedown process will involve temporary full-time monitoring of system operation under full-scale conditions. Well-specific adjustments to airflow will be made during this period as subsurface conditions adjust to the injection application. Dissolved oxygen levels in surrounding monitoring wells will be measured to determine proper airflow rate and radius of influence.

Generally, 7 to 10 days of manifold valving adjustments are required to adjust the air sparging system. These adjustments will balance flow to optimize the carbon dioxide production and oxygen uptake rate. Monitoring data will include sparge pressure and airflows, dissolved oxygen levels and pH. During the initial start up, these parameters will be monitored hourly once the flow is stabilized.

3.5.7 Long-Term Monitoring and Confirmation Sampling

To evaluate the performance of the biosparging system, the following parameters will be monitored biweekly after the startup operation:

- Contaminant levels, dissolved oxygen level, and pH in the groundwater
- Pressures and flow rates in the sparging wells

The samples from the groundwater monitoring wells will be analyzed to track dissolved contaminant concentrations and should be collected after a short period of time following system shutdown. Sampling at these times allows the subsurface environment to reach equilibrium. Samples collected during sparging operations may have lower concentrations of dissolved contaminants than does the surrounding aquifer. This result could lead to the erroneous conclusion that remediation is occurring throughout the aquifer because the monitoring wells may serve as preferential flow paths for the injected air. Quarterly groundwater sampling will be performed at the existing monitoring wells at the site for BEX to monitor the remediation progress. It is anticipated that the biosparge system will operate for 6-months.

Confirmation soil sampling will be conducted when system and groundwater monitoring results indicate that significant progress has been made in the remediation of residual contamination in the source area. Samples will be collected from up to 10 locations identified by PID screening during the installation of the biosparge wells. The procedures for soil sampling and laboratory analysis are discussed in the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP) which are included as **Appendix A.**

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4 Enhanced in-situ Aerobic Remediation utilizing Calcium Peroxide

This section presents the basic design for the treatment of the dissolved-phase BEX plume in the groundwater at ERP Site 15. It documents the technical approach and the basis of the design, and the methods for implementing the remedial action. The remedial action will consist of the direct injection of calcium peroxide, which was specifically called out in the PRAP, at 44 locations as prescribed in the ROD.

4.1 Technical Approach

The major mass removal processes for BEX and other hydrocarbons are aerobic and anaerobic biodegradation. Most aliphatic and aromatic hydrocarbons (e.g., BEX) are readily biodegraded under aerobic conditions by naturally occurring microorganisms utilizing oxygen as the electron acceptor. The final end products of this biodegradation process are carbon dioxide and water. Since oxygen recharge at most sites is slow relative to the rate of depletion due to biodegradation, aerobic biodegradation of hydrocarbons results in the depletion of oxygen from groundwater and unsaturated zone soils with the production of carbon dioxide. As oxygen is depleted, subsurface conditions become anaerobic and the redox potential decreases. The introduction of calcium peroxide will provide a controlled release of oxygen which will permeate throughout the substrate, enhancing microbial activity which biodegrade BEX compounds. The released oxygen will enhance aerobic biodegradation and as concentrations of VOCs decrease over time, the treatment area will be reduced. The number of injection points will be fewer than the first injection event, since the attenuation of the plume is expected to accelerate due to the flux reduction resulting from the source area removal action and the initial peroxide injections.

A process flow diagram for the njection of calcium peroxide into the groundwater is provided as **Figure 4-1**.

4.2 Basis of Design

As described in the technical approach (Section 4.1), COCs will be degraded through biodegradation under aerobic conditions. This full-scale remedial engineering system is designed to achieve the following objectives:

- **Remedial Action Objectives.** All RAOs are described in Section 1.3.
- **Reasonable Cleanup Timetable.** This full-scale design should provide an appropriate remedial system to achieve all RAOs within a reasonable timeframe of 2 to 4 years.

4.3 Layout of Calcium Peroxide Injections

As illustrated on **Figure 4-2** calcium peroxide will be injected via direct push methods at 44 locations in a linear fashion with 20 foot spacing along five transects. Injections will begin at a depth of approximately 25 to 20 feet bgs and continue until the top of the water table, at 10 to 5 feet bgs. A total of 50 pounds of calcium peroxide will be delivered at each point. Underground Injection Control (UIC) Class V Well Application Forms will be completed and submitted for the injection points.

4.4 Oxygen Loading and Volume Calculations

The mass of BEX in the down gradient groundwater plume is estimated at 1.4 pounds (based on a BEX concentration of 100 µg/L; down gradient plume dimensions of 500 feet long, 100 feet wide, 15 feet thick; and a soil porosity of 0.3. Approximately 3 pounds of oxygen are required to degrade 1 pound of benzene as shown below.

$$C_6H_6 + 7.5\ O_2 \rightarrow 6\ CO_2 + 3\ H_2O$$

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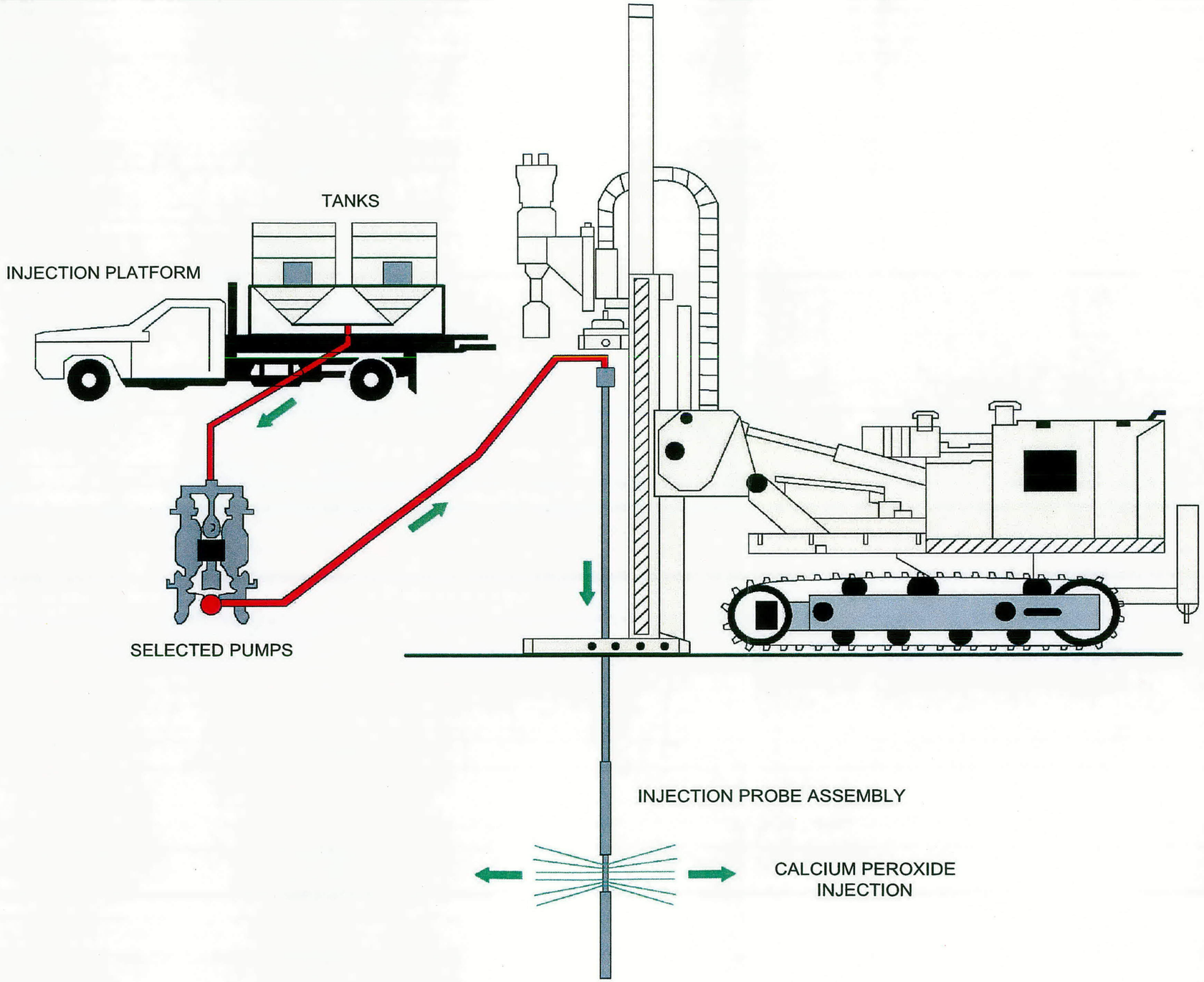

AECOM

FIGURE 4-1
CALCIUM PEROXIDE INJECTION
PROCESS DIAGRAM
174 TH FIGHTER WING - HANCOCK AIR NATIONAL GAURD
SYRACUSE, NEW YORK

FILE NAME:	DRN	PROJECT NO.	DATE	FIGURE NO.
BIOSPARGE-WP.dwg	---	60214697	7 / 2011	4-1

Plotted By: meisterk
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Plot File Date Created: Jul/22/2011 8:59 AM

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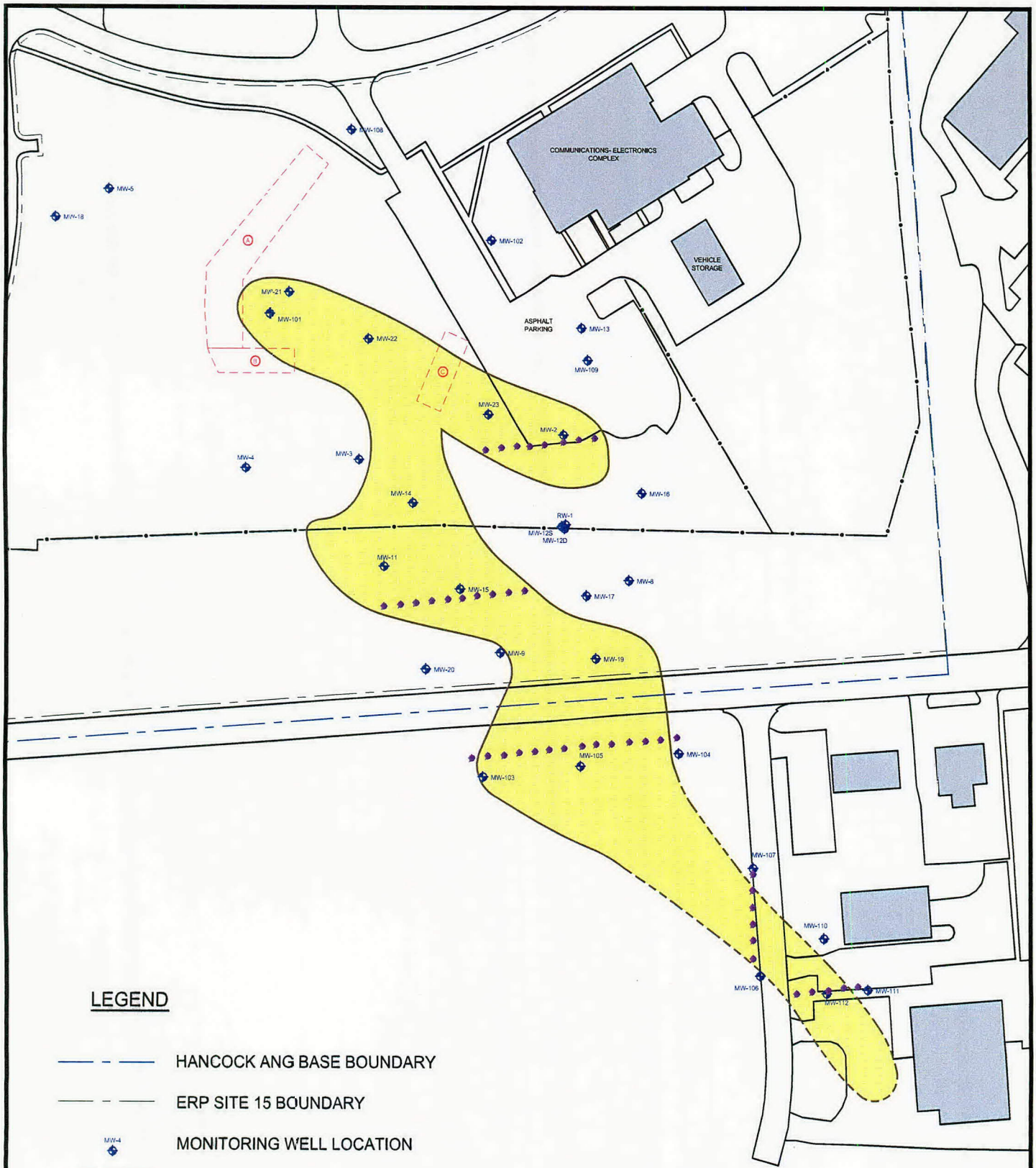

LEGEND

- HANCOCK ANG BASE BOUNDARY
- ERP SITE 15 BOUNDARY
- MW-4 MONITORING WELL LOCATION
- B SOURCE SOIL REMOVAL AREA
- APPROXIMATE EXTENT OF BEX PLUME (OCT. 2009)
- APPROXIMATE INJECTION LOCATION

MAP REFERENCE:

1) BASE MAPPING PROVIDED BY ANG.

2) INFORMATION SHOWN ADOPTED FROM ENVIRONMENTAL RESTORATION PROGRAM FINAL RECORD OF DECISION FOR SITE 15, PREPARED BY AIR NATIONAL GUARD APRIL 2011

AECOM

FIGURE 4-2

CALCIUM PEROXIDE INLECTION LOCATIONS

174 TH FIGHTER WING - HANCOCK AIR NATIONAL GAURD
SYRACUSE, NEW YORK

FILE NAME:	DRN	PROJECT NO.	DATE	FIGURE NO.
BIOSPARGE-WP.dwg	---	60214697	7 / 2011	4-2

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Plot File Date Created: Jul/22/2011 2:52 PM

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The quantity of oxygen required to degrade 1.4 pounds of BEX is approximately 4.2 pounds. Commercial grade calcium peroxide reportedly provides approximately 19% oxygen; therefore, the 2,150 pounds injected will theoretically produce approximately 400 pounds of oxygen. Each injection will be introducing upwards of 100 times the amount of oxygen required. While this sounds more than sufficient, the actual oxygen demand of the aquifer is unknown and therefore three rounds of injections for the dissolved phase plume (where minimal amounts of adsorbed phase is expected to exist) should be sufficient to reach cleanup criteria.

4.5 Calcium Peroxide Delivery

Delivery of calcium peroxide to the aquifer involves injection for distribution via advection under the natural hydraulic gradient, which is accomplished by pressure injection. Injection under pressure will ensure a more uniform distribution across the entire injection interval and addition of the substrate at a faster rate. Substrate will be injected by direct-push methods.

Calcium peroxide will be shipped to the site in totes and diluted to the desired injection concentration using potable water. As specified in the ROD 50 lbs of calcium peroxide will be will be injected at each point. The slurry will be mixed in a drum or bucket with a 40 percent calcium peroxide slurry (9 gallons of water per 50-pounds of calcium peroxide). The slurry wil be injected in a "bottom-to-top" method in three 5-foot injection intervals, starting at the bottom of the targeted injection zone, approximately 25 feet bgs, and continuing until the top of the middle confining unit is reached. The direct push rig will be used to slowly retract the drilling rods while the slurry is injected over the targeted zone. A total of up to 2,150 pounds of calcium peroxide and 400 gallons of water will be injected during each round. Up to three injection rounds are proposed at six-month intervals, beginning in Summer/Fall of 2011.

Underground Injection Control (UIC) Class V Well Application Forms will be completed and submitted for the injection points.

4.6 Evaluation of Calcium Peroxide Injection Effectiveness

Calcium peroxide injection effectiveness will be evaluated by the following indicators:

- **Efficiency in Maintaining an Aerobic Condition After Substrate Injection.** An aerobic condition is critical for BEX biodegradation. The purpose of the calcium peroxide injections is to supply a slow release source of oxygen to support the biodegradation of the dissolved BEX. The calcium peroxide solution should be amended sufficiently to maintain oxygenated (aerobic) conditions. Dissolved Oxygen will be monitored routinely after the injections to verify the supply of oxygen is sufficient.
- **Efficiency in Degradation of Contaminants.** The goal of this remedy is to remediate the groundwater plume so that levels of petroleum reduced below NYSDEC Ambient Groundwater Quality Standards AGWQS. The introduction of calcium peroxide provides a controlled release of oxygen which permeates throughout the substrate enhancing microbial activity which biodegrades BEX compounds. The monitoring of natural attenuation parameters and COC concentrations will be performed during and after the treatment period and reviewed to determine trends in the data. A decreasing trend in COC concentrations and/or increasing trend in DO concentrations should be observed if the bioremediation system performs efficiently. The final end products of this biodegradation process will be carbon dioxide and water.

In order to confirm that RAOs will be achieved, a trend analysis of COC reductions must be performed using appropriate statistical tools. Given the results of the pilot study and the removal of residual source material through the biosparge remedy it is anticipated that the dissolved phase plume will be remediated bellow the AGWQS in 2 to 4 years. Confirmatory groundwater sampling will also be conducted to evaluate the effectiveness of the remedial action and support an NFA decision.

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5 Remedial Activities

As described in Section 3, biosparging will be used to remediate residual petroleum impacts to soil within the smear zone at the former source areas. Calcium peroxide will be injected into the subsurface to enhance the biodegradation of the dissolved phase plume extending off site. With each remedy it is anticipated that significant reductions in contaminant concentrations will be observed in the first year following implementation. Soil samples will be collected from the former source area following the operation of the biosparge system to confirm that concentrations of petroleum hydrocarbons have been reduced to levels that meet the NYSDEC Unrestricted Use RSCOs. A long-term monitoring program will be implemented for the groundwater plume to confirm that remedial goals will be achieved. It is anticipated that the biosparge system will operate for 6- to 12-months and that the dissolved phase plume will attenuate in 2 to 4 years.

The remedial activities are subject to adjustments based on the initial and ongoing system effectiveness. The necessity for modifications to either the soil or groundwater remedy will be based on monitoring data. The remediation sequences presented in Section 5.1 are anticipated but preliminary. These sequences are subject to Site conditions and adjustment. A project schedule is included as **Appendix B**.

5.1 Remediation Sequence

The proposed remedial actions will be performed in the following sequence:

1. Access agreements will be established with off-site property owners for access to monitoring wells and calcium peroxide injection locations.
2. A baseline groundwater monitoring event will be conducted to assess the current groundwater conditions.
3. Utilities will be identified and marked.
4. A location for the biosparge system will be established with the HANG personnel and power will be brought to the area.
5. Final specifications for the biosparge system blower will be established based on the available power.
6. The biosparge wells, associated piping, and the biosparge system will be installed.
7. Startup monitoring for the biosparge system will be conducted and the system will be brought online. The system will be optimized at this time and will be adjusted during the operation period.
8. A staging area for equipment and supplies will be established.
9. Direct-push calcium peroxide injections will be conducted in 6-month intervals beginning in the Summer/Fall of 2011.
10. Performance monitoring for the Biosparge system and groundwater plume will be conducted. Biosparge system O&M and monitoring will be conducted on a monthly basis. Groundwater monitoring will be conducted on a quarterly basis during the injection program and semi-annually thereafter.
11. Confirmatory soil samples will be collected at each of the biosparge points after 6 months of operation. If results indicate that the residual soil contamination has been remediated the system will be shut off.

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6 Groundwater Monitoring

6.1 Sampling Strategy

The groundwater sampling program is designed for two purposes:

1. **Baseline characterization** of the 30 existing monitoring wells as a basis for design and performance comparison.
2. **Performance monitoring** of up to 30 existing monitoring wells quarterly for the first two years, and semi-annual monitoring of up to 20 monitoring wells to evaluate groundwater remediation performance the following two years.

The following sections present the proposed monitoring plans. The monitoring plan is intended to be flexible and subject to change during the course of the remedial alternative should site conditions warrant modification. The sampling protocol and frequencies can be altered in response to changing conditions, or parameters may be eliminated if they are not providing useful information. NYSDEC approval will be obtained prior to implementing any changes to the groundwater monitoring program.

6.2 Baseline Characterization

A groundwater monitoring event will be conducted during the summer of 2011, prior to the first round of calcium peroxide injections, in order to establish a baseline for the comparison point for data from subsequent monitoring events. Samples will be collected from the 30 existing site monitoring wells to provide characterization of the BEX plume, up-gradient and down-gradient conditions, and to monitor contamination at the plume boundaries in the south. Samples from the wells will be analyzed for Stars List VOCs by EPA Method 8260. Geochemical parameters will be monitored while purging the wells prior to sampling. The geochemical parameters that are to be monitored include: temperature, pH, DO, ORP, specific conductivity, turbidity and depth to water. The monitoring well locations for the baseline groundwater monitoring event are depicted in **Figure 1-2**. The wells that will comprise the monitoring network are listed in **Table 6-1**. The list of analytical methods for groundwater monitoring events is provided as **Table 6-2.**

6.3 Performance Monitoring

Performance monitoring is intended to optimize treatment efficiency by ensuring that favorable biogeochemical conditions are established and maintained and the COCs are remediated in the treatment area. This phase of monitoring will last up to 48 months. The groundwater parameters mentioned in Section 6.2 will be used to assess trends in COC concentrations and to determine if additional substrate injections are necessary and, if so, where they should be conducted. Ten wells that have had no detections for the first year of quarterly sampling will be removed from the sampling regime during semi-annual sampling events. A total of 12 groundwater sampling events, including the baseline sampling event, are planned. Results will be reported in a summary letter including data tables and a plume figure. The results including plume reduction trend analysis will be presented to the NYSDEC in yearly PRRs. Closeout of the site will occur once sampling data shows that wells have concentrations below cleanup criteria for four consecutive sampling rounds, as specified in DER-10 Section 6.4.

6.4 Groundwater Sampling Equipment and Procedures

6.4.1 Monitoring Well Sampling

Groundwater samples will be collected from monitoring wells beginning in areas known or assumed to be least contaminated and progress to areas known or assumed to be the most contaminated. All sampling and purging equipment (pumps, water level indicators, etc.) that come into contact with groundwater will be decontaminated before use and between sampling locations. Groundwater geochemical parameters and collection of

groundwater samples will be documented on a monitoring well sample collection form. Low-flow groundwater sampling will be the initial method of groundwater sampling. If low-flow sampling is not possible, the well will be sampled with a bailer. An evaluation between low-flow sampling techniques and passive diffusion bag (PDB) sampling will be conducted during the initial sampling event. Ten known contaminated wells will be sampled utilizing both techniques, first sampling with the PDB, then low-flow sampling. Data produced from the two techniques during the first round of sampling will be compared and a decision will be made to continue using low-flow or PDB sampling for subsequent sampling events.

The low-flow (minimum drawdown) sampling method is based on the premise that a pump or pump intake placed within the screened interval of a well and pumped at a rate corresponding to the hydraulic conductivity of the formation will rapidly establish a horizontal laminar flow of groundwater and withdraw fresh formation water without significant mixing or dewatering of the stagnant casing water in the well and without mobilizing naturally occurring colloidal material within the aquifer. Field personnel conducting groundwater sampling will be trained in low-flow sampling procedures and will be provided a copy of the sampling protocols. Groundwater geochemical parameters will be monitored during well purging to determine well stabilization for sampling. The procedures for collecting groundwater samples using low-flow techniques are presented in further detail in the FSP (**Appendix A**).

In some instances, the hydraulic conductivity of the formation may not be high enough to allow for low-flow sampling techniques. In these cases, the monitoring well will be purged of three well volumes or until dry and sampled with a disposable bailer after allowing the well to recharge. The procedures for collecting samples using bailers are presented in further detail in the FSP.

Passive diffusion bags are a low-density polyethylene diffusion membrane filled with deionized water which allow volatile contaminants to diffuse into the deionized water. Each PDB is single use, therefore they require no decontamination. PDBs will be deployed for at least 2 weeks prior to sample collection in order to allow for diffusion of the analytes across the membrane. Field personnel conducting groundwater sampling will be trained in PDB sampling procedures and will be provided a copy of the sampling protocols. Groundwater geochemical parameters will be noted post sample collection. The procedures for collecting groundwater samples using PDBs are presented in further detail in the FSP (**Appendix A**).

Table 6-1: Performance Monitoring Locations

Well ID	Screened Interval (Feet below top of casing)	BEX Detected in October 2010
MW-2	3.62-13.62	No
MW-3	3.62-13.62	No
MW-4	8.53-18.53	No
MW-5	NA	No
MW-8	5-15	No
MW-9	3.5-13.5	No
MW-11	6.5-16.5	**YES**
MW-12S	NA	NS
MW-12D	NA	NS
MW-13	NA	NS
MW-14	NA	**YES**
MW-15	NA	**YES**
MW-16	NA	No
MW-17	NA	**YES**
MW-18	5.5-15.5	No
MW-19	4.7-14.7	**YES**
MW-20	4-14	No
MW-21	6-16	NS
MW-22	7-17	No
MW-23	6.5-16.5	No
MW-101	12-23	**YES**
MW-102	9-24	No
MW-108	10-20	No
MW-109	4.5-14.5	No
RW-1	NA	**YES**
MW-103	13-33	**YES**
MW-104	6-26	No
MW-105	15-35	**YES**
MW-106	4-26	No
MW-107	4-24	No
MW-110	12.75-22.75	No
MW-111	6.7-16.7	No
MW-112	7.5-17.5	**YES**
MW-113	14-24	No
MW-114	9-19	No

Notes: 1. COCs are BEX.

2. Wells with COCs detected during the October 2010 sampling event are those to be sampled by both low-flow and PDB techniques during the initial sampling event.

3. **YES** = results above NYSDEC Standards

Table 6-2: Analytical Methods for Groundwater

Parameter	Analytical Method	Units
Laboratory Analyses		
Volatile Organic Compounds	USEPA 8260	µg/L
Geochemical Parameters		
Temperature	Field Measurement	°C
pH	Field Measurement	pH
Dissolved Oxygen	Field Measurement	mg/L
Oxidation-Reduction Potential	Field Measurement	mV
Specific Conductivity	Field Measurement	µS/cm
Turbidity	Field Measurement	NTU
Depth to Water	Field Measurement	Feet Below Top of Casing

Notes: 1. Samples will be analyzed by the contract laboratory
2. Geochemical parameters are monitored during purging to determine well stabilization.
3. All geochemical parameters with the exception of depth to water will be measured using a YSI-6920 water quality meter or equivalent instrument. Depth to water well be measured using a water level indicator.

7 Health and Safety

7.1 Site Specific Health and Safety Plan

A site-specific health and safety plan (HASP) has been prepared and is attached as **Appendix C**. Field personnel will review the HASP prior to the start of the fieldwork. A member of the AECOM field team will be designated as the site safety officer and will be responsible for enforcing the HASP. The HASP will be a "living" document and Task Hazard Analysis (THAs) will be added as new tasks are added to the fieldwork. Any subcontractors working under AECOM's direction will be required to prepare a HASP for their portion of the fieldwork.

7.2 Community Air Monitoring Plan

A community air monitoring program will be implemented in accordance with DER-10. The Generic NYSDOH Community Air Monitoring Plan (CAMP) (DER-10, Appendix 1A) is attached as **Appendix D**. The generic CAMP includes methods for the monitoring of VOCs and dust particulates during intrusive site work including soil borings and well installation. The CAMP will be implemented during the injection of calcium peroxide and during the installation of the biosparge wells. The data collected as part of the CAMP will be reported in the annual Periodic Review Reports as required by the NYSDEC.

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8 Project Operation and Maintenance Plan

8.1 Biosparge System O&M Plan

The anticipated duration for active remediation of smear zone soils in the former source area via biosparging is expected to be 6- to 12-months months. O&M activities will be conducted for the system on bi-weekly basis for the first month and monthly for the remainder of the remediation. O&M activities will consist of inspection of the system for damage, data collection, including flow measurements and recording of hour readings. The O&M period for the biosparge system will begin when the full-scale system has been brought online.

8.2 Calcium Peroxide Injection O&M Plan

The calcium peroxide injection O&M plan consists of groundwater monitoring to determine system efficiency and evaluate the necessity for adjustments to the system (i.e., reinjection). An overview of the groundwater monitoring plan is provided in Section 7 and is discussed in greater detail in the FSP.

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9 Reporting

Reports prepared as a component of the remedial actions for ERP Site 15 will consist of annual Periodic Review Reports (PRR), a Site Management Plan (SMP), and a Final Engineering Report (FER). The reports are discussed in the sections below.

9.1 Annual Periodic Review Reports

As required by DER-10 Section 6.3, annual PRRs will be prepared to document implementation of groundwater remediation for 2011, 2012, 2013 and 2014. The PRRs will determine if the intent of the SMP is being met and that the IC/ECs at the site are in place. The PRRs will include trend analysis of the groundwater impacts including a plume figure and associated charts. The PRR will include a section on the operation of the biosparge system and the injection program if they occur during the particular reporting period. The PRR submitted in 2014 or before will request a petition for no further monitoring as dissolved-phase concentrations will be below cleanup criteria at this point. As required by the NYSDEC the PRR will be certified by a licensed New York State Professional Engineer.

9.2 Site Management Plan

As required by NYSDEC DER-10 Section 6.2, a SMP will be developed for the site. In accordance with DER-10 the SMP will include the following elements:

- The institutional and engineering control (IEC) plan,
- Groundwater monitoring plan, and
- The operations and maintenance (O&M) plan (biosparge system, calcium peroxide injections).

The SMP will be the regulatory decision document containing the exit strategy for site closure which will be consistent with the RAOs in the ROD. The SMP will recommend petitioning the NYSDEC for site closure once groundwater results from *all* monitoring wells are below NYSDEC Ambient Water Quality Standard (AWQS) for four consecutive sampling events.

9.3 Final Closure Report

AECOM will prepare and submit a NFA Report to the ANG and NYSDEC for documenting that RAOs have been met and ERP Site 15 can be closed. The report will summarize the remedial actions conducted at Site 15 and will document the trend of BEX concentrations in groundwater.

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Appendix A.
Field Sampling Plan and Quality Assurance Project Plan

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Field Sampling Plan
ERP Site 15
Hancock Air National Guard Base

Final

Site:

Hancock Air National Guard Base
Syracuse, New York

Prepared for:

NGB/A7OR
Shepperd Hall
3501 Fetchet Avenue
Joint Base Andrews, MD 20762-5157

Contract #: DAHA92-02-D-0012
Delivery Order #: 0093

September 2011

AIR NATIONAL GUARD
GUARDING AMERICA DEFENDING FREEDOM

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List of Acronyms

ANG	Air National Guard
ASP	Analytical Services Protocol
ASTM	American Society for Testing and Materials
BEX	Benzene, Ethylbenzene, Xylenes
°C	Degrees Celsius
CaO_2	Calcium Peroxide
CES	Civil Engineering Squadron
COC	Constituent of Concern
CoC	Chain of Custody
DO	Dissolved Oxygen
DPT	Direct-Push Technology
DQO	Data Quality Objective
DTW	Depth to Water
EDD	Electronic Data Deliverable
EISB	Enhanced in-*Situ* Bioremediation
ELAP	Environmental Laboratory Accreditation Program
ERP	Environmental Restoration Program
ERPIMS	Environmental Restoration Information Management System
FSP	Field Sampling Plan
ft bgs	Feet Below Ground Surface
g/mL	Grams per Milliliter
HANGB	Hancock Air National Guard Base
JP	Jet Propulsion
lbs/gal	Pounds per Gallon
LPM	Liters per Minute
LTM	Long-Term Monitoring
MS/MSD	Matrix Spike/Matrix Spike Duplicate
µg/kg	Micrograms per Kilogram
µg/L	Micrograms per Liter
µS/cm	MicroSiemans per Centimeter
mg/L	Milligrams per Liter
mV	Millivolts
MNA	Monitored Natural Attenuation
MW	Monitoring Well
NGB	National Guard Bureau
NTU	Nephelometric Turbidity Units
NYSDEC	New York State Department of Environmental Conservation
O&M	Operations and Maintenance
ORP	Oxidation Reduction Potential
OVM	Organic Vapor Analyzer
PCB	Polychlorinated Biphenyls
pH	Pondus Hydrogenii
PID	Photoionization Detector
PPE	Personal Protection Equipment
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan

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QC	Quality Control
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RD	Remedial Design
RI	Remedial Investigation
RPD	Relative Percent Difference
RSCO	Recommended Soil Cleanup Objective
SSO	Site Safety Officer
TOC	Total Organic Carbon
UIC	Underground Injection Control
U.S.	United States
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1 Introduction

A Field Sampling Plan (FSP) presents, in specific terms, the requirements and procedures for conducting field operations. This FSP was produced in support of the remediation of the petroleum hydrocarbon groundwater plume associated with Environmental Restoration Program (ERP) Site 15 at the 174th Fighter Wing, New York Air National Guard (ANG), Hancock Air National Guard Base (HANGB) Syracuse, New York. The purpose of this FSP is to ensure that (1) the data quality objectives (DQOs) specified for this project are met, (2) the field sampling protocols are documented and reviewed in a consistent manner, and (3) the data collected are scientifically valid and defensible.

This FSP is required reading for all staff participating in the work effort. The FSP will be in the possession of field teams conducting sampling, well installation, treatment system construction and other field activities. All contractors and subcontractors will comply with the procedures documented in this FSP in order to maintain comparability and representativeness of data.

AECOM will control the distribution of the FSP to ensure that the current and correct version is being used. A sequential numbering system will be used to identify copies of the FSP. Controlled copies shall be provided to applicable HANGB personnel, regulatory agencies, remedial project managers, task managers, and quality assurance (QA) coordinators. Whenever revisions are made or addenda added to the FSP, a document control system will be put into place to assure that all parties holding a controlled copy of the FSP receive the revisions/addenda and that outdated material is removed from circulation. The document control system does not preclude making and using copies of the FSP; however, the holders of controlled copies are responsible for distributing additional material to update any copies within their organizations.

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2 Project Background

The HANGB is located in Syracuse, New York and ERP Site 15 is approximately 2.5 acres in area and formerly consisted of brush and wooded vegetation, a large concrete pad, and a bermed area where a 215,000-gallon aboveground tank was located. Site 15 was formerly used as a pump house and sustained spills of mainly jet propulsion (JP)-4 and JP-8 military aviation fuels and polychlorinated biphenyls (PCBs) over the years of operation. Site 15 was listed as a Class 2 site on the NYS Inactive Hazardous Waste Disposal Site Registry in 1994 as Site Number 734054. PCBs identified at the site have been successfully remediated. A map illustrating the location of the HANGB is provided as Figure 1-1 in the Remedial Action Work Plan (RAWP).

The groundwater plume associated with Site 15 is approximately 1,000 feet long and 150 feet wide extending from the source area (i.e., defined by MW-101) and terminating at the General Electric property (i.e., MW-112, last impacted well). Concentrations of dissolved petroleum related volatile organic BEX have been as high as 1,500 micrograms per liter (µg/L) (MW-19 in September 2005). The most recent sampling results from October 2010 indicated that only 6 of the 30 monitoring wells sampled exceeded cleanup criteria, with only two wells having total BEX concentrations over 100-µg/L: MW-19 at 118 µg/L and MW-105 at 189 µg/L. The extent of the plume and the monitoring well network is depicted on Figure 1-2 in the RAWP.

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3 Project Scope and Objectives

3.1 Remedial Action Objectives

The RAOs for this project are to (1) prevent exposure to contaminated groundwater containing BEX concentrations above the NYSDEC Ambient Water Quality Standards and Guidance, (2) prevent or minimize further off-site migration of the contaminant plume (plume containment), (3) prevent or minimize further migration of contaminants from source materials to groundwater (source control); and (4) enhance the natural process for the attenuation of BEX compounds on-site and off-site.

Collection of defensible, valid data is essential to demonstrating that the RAOs for the project have been met. The procedures presented in this FSP are intended to produce data that is scientifically valid and defensible.

3.2 Sample Analysis Summary

The analyses performed on a sample will depend on the sample media and the manner in which the sample was collected. Section 6 summarizes the proposed laboratory analyses, methods, number of samples, and number of quality assurance/quality control (QA/QC) samples for each sampling method/media.

Groundwater and soil samples will be analyzed for volatile organic compounds (VOCs).

3.3 Field Activities

The field activities to be conducted consist of installation of a temporary biosparge system for treatment of residual petroleum impacts in the smear zone soil near the former source areas, collection of baseline soil samples, operation and maintenance (O&M) of the biosparge system , collection of soil remediation confirmation samples, collection of groundwater samples to confirm the effectiveness of the biosparge system at achieving cleanup criteria, injection of calcium peroxide (CaO_2) for remediation of contaminated groundwater, and groundwater sampling to confirm the effectiveness of the injections at achieving cleanup criteria.

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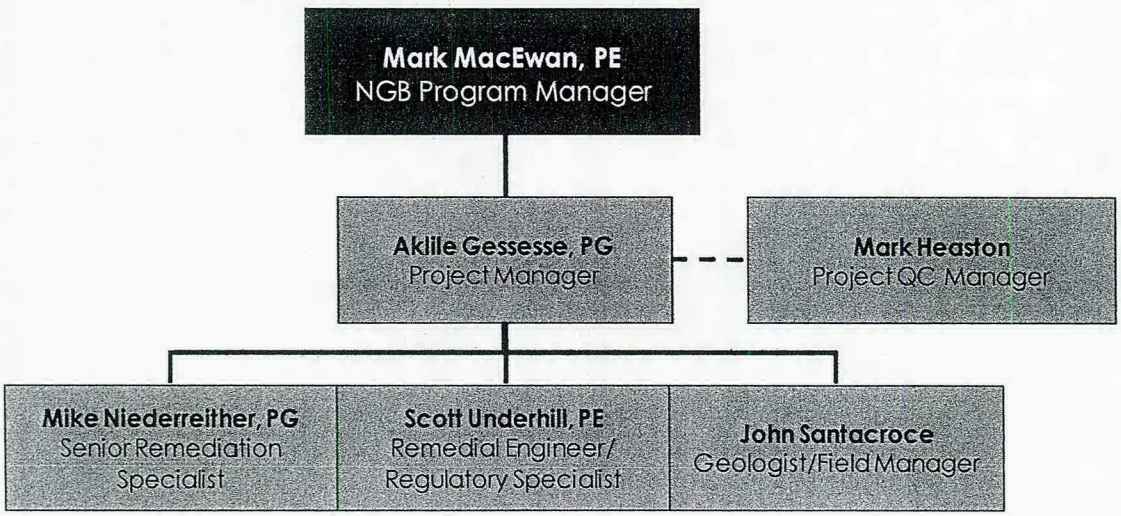
4 Project Organization and Responsibility

AECOM will manage all field activities including sample collection, data analysis and reporting. The project team will be comprised of AECOM personnel and AECOM approved subcontractors. The AECOM team has identified key management and technical personnel who will participate in this project. Guidance will be provided to all personnel conducting field activities, data analysis, and reporting to ensure that overall project goals and objectives are met. Additional technical staff will be available throughout the course of the project if needed. **Figure 4-1** presents the project organization chart.

Figure 4-1: Project Organization Chart



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5 Field Operations

In order to remediate soil and groundwater contaminated with BEX at the HANGB, the following activities will be conducted:

- Utility clearance
- Biosparge system construction including well installation
- Biosparge system O&M and monitoring
- Soil sampling
- Calcium peroxide injections
- Groundwater monitoring
- Waste handling

5.1 Site Reconnaissance, Preparation and Utility Clearance

As part of the initial site reconnaissance, the locations of proposed biosparge wells, biosparge piping trenches, the pad that will support the prefabricated enclosed trailer housing the compressor, piping manifolds, and electrical panels to the biosparge system will be identified and marked using paint, stakes and pin flags. AECOM will complete and submit Air Force Form 103 to the 174th Civil Engineering Squadron (CES) for clearance of utilities owned and maintained by ANG. AECOM will also file a ticket with Dig Safely New York to have privately owned utilities located and marked. Should a dispute arise as to the ownership of a utility, a geophysical subcontractor will survey the area and locate and mark the disputed utility. AECOM will maintain all utility marks during the course of intrusive work (e.g., drilling and trenching). AECOM will renew dig permits issued by the HANGB and Dig Safely New York as necessary. Intrusive work will not be performed without valid dig permits and Dig Safely New York tickets.

AECOM will obtain Underground Injection Control (UIC) Class V Well Permits for the direct-push calcium peroxide injection points.

5.2 Well Installation

An AECOM geologist will monitor all drilling and well construction. The field geologist shall affix their signature to all drilling logs and well construction diagrams. Up to 30 wells will be installed for the biosparge system at ERP Site 15. The following sections detail the procedures for the drilling and construction of biosparge wells.

5.2.1 General Drilling/Logging Procedures

The location and orientation of the drilling rig and ancillary equipment will be determined jointly by the driller and the Site Safety Officer (SSO). Biosparge wells will be drilled using direct-push technology, and will employ MacroCores™ to collect soil samples for lithologic logging.

5.2.1.1 Direct-Push Drilling for Biosparge Well Installation

A direct-push rig will be employed to install the biosparge wells at ERP Site 15. The direct push drilling procedures will follow ASTM D6282-98 (Standard Guide for Direct Push Sampling for Environmental Site Characterization).

5.2.1.2 Logging Procedures

The following information will be documented on a borehole log, an example of which can be found in the attachments section:

- Boring or well identification, project name and site if applicable
- Location in relation to an easily identifiable landmark
- Names of drilling contractor, rig model and drilling method
- Logging geologist and driller

- Start and finish dates
- Borehole diameter and depths if different diameters are used downhole
- Amount and types of drilling fluids and depths at which they were used
- Depth at which drilling fluids were lost and the amount of fluid lost
- Changes in the properties of drilling fluids
- Lithologic descriptions and depths of lithologic boundaries
- Depth at which saturated conditions were first encountered
- Sample numbers, sampling-interval depths, times and required analysis
- Zones of caving or heaving
- Drilling rate and drill rig reactions (e.g., chatter, rod drops, bouncing)

A MacroCore™ sample for lithologic description will be obtained in five-foot intervals, or at the discretion of the field geologist.

5.2.2 Drilling Requirements

All drilling and well installations shall conform to state and local regulations, and the contractor shall obtain and pay for all permits, applications, and other documents required by state and local authorities. The location of all borings shall be coordinated in writing with the 174th CES before drilling commences. Drilling will not be conducted without an approved dig permit obtained from the 174th CES, a valid Dig Safely New York ticket number and marked and cleared utilities.

Drilling rigs will be cleaned and decontaminated before any drilling operation can commence. The rig shall not leak any fluids that may enter the borehole or contaminate equipment that is placed in the hole. The use of rags or absorbent materials to absorb leaking fluids is unacceptable. The only acceptable drilling fluids are air, water, and mud. The air used shall be filtered to remove organic vapors, and if water is used, the prime contractor shall provide chemical analyses of the water assuring its purity. The water quality shall be monitored daily for analytes of concern. The mud used shall be 100 percent sodium bentonite and the contractor shall provide chemical analyses of any drilling mud additive or substitute (e.g., foam, biodegradable material, etc.) proposed for use. The additives or substitutes for drilling will be tested for all analytes of concern at the site and must be approved prior to drilling mobilization.

When air is used, the effectiveness of the air filter will be checked at least every four hours. The air passing through the downstream end of the air delivery line shall be monitored with an organic vapor monitor (e.g., PID, organic vapor analyzer [OVA]), and if organic vapors are detected, their source (filter, contaminated line, etc.) will be decontaminated or replaced.

Drilling lubricants shall not introduce or mask contaminants at the site. The contractor shall provide chemical analyses of all lubricants proposed for use in the boring prior to the start of drilling. Chemical detection limits will be equivalent to those used in analyzing the project ground-water samples. Lubricants with constituents that are toxic or that increase/decrease, or mask the target chemical species of the investigation shall not be permitted. The contractor must provide the analysis results prior to drilling mobilization.

The contractor will dispose of all trash and waste grout. AECOM will be responsible for the disposal of cuttings, decontamination water and drilling fluids. When installing wells through more than one water-bearing zone or aquifer, the contractor shall take measures to prevent cross-connection or cross-contamination of the zones or aquifers.

5.2.3 Well Casing Requirements

The following requirements apply to all casings to be installed at this site:

- All casing shall be new, unused, and decontaminated Schedule 40 polyvinyl chloride (PVC).
- Biosparge wells will be constructed with 1-inch diameter casing.
- Glue shall not be used to join casing. The casing used shall be manufactured with threads for joining the sections.
- All PVC shall conform to the ASTM Standard F-480-88A or the National Sanitation Foundation standard 14 (Plastic Pipe System).
- The casing shall be straight and plumb within the tolerance stated for the borehole.

5.2.4 Well Screen Requirements

The following requirements apply to all well screens to be installed at this site:

- All requirements that apply to casing will also apply to well screen with the exception of those pertaining to strength.
- Screens shall be factory slotted or wrapped.
- Screen slots shall be sized to prevent 90% of the filter pack material from entering the well. For wells where no filter pack is used the screen slot size shall be selected to retain 60% to 70% of the formation materials.
- The bottom of the screen is to be capped, and the cap will be joined to the screen via threads.
- Biosparge wells will be constructed with 2-foot screened intervals. The screened intervals of biosparge wells will be set 5-15 feet below the deepest extent of adsorbed contaminants.

5.2.5 Annular Space Requirements

The following requirements outline the elimination of annular space in biosparge boreholes:

- The annular space will be filled with a filter pack, bentonite seal, and casing grout between the well string and the borehole wall.
- As the annular space is being filled, the well string shall be centered and suspended such that it does not rest on the bottom of the hole. For wells greater than 50-feet deep, at least two centralizers should be used – one at the bottom of the screen and the other at the top of the screen. Additional centralizers may be used if necessary.

5.2.6 Filter Pack Requirements

The following requirements apply to the installation of filter pack:

- The filter pack shall consist of silica sand and shall extend from the bottom of the hole to at least one foot above the top of the well screen.
- The filter pack shall be sounded to verify its depth during placement.
- The contractor shall record the volume of the filter pack placed in the well.
- Potable water may be used, with the approval of the regulatory agency providing oversight, to emplace the filter pack so long as no contaminants are introduced.
- The well shall be surged with a surge block for ten minutes after the filter pack is emplaced.
- The top of the sand pack shall be sounded to verify its depth after surging. Additional filter pack shall be placed as required to return the level of the pack to at least one foot above the screen.
- The well shall be surged for an additional five minutes Again, place additional filter pack as required to bring its level to at least one foot above the screen.

The following requirements apply to the filter pack material:

- The filter pack material shall be clean, inert, and well-rounded and shall contain less than two percent flat particles. The sand shall be certified free of contaminants by vendor or contractor. If decontamination is necessary, the methods shall be approved in writing by NYSDEC.
- The filter pack shall have a grain size distribution and uniformity coefficient compatible with the formation materials and the screen.

5.2.7 Bentonite Seal Requirements

- The bentonite seal shall consist of at least two feet of bentonite placed above the filter pack and below the casing grout.
- Only 100% sodium bentonite is to be used, in the form of chips or powder.
- Bentonite chips shall be hydrated with distilled water after placement.
- Bentonite chips will be allowed to hydrate for one hour prior to grout emplacement.

5.2.8 Casing Grout Requirements

The casing grout requirements are the following:

- Casing grout shall extend from the top of the bentonite seal to 3-feet bgs to allow for connection with the biosparge system.
- The grout shall be mixed in the following proportions:
  - 94-pounds of neat Type I Portland of American Petroleum Institute Class A cement.
  - Not more than 4-pounds of 100 percent sodium bentonite powder.
  - Not more than 8-gallons of potable water.
- All grout will be added using a tremie pipe that will be pulled back as the grout is emplaced.

5.2.9 Surface Completion Requirements

Installed biosparge wells will be left unfinished and capped at the surface until such time as it is connected with the remediation system.

5.3 Drilling Equipment Decontamination

Drilling equipment will be decontaminated using the following procedures.

- Remove any large debris such as clumps of soil from the equipment by hand. A pressure washer may also be used to remove debris.
- Wash and scrub the equipment with a detergent solution such as Alconox™ or Simple Green™ and potable water.
- Rinse the equipment with potable water using a pressure washer.

5.4 Substrate Injections

Treatment of groundwater contaminated with BEX will also include the injection of calcium peroxide at 44 direct-push locations.

Substrate will be mixed by combining calcium peroxide and potable water in a tank connected to a second tank by a transfer pump. The substrate solution will be transferred between the tanks until it is thoroughly mixed. Once the substrate has been mixed a second pump will be used to transfer the solution to the injection pump connected to the DPT injection rig. Substrate will be injected in the following manner:

1. The drive rods will be fitted with expendable tips and driven down to the desired maximum depth.
2. The drive rods will then be withdrawn three to six inches, dropping the expendable tips. Should an injection tool be used instead of an expendable tip, substrate injection can occur without this withdrawal.
3. The container used to mix and filled with the appropriate amount of substrate will then be securely attached to the drive rods and pumped through the delivery system.
4. The rods will slowly be retracted, delivering the calcium peroxide in a "bottom-to-top" method in three 5 feet intervals starting at the bottom of the targeted injection zone, approximately 20-25 ft bgs, and continuing until the top of the middle confining unit is reached.
5. Once treatment of the zone has been achieved, a bentonite seal will be installed to 0.5 ft bgs, with the hole being finished to grade with topsoil.

A total of 50-lbs of calcium peroxide will be delivered at each point, for a total of up to 2,150 pounds of calcium peroxide and 300 gallons of water being injected during each round.

5.5 Waste Handling

Soil cuttings not exhibiting signs of petroleum impacts will be spread on the ground in the vicinity of the boring. Soil cuttings from well installation exhibiting staining or petroleum odors will be contained in drums or roll-offs, sampled for characterization and disposed off-site. Decontamination water will be transferred to a bulk storage tank at the AECOM staging area, sampled for characterization and disposed off-site.

6 Environmental Sampling

Environmental sampling conducted for this project will consist of groundwater monitoring to assess the effectiveness and optimize the implementation of the remedial action for the groundwater, and the collection of soil samples to confirm the effectiveness of the biosparge system in addressing soil contamination at ERP Site 15. The environmental sampling procedures to be followed during this project are detailed in the following sections.

6.1 Groundwater Monitoring

Groundwater monitoring will be conducted quarterly for the first two years of up to 30 existing monitoring wells, and semi-annually of up to 20 monitoring wells the following two years. Data collected from groundwater monitoring will be used to evaluate groundwater remediation performance. Potential groundwater monitoring locations are presented in Table 6-1 of the RD.

Groundwater sampling will consist of collection of samples from an approved monitoring network using passive diffusion bag and low-flow sampling equipment and techniques. Samples will be analyzed for VOCs. VOC data will be used to establish statistical trends in COC concentrations and assess the natural attenuation of COCs after the remedy has been implemented. The procedures for collecting low-flow and passive diffusion bag groundwater samples are presented in the following sections.

6.1.1 Low Flow Groundwater Sampling

Monitoring wells will be sampled using low flow techniques. The techniques employed will conform to the guidance established in the USEPA Low-Flow (Minimal Drawdown) Ground-water Sampling Procedures (Barcelona and Puls, 1996) and ASTM Standard D6771-02. Personnel collecting groundwater samples will be familiar with and have access to both guidance documents.

Groundwater samples will be collected using the following equipment:

- A peristaltic pump with disposable polyethylene sample tubing;
- A power source for the pump;
- A YSI-6920 water quality meter with probes for measuring temperature, pH, DO, specific conductivity, ORP, and turbidity; and
- A water level indicator for measuring the depth to water and total well depth.

Water quality meters will be calibrated in accordance with the manufacturers' instructions on a daily basis prior to the start of sampling activities. Additional calibration checks/calibration will be performed during the course of sampling if there is reason to suspect that instrument readings are not accurate.

Equipment that will come in contact with groundwater (water level indicator) will be decontaminated prior to sampling. Equipment will be decontaminated following sample collection. Disposable tubing will be used in order to prevent cross-contamination. The procedure for collecting low flow groundwater samples are as follows:

1. Nitrile gloves will be worn while sampling.
2. Determine the well location. Record the following information on a Monitoring Well Sample Collection Form.
    - Project and location
    - Date
    - Sampler name
    - Well ID
    - Weather
    - Sampling equipment models
    - Casing diameter

3. Using the water level indicator determine the initial depth to water (DTW) in the well and the total depth of the well. If the water level is rising or falling a low it to equilibrate. Record the initial DTW and the total well depth on the Monitoring Well Sample Collection Form.
4. Insert disposable tubing down the well to the middle of the saturated screen.
5. Connect disposable tubing to the pump and connect the pump to its power source.
6. Connect the disposable tubing from the pump to the inlet port on the lower portion of the flow cell of the water quality meter. Attach a length of tubing to the discharge port at the top of the flow cell so that water will be discharged into a bucket.
7. Turn on the peristaltic pump and adjust the flow rate while monitoring the water level. Follow the recommendations for flow adjustment in the manual supplied with the pump.
   - If the water level has stabilized at a flow rate between 0.050-Lpm and 0.500-Lpm, begin taking readings with the water quality meter. Readings should be collected at 5 minute intervals. The time of reading, depth to water, volume purged, flow rate, temperature, pH, DO, specific conductivity, ORP, and turbidity shall be recorded on the Monitoring Well Sample Collection Form for each reading as well as any observations as to the clarity, odor, or other characteristics of the groundwater. Wells should be purged until the monitoring parameters have stabilized. Stabilization criteria for the monitoring parameters are presented in Table 6-1.
   - If the water level will not stabilize at a flow rate above 0.050-Lpm, the well will be pumped dry, allowed to recharge, then sampled with a bailer.
8. The sample can be collected once stabilization has been achieved or after 1 hour of low-flow purging. In order to collect the sample, disconnect the water tubing from the inlet port of the water quality meter. Water that has passed through the flow cell must not be sampled. Fill sample bottles at the same flow rate at which the well was purged. Samples shall be placed on ice as soon as they are collected. Sample information shall be recorded on a chain of custody form.
9. Decontaminate equipment as necessary according to the procedures in Section 6.1.3 and dispose of used tubing and PPE.

Table 6-1: Groundwater Sampling Stabilization Parameters

Parameter	Units	Stabilization Criteria
Temperature	°C	+/- 0.50
pH	pH	+/- 0.10
Dissolved Oxygen	mg/L	10%
Specific Conductivity	uS/cm	2%
Oxidation-Reduction Potential	mV	+/- 10
Turbidity	NTU	+/- 10

Note: Parameters are considered stabilized when they fall within the specified ranges for three consecutive readings

6.1.2 Passive Diffusion Groundwater Sampling

An evaluation between low-flow sampling techniques and passive diffusion bag (PDB) sampling will be conducted during the initial sampling event. Ten known contaminated wells will be sampled utilizing both techniques, first sampling with the PDB, then low-flow sampling. Data produced from the two techniques during the first round of sampling will be compared and a decision will be made to continue using low-flow or PDB sampling for subsequent sampling events.

Each PDB is single use, therefore they require no decontamination. PDBs will be deployed for at least 2 weeks prior to sample collection in order to allow for diffusion of the analytes across the membrane. Field personnel conducting groundwater sampling will be trained in PDB sampling procedures and will be provided a copy of the sampling protocols. The procedures for collecting groundwater samples using PDB techniques are as follows:

1. Nitrile gloves will be worn while sampling.
2. Determine the well location. Record the following information on a Monitoring Well Sample Collection Form.
   - Project and location

- Date
- Sampler name
- Well ID
- Weather
- Sampling equipment models
- Casing diameter

3. Using the water level indicator, determine the initial depth to water (DTW) in the well. If the water level is rising or falling allow it to equilibrate. Record the measurement on the Monitoring Well Sample Collection Form and in the logbook.
4. Retrieve the previously installed PDB by retracting the tether/suspension cord attaching it to the well plug.
5. In order to collect the sample, the bag will be opened and the sample vials filled. Samples shall be placed on ice as soon as they are collected. Sample information shall be recorded on a chain of custody form.
6. If low-flow purging is not to be conducted subsequent to PDB sampling, a submersible water quality meter will be lowered down well into the screen section and measurements recorded on the Monitoring Well Sample Collection Form.
7. When the bags need replacing, a new, prefilled passive diffusion bag will be attached to the tether/suspension cord and lowered slowly down the well to the same interval as the bag retrieved.

6.1.3 Groundwater Sampling Equipment Decontamination

All equipment that is inserted into a monitoring well must be decontaminated after sampling a well. The tapes of water level indicators shall be wiped with a paper towel sprayed with detergent solution and distilled water as they are reeled in from the well. Once the tape has been retrieved, the tape and probe shall be scrubbed and washed in a solution of detergent and potable water, rinsed with potable water, and rinsed again with distilled water. Nitrile gloves shall be worn at all times while decontaminating and reassembling equipment.

6.2 Baseline Screening and Confirmation Soil Sampling

Baseline soil screening will be performed using a PID during the installation of the biosparging wells. Intervals with elevated PID readings will be noted on boring logs and used to determine locations for confirmation sampling. Confirmation samples will be collected following a minimum 6-month operational period of the biosparging system. A total of 10 confirmation samples will be collected adjacent to locations where elevated PID readings were observed during well installation. The samples will be collected by advancing a sampling probe on a direct-push rig and retrieving soil in an acetate liner. Soil will be screened using a PID and samples will be collected from the interval most likely to be contaminated based upon these results, as well as visual and olfactory observations, with a bias towards locations and depths corresponding to historic detections of COCs in subsurface soil and areas where elevated PID readings were observed during well installation. Samples will be analyzed for VOCs by EPA SW-846 Method 8260B at a NYSDEC approved laboratory.

6.3 Field Quality Control Samples

6.3.1 Equipment Blank

An equipment blank is a sample of ASTM Type II reagent grade water poured into, over or through a sampling device, collected in sample containers and analyzed at a laboratory to assess the effectiveness of equipment decontamination. Equipment blanks are not required for dedicated or disposable sampling equipment. If non-dedicated sampling equipment is used in the collection of samples, one equipment blank will be collected per groundwater sampling event.

6.3.2 Trip Blank

A trip blank consists of a VOC sample vial filled with ASTM Type II reagent grade water. Trip blanks are prepared in the analytical laboratory and shipped to the site with the sample containers, handled like an environmental sample and returned to the laboratory for analysis. Trip blanks are not opened in the field. Trip blanks are only analyzed for VOCs. Trip blanks are used to assess the potential introduction of volatile contaminants to samples

or sample containers during transit and storage. One set of trip blanks (2 vials) shall be packed with each cooler containing groundwater samples for VOC analysis.

6.3.3 Ambient Blank

An ambient blank consists of ASTM Type II reagent grade water collected in a VOC sample vial at the sampling site. It is handled like an environmental sample and transported to the laboratory for VOC analysis. Ambient blanks are collected only when groundwater samples are being collected and analyzed for VOCs. Ambient blanks are used to assess the potential introduction of contaminants to samples and/or sample containers during sampling from ambient sources such as engine exhaust or fuel storage. Ambient blanks shall be collected downwind from potential VOC sources at a frequency of one per every twenty (20) groundwater samples.

6.3.4 Field Duplicates

A field duplicate is a second sample collected from a specific location. Duplicate samples are collected simultaneously or in immediate succession using identical techniques and treated in an identical manner during storage, transportation and analysis. Duplicate sample results are used to assess the precision of the sample collection process. Only VOC data will be validated during the course of this project and as such duplicate samples will be collected and analyzed for VOCs only at a frequency of one per every twenty (20) samples, for both groundwater and soil samples. Acceptance and control limits for the laboratory follow NYSDEC ASP guidelines for organic analyses. However, any deviations in the data with respect to the limits will be discussed in the associated sampling event report. Although there are no established QC limits for field duplicate relative percent difference (RPD) data, AECOM considers RPD values of 40% or less an indication of acceptable sampling and analytical precision.

6.3.5 Matrix Spikes/Matrix Spike Duplicates

Matrix spikes and matrix spike duplicates are extra sets of samples collected from a specific location to assess the precision of laboratory analytical equipment. An MS/MSD consists of two sets of sample containers filled simultaneously or in immediate succession to the original sample. Known concentrations of analytes are added to the sample media at the laboratory to check the calibration and accuracy of instruments. Only VOC data will be validated during the course of this project and as such MS/MSDs will be collected and analyzed for VOCs only at a frequency of one per every twenty (20) samples, for both groundwater and soil samples.

6.4 Sample Handling

Sample handling procedures are discussed in the following sections.

6.4.1 Sample Containers

Sample containers are supplied by the analytical laboratory pre-cleaned and treated according to USEPA specifications for the analytical methods to be performed. Containers shall be stored in clean areas to prevent exposure to fuels, solvents, and other contaminants. Only new sample containers will be used for collecting samples.

6.4.2 Sample Volumes, Container Types and Preservation Requirements

Sample volumes, container types, and preservation requirements for the analytical methods performed on samples are listed in Table 6-2. Sample holding time tracking begins with the collection of samples and continues until the analysis is complete. Holding times are specified in Table 6-2. Samples not preserved or analyzed in accordance with these requirements shall be sampled and analyzed again.

Table 6-2: Sample Container, Volume, Preservation and Holding Time Requirements

Analyte	Analytical Method	Container	Preservative	Volume	Maximum Holding Time
VOCs (Soil)	SW8060B	2 Oz Glass Jar	None, 4°C	2 oz	24 hours
VOCs (Water)	SW8260B	Glass vial with Teflon® lined septum	HCl, 4°C	3 x 40 mL	14 days

6.4.3 Sample Identification

All samples will be given a unique identifier. The date and time of sample collection will be listed on the sample label. The date, time, and sample identifier will be recorded on all applicable forms (e.g. Monitoring Well Sample Forms, Borehole Logs) and in the logbook. Sample identification for soil samples and groundwater samples are discussed below.

Soil Sample Identification

Soil samples will be collected from the former source area following the operation of the biosparge system to confirm that concentrations of petroleum hydrocarbons have been reduced to levels that meet the NYSDEC Unrestricted Use RSCOs. Direct-push soil sample identifiers will begin with the prefix 'DP' to indicate that it is a direct-push sample followed by a sequential number that indicates the round of sampling during which the sample was collected and the location of the sample. The sample identifier will also indicate the depth at which the sample was collected. Samples collected during the first round of direct-push confirmation sampling conducted after one year of treatment via biosparge system will be identified in the following format:

- DP100#-Depth Interval

For example, if the third sample collected during this round was collected from a depth of 8 to 13-feet bgs, the identifier would be:

- DP1003-0813

Samples collected during the second round of confirmation sampling will be identified in the following manner:

- DP200#-Depth Interval

For example, if the fifth sample collected during this round was collected from a depth of 2 to 7-feet bgs, the identifier would be:

- DP2005-0207

MS/MSD samples will be identified by adding the suffixes 'MS' or 'MSD' to the sample identifier:

- Matrix Spike: DP100#-Depth Interval-MS
- Matrix Spike Duplicate: DP100#-Depth Interval-MSD

Field Duplicate Identification

Field duplicates will be identified by substituting 'Dup' for the sample number to indicate that the sample is a duplicate followed by the date and a sequential number for each sampling event. The format for field duplicate identifiers shall be:

- DPDup-Date-###

For example, if the first two field duplicate samples were collected on 09/15/2011 and the next on 09/16/2011, the samples would be identified as follows:

- Duplicate 1: DPDup-091511-001
- Duplicate 2: DPDup-091511-002
- Duplicate 3: DPDup-091611-003

Groundwater Sample Identification

Groundwater samples collected from monitoring wells will be identified in the following manner:

- Well Name-Date

For example, the sample collected from MW-30 on 09/15/2011 would be identified as:

- MW30-091511

MS/MSD samples will be identified by adding the suffixes 'MS' or 'MSD' to the sample identifier

- Matrix Spike: MW30-091511-MS
- Matrix Spike Duplicate: MW30-091511-MSD

Field Duplicate Identification

Field duplicates will be identified using the prefix 'Dup' to indicate that the sample is a duplicate followed by the date and a sequential number for each sampling event. The format for field duplicate identifiers shall be:

- Dup-Date-###

For example, if the first field duplicate sample is collected on 09/15/2011 and the second on 09/16/2011, the samples would be identified as follows:

- Duplicate 1: Dup-091511-001
- Duplicate 2: Dup-091611-002

Trip Blank Identification

Trip blanks will be identified using the prefix 'TB' to indicate that the sample is a trip blank followed by the date and a sequential number. The format for trip blank identifiers shall be:

- TB-Date-###

For example, if two coolers containing VOC samples were shipped on 09/15/2011, the trip blanks would be identified as follows:

- Cooler 1: TB-091511-001
- Cooler 2: TB-091511-002

Equipment Blank Identification

Equipment blanks will be identified using the prefix 'EB' to indicate that the sample is an equipment blank followed by the date and a sequential number. The format for equipment blank identifiers shall be:

- EB-Date-###

For example, if the first equipment blank sample is collected on 09/15/2011 and the second on 09/16/2011, the samples would be identified as follows:

- Equipment Blank 1: EB-091511-001
- Equipment Blank 2: EB-091611-002

Ambient Blank Identification

Ambient blanks will be identified using the prefix 'AB' to indicate that the sample is an ambient blank followed by the date and a sequential number. The format for ambient blank identifiers shall be:

- AB-Date-###

For example, if the first ambient blank sample is collected on 09/15/2011 and the second on 09/16/2011, the samples would be identified as follows:

- Ambient Blank 1: AB-091511-001
- Ambient Blank 1: AB-091611-002

6.4.4 Sample Preservation, Packing and Shipping

Groundwater and soil samples will be shipped on ice to the analytical laboratory in coolers. Coolers shall only contain samples from one matrix, therefore, soil and groundwater samples will be shipped separately. Packing materials such as foam blocks and bubble wrap shall be utilized to minimize the potential for damage of samples during transit. Coolers will contain an adequate amount of ice to maintain samples at 4°C. Ice will be bagged in sealable plastic bags to prevent leakage. Temperature blanks will be packed in coolers to ensure samples are

received at an appropriate temperature. Trip blanks will be included in coolers containing samples for VOC analysis. Coolers will be secured using packing tape and signed, dated custody seals. Coolers containing glass sample containers will be labeled with stickers indicating that the cooler contains glass and should be handled with care.

A Chain of Custody (CoC) form will be completed for each sample shipping container (cooler) as described in Section 6.6.1 (Field Custody Procedures). AECOM will retain a record of the completed CoC. The remaining copies will be placed in a watertight plastic bag and packaged inside the shipping container.

6.5 Sample Custody

During field sampling activities, traceability of the samples must be maintained from the time that the samples are generated until laboratory data are issued. Information concerning collection of the samples and identification will be recorded in the field notebook and sample log. Information on the custody, transfer, handling, and shipping of samples will be recorded on the CoC forms.

6.5.1 Field Custody Procedures

In order to ensure the integrity of samples in transit the following procedure shall be followed:

1. All samples should be clearly abeled according to the methods outlined in Section 6.5.3. The date and time of sampling should be recorded on the sample collection form or borehole log, the CoC, and in the logbook.
2. The number of containers for each sample being shipped in a cooler (soil or groundwater samples) shall be recorded on the CoC.
3. The analyses requested for each sample shall be recorded on the CoC.
4. The project name, project manager, sampler name, and state of origin shall be recorded on the CoC.
5. The date and time of the transfer of custody shall be recorded on the CoC, as should the name of the AECOM employee relinquishing custody and the laboratory employee assuming custody. In the event that the samples are shipped via Fed Ex, the name of the laboratory employee will be replaced by "Fed Ex."
6. When the cooler has been packed in accordance with the methods described in Section 6.5.4 (Sample Preservation, Packing and Shipping), the CoC shall be placed in a water tight bag in the cooler and the cooler or box secured with signed, dated custody seals and packing tape.

6.5.2 Transfer of Custody and Shipment

AECOM personnel shall record the date and time at which they relinquished samples and their name on the CoC. The name of the laboratory representative assuming custody of the samples will also be recorded.

6.5.3 Laboratory Receipt and Entry of Samples

AECOM requires notification of receipt of samples from the analytical laboratory. If there are any discrepancies with the samples (e.g., analysis requests, sample temperature, etc.), AECOM shall be informed of them upon receipt of the samples by the laboratory.

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7 Project Documentation

7.1 Project Logbook

Field activities will be documented in a logbook as described in the QAPP. Events will be described at a level of detail such that situations can be constructed by all parties without the aid of memory. All logbooks will be kept in the project files. Project files will be maintained for a minimum of 7 years following the completion of the project contract.

The information to be documented in logbook entries shall include, but not be limited to:

- Project identification;
- Field activity subject;
- General work activity;
- Personnel on-site, identified by company or affiliation;
- Weather conditions;
- Time and topics of safety briefings;
- Unusual events;
- Visitors to the site;
- Subcontractor progress or problems;
- Communications with co-workers, subcontractors, clients or others;
- Sample identification, collection times, analyses, and CoC numbers;
- Accomplishment of required equipment calibration and calibration checks;
- Accomplishment of required equipment decontamination, and
- Variances from project plans and procedures;

7.2 Field Forms

A variety of forms will be used to document field activities. Forms to be used on this project are:

- Safety briefing forms;
- Equipment calibration forms;
- Borehole logs;
- Well Construction forms;
- Monitoring well sample collection forms;
- Injection logs, and
- Chain of Custody forms.

Completed forms will be stored in the project files. Forms will be scanned and electronic copies will be saved. Working copies of forms will be retained for data evaluation and report preparation, as necessary. Copies of the forms to be utilized during this project are included as Attachment A.

7.3 Photographs

All photographs will include documentation of the date on which they were taken as well as a brief description of the subject matter.

7.4 Electronic Data Management

Data collected during field activities will require electronic data submission to the ANG in ERPIMS format. Laboratory data will be reported to AECOM within 4 weeks of receipt of samples by the analytical laboratory.

AECOM will implement data management procedures to meet the deliverable requirements of ERPIMS. Data will be managed using database software. Field and laboratory data will be reported to meet ERPIMS format deliverable requirements. AECOM will assess the accuracy and completeness of all data submitted. All data entered into the data files and submitted by AECOM shall correspond with the data contained in laboratory reports and other documents associated with the contracted sampling and laboratory analysis tasks.

8 References

American Society for Testing and Materials, 2002. ASTM Guideline D6771-02, Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations. July.

American Society for Testing and Materials, 2005, ASTM D6282 - 98(2005) Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations.

Barcelona, M.J and Puls, R.W. 1996. Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures. United States Environmental Protection Agency. Office of Research and Development. Office of Solid Waste and Emergency Response. EPA/540/S-95-504. April.

U.S. Geological Survey, 2001. User's Guide for Polyethylene-Based Passive Diffusion Bag Samplers to Obtain Volatile Organic Compound Concentrations in Wells.

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Attachment A – Field Forms

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Hancock ANGB Field Activities
Syracuse, New York
Tailgate Safety Briefing Sign-In Log

Date: **Time:**

Briefing Conducted By:	Signature:	Company: AECOM

This sign-in log documents the tailgate safety briefing conducted in accordance with 8 CCR 5192 (29 CFR 1910.120) "Hazardous Waste Operations and Emergency Response" as well as other applicable regulatory requirements. Personnel who perform work operations onsite are required to attend each safety briefing and acknowledge receipt of such briefings daily.

Topics Covered:

☐ General PPE usage	☐ Decontamination Procedures	☐ Emergency Procedures
☐ Hearing Conservation	☐ Smoking, Eating and Drinking	☐ Existing Work Zones
☐ Respiratory Protection	☐ Slips, Trips and Falls	☐ Lockout/Tagout Safety
☐ Personal Hygiene	☐ Heat Stress	☐ Excavation/Confined Space Safety
☐ Exposure Guidelines	☐ Site Control	☐ New Work Procedures

Personnel Sign-In List

Printed Name	Signature	Company Name

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Hancock ANGB ERP Site 15 Performance Based Remediation

EQUIPMENT CALIBRATION DAILY LOG

Date:	Project Name: Hancock ANGB ERP Site 15
Project Number: 60214697	Recorded By:

PID	Model:		Bulb: meV		Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration	Vapor conc. (ppm)	0.0 (ambient air)	NA	NA	Initials:	Value:	
Second Point Calibration	Vapor conc. (ppm)	(isobutylene)			Initials:	Value:	

WATER QUALITY METER	Model:				Morning Calibration/Check	Evening Check (one point only)	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration (Auto)	pH				Initials:	Value:	
	Turbidity (NTU)					Value:	
	Conductivity (mS/cm)					Value:	
	ORP					Value:	
	DO (mg/L)	8.9-9.1 (ambient air)	NA	NA		Value:	
Second Piont Calibration	pH				Initials:	Value:	
	Turbidity (NTU)					Value:	
	Conductivity (mS/cm)					Value:	
Third Piont Calibration					Initials:	Value:	
						Value:	
						Value:	

Additional Remarks:

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AECOM

Soil Boring Log

Project Name:	Site:	**Hole ID:**
[redacted]ct Number:	*Northing:*	Total Depth (feet):
Drilling Contractor:	*Easting:*	Date / Time Started:
Driller:	Elevation (feet MSL): *Ground:*	Date / Time Finished:
Drilling Equipment:	▼ Water Depth During Drilling (feet bgs):	Date / Time Completed:
Drilling Method: Roto Sonic	Logged By:	Checked By:
Borehole Diameter (inches):	Weather/Comments:	

Depth (feet)	USCS Description	Log: Graphic	Log: USCS or Rock Type	Samples: Attempted Recovered	Samples: Method	Samples: Run Number	Samples: PID/FID (ppm)	Samples: Time	Well Diagram	Remarks (list sample numbers here)
5										
10										

Tracking Codes: C:\DOCUMENTS AND SETTINGS\LARSENE1\MY DOCUMENTS\PROJECTS\MIKE POMPLIANO\LUALUALEI.GPJ, 4/6/10, 15:05

USCS Name, **Consistency/Density** (predominantly fine: very soft {n=0-1}, soft {n=2-4}, medium stiff {n=5-8}, stiff {n=9-15}, very stiff {n=16-30}, hard {n=31+}/predominently coarse: very loose {n=0-4}, loose {n=5-10}, medium dense {n=11-30}, dense {n=31-50}, very dense {n=51+}). **Moisture**, (dry, moist, wet). **Color**. **Gradation** (relative percentages of soil components). **Plasticity/Cohesiveness** (predominently fine: nonplastic, slightly plastic, low plasticity, medium plasticity, high plasticity)/predominently coarse: cohesionless, slightly cohesive, cohesive). **Stratification/Structure** (blocky, massive, lensed, etc) (contacts: sharp, gradational) (bedding: horizontal, inclined). **Cementation** (none, weak, moderate, strong). **Other descriptive elements; Geologic Origin**

S# = Sample Number, **SD** = Sample Depth, **ST** = Sample Time, **A** = Analysis.

BZ = Breathing Zone, **BG** = Background, **BH** = Borehole, **CB** = Cuttings Bin

AECOM

Soil Boring Log (Continued)

Project Name:	Site:	Hole ID:

Depth (feet)	USCS Description	Log: Graphic	Log: USCS or Rock Type	Samples: Attempted Recovered	Samples: Method	Samples: Run Number	Samples: PID/FID (ppm)	Samples: Time	Well Diagram	Remarks (list sample numbers here)
20										
25										
30										

Form: 00-BLANK LOG

Tracking Codes: C:\DOCUMENTS AND SETTINGS\LARSENE1\MY DOCUMENTS\PROJECTS\MIKE POMPLIANO\LUALUALEI.GPJ, 4/6/10, 15:05

USCS Name, Consistency/Density (predominantly fine: very soft {n=0-1}, soft {n=2-4}, medium stiff {n=5-8}, stiff {n=9-15}, very stiff {n=16-30}, hard {n=31+}/predominently coarse: very loose {n=0-4}, loose {n=5-10}, medium dense {n=11-30}, dense {n=31-50}, very dense {n=51+}). **Moisture**, (dry, moist, wet). **Color**. **Gradation** (relative percentages of soil components). **Plasticity/Cohesiveness** (predominently fine: nonplastic, slightly plastic, low plasticity medium plasticity, high plasticity)/predominently coarse: cohesionless, slightly cohesive, cohesive). **Stratification/Structure** (blocky, massive, lensed, etc) (contacts: sharp, gradational) (bedding: horizontal, inclined). **Cementation** (none, weak, moderate, strong). **Other descriptive elements; Geologic Origin**

S# = Sample Number, **SD** = Sample Depth, **ST** = Sample Time, **A** = Analysis.

BZ = Breathing Zone, **BG** = Background, **BH** = Borehole, **CB** = Cuttings Bin

AECOM

Soil Boring Log (Continued)

ject Name:	Site:	Hole ID:

Depth (feet)	USCS Description	Log: Graphic	Log: USCS or Rock Type	Samples: Attempted Recovered	Samples: Method	Samples: Run Number	Samples: PID/FID (ppm)	Samples: Time	Well Diagram	Remarks (list sample numbers here)
35										
40										
45										
50										

Form: 00-BLANK LOG

Log Codes: C:\DOCUMENTS AND SETTINGS\LARSENE1\MY DOCUMENTS\PROJECTS\MIKE POMPLIANO\LUALUALEI.GPJ, 4/6/10 15:05

USCS Name, **Consistency/Density** (predominantly fine: very soft {n=0-1}, soft {n=2-4}, medium stiff {n=5-8}, stiff {n=9-15}, very stiff {n=16-30}, hard {n=31+}/predominently coarse: very loose {n=0-4}, loose {n=5-10}, medium dense {n=11-30}, dense {n=31-50}, very dense {n=51+}). **Moisture**, (dry, moist, wet). **Color**. **Gradation** (relative percentages of soil components). **Plasticity/Cohesiveness** (predominently fine: nonplastic, slightly plastic, low plasticity, medium plasticity, high plasticity)/predominently coarse: cohesionless, slightly cohesive, cohesive). **Stratification/Structure** (blocky, massive, lensed, etc) (contacts: sharp, gradational) (bedding: horizontal, inclined). **Cementation** (none, weak, moderate, strong). **Other descriptive elements; Geologic Origin**

S# = Sample Number, **SD** = Sample Depth, **ST** = Sample Time, **A** = Analysis.

BZ = Breathing Zone, **BG** = Background, **BH** = Borehole, **CB** = Cuttings Bin

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AECOM

WELL CONSTRUCTION LOG (FLUSH MOUNT COMPLETION)

Site:	**LocID:**	Date/Time Started:
Project Name: Delaware ANG	Project Number:	Date/Time Completed:
Drilling Contractor:	Drilling Equipment:	Logged By:
Driller:	Borehole Diameter (in.):	Checked By:

FILTER PACK

Type & Size of Filter Pack: _____ Filter Pack Manufacturer: _____

Amount of Filter Pack Used (lbs): _____

BENTONITE SEAL

Type & Size of Bentonite: _____ Bentonite Manufacturer: _____

Amount of Bentonite Used (lbs): _____ Bentonite Hydration Water (gal): _____

GROUT

Type of Cement: _____ Bentonite Powder Type: _____

Cement Manufacturer: _____ Bentonite Powder Manufacturer: _____

Amount of Cement Used (lbs): _____ Amount of Bentonite Powder Used (lbs): _____

WELL DETAILS

Screen/Casing Diameter (in): _____ Casing Material/Manufactuer: _____

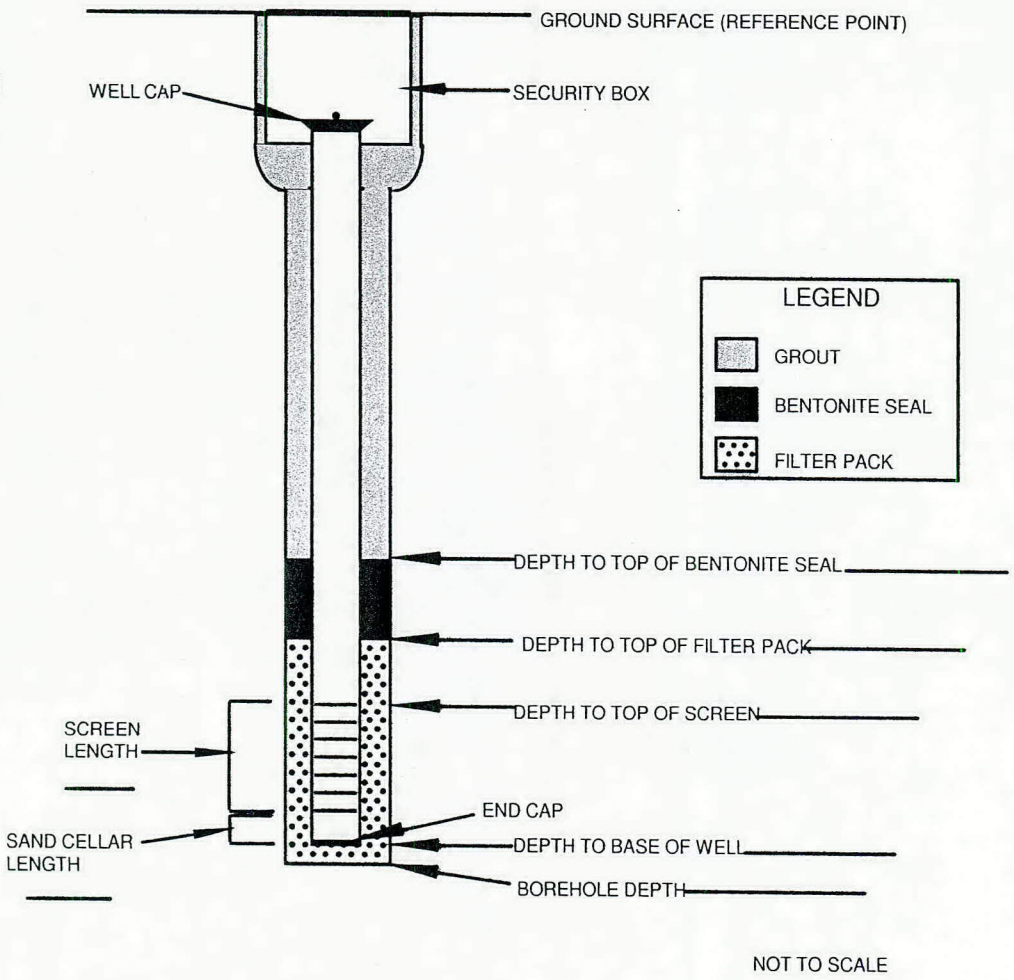
Screen Material/Manufactuer: _____ Type of Well Cap/Manufactuer: _____

Screened Interval (ft): _____ Type of End Cap/Manufactuer: _____

Depth to Water (ft): _____ Dimensions of Security Box: _____

Non-seal Water Added During Construction (gal): _____

SPECIAL CONDITIONS
(describe and draw)



NOT TO SCALE

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AECOM

MONITORING WELL DEVELOPMENT FORM

LOCATION	Site:	LocID:	Date:
	Project Name: Hancock ANGB ERP Site 15	Project #: 60214697	Recorded By: Checked By:
EQUIPMENT	H2O Quality Meter Type/ID #:	Development Equipment:	
	Water Level Indicator Type/ID #:	Equipment Decon.: Liquinox Wash, Potable Rinse, Distilled Rinse	
WELL INFO	Casing I.D. (in):	Unit Casing Volume (gal/lin ft) [b]:	Initial Depth to Water (ft):
	Total Well Depth (ft) [d]:	Water Column Thickness (ft) [d-c]:	
	Well Volume (Gal) [(d-c)xb]:		
	Remarks:		

Date (mm/dd/yy)	Time (24 hr)	Water Level (FTOC)	Volume Removed (Gals)	Pumping Rate (Lpm)	Temp. (C)	Specific Conduct. (mS/cm)	DO (mg/L)	pH	ORP (mv)	Turb. (NTU)	Pump Refill/Discharge (Seconds)	PSI (pump)	Note

Pumping Rate:<=0.5 L/min **Drawdown:** <0.33 ft **Measurements:**3-5 min **Stabilization:**+/- 0.5 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, +/- 10% turb (<= 10 NTU ideal) **All for 3 consecutive readings**

AECOM

MONITORING WELL DEVELOPMENT FORM

LOCATION	Site:	LocID:
	Project Name: Hancock ANGB ERP Site 15	Project #: 60214697

Date (mm/dd/yy)	Time (24 hr)	Water Level (FTOC)	Volume Removed (Gals)	Pumping Rate (Lpm)	Temp. (C)	Specific Conduct. (mS/cm)	DO (mg/L)	pH	ORP (mv)	Turb. (NTU)	Pump Refill/Discharge (Seconds)	PSI (pump)	Note

Pumping Rate: <=0.5 L/min **Drawdown:** <0.33 ft **Measurements:** 3-5 min **Stabilization:** +/- 0.5 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, +/- 10% turb (<= 10 NTU ideal) **All for 3 consecutive readings**

AECOM

MONITORING WELL SAMPLE COLLECTION FORM
HANCOCK A[illegible]B - ERP SITE 15

LOCATION	**Site:**	**LocID:**	Date:
	Project Name: Hancock ANGB ERP Site 15	Project #: 60214697	Recorded By: Checked By:
EQUIPMENT	H2O Quality Meter Type/ID #:	Sampling Equipment:	PID Type/ID #:
	Water Level Indicator Type/ID #:	Equipment Decon.: Liquinox and Potable Wash/Potable Rinse/Distilled Rinse	
WELL INFO	Casing I.D. (in):	Ambient PID (ppm):	Initial Depth to Water (ft):
	Ground Condition of Well:	Well Mouth PID (ppm):	Total Well Depth (ft):
	Approximate Pump Intake Depth (ft):		
	Remarks:		

Date (mm/dd/yy)	Time (24 hr)	Water Level (FTOC)	Volume Removed (Gals)	Pumping Rate (Lpm)	Temp. (C)	Specific Conduct. (mS/cm)	DO (mg/L)	pH	ORP (mv)	Turb. (NTU)	Pump Refill/Discharge (Seconds)	PSI (pump)	Note

Pumping Rate:<=0.5 L/min **Drawdown:** <0.33 ft **Measurements:**3-5 min **Stabilization:**+/- 0.5 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, +/- 10% turb (<= 10 NTU ideal) **All for 3 consecutive readings**

Sample ID #(s)/Time(s)	# of conts./Vol./Type	Preservative	Parameter(s)
	(3) 40 mL VOAs	HCl	VOCs by 8260B

AECOM

MONITORING WELL SAMPLE COLLECTION FORM
Delaware ANG

Page ___ of ___

LOCATION	Site:	LocID:
	Project Name: Hancock ANGB ERP Site 15	Project #: 60214967

Date (mm/dd/yy)	Time (24 hr)	Water Level (FTOC)	Volume Removed (Gals)	Pumping Rate (Lpm)	Temp. (C)	Specific Conduct. (mS/cm)	DO (mg/L)	pH	ORP (mv)	Turb. (NTU)	Pump Refill/Discharge (Seconds)	PSI (pump)	Note

Pumping Rate:<=0.5 L/min **Drawdown:** <0.33 ft **Measurements:**3-5 min **Stabilization:**+/- 0.5 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, +/- 10% turb (<= 10 NTU ideal) **All for 3 consecutive readings**

Quality Assurance Project Plan
For ERP Site 15
Hancock Air National Guard Base

Final

Site:

Hancock Air National Guard Base
Syracuse, New York

Prepared for:

NGB/A7OR
Sheppard Hall
3501 Fetchet Avenue
Joint Base Andrews, MD 20762-5157

Contract #: DAHA92-02-D-0012
Delivery Order #: 0093

September 2011

AIR NATIONAL GUARD
GUARDING AMERICA DEFENDING FREEDOM

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Table of Contents

Table of Contents

List of Attachments

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Table of Contents

List of Acronyms and Abbreviations

ANG	Air National Guard
ASP	Analytical Services Protocol
ASTM	American Society for Testing and Materials
BFB	Bromofluorobenzene
BS	Blank Spike
BSD	Blank Spike Duplicate
CoC	Chain-of-Custody
COPC	Chemical of Potential Concern
CCV	Continuing Calibration Verification
DOT	Department of Transportation
DQO	Data Quality Objective
DVR	Data Validation Report
FSP	Field Sampling Plan
g	grams
GC	Gas Chromatograph
GC/MS	Gas Chromatograph/mass spectrometer
HANGB	Hancock Air National Guard Base
ICAL	Initial Calibration
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
IS	Internal Standard
L	liter
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MCL	Maximum Contaminant Level
mL	milliliter
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NA	Not Available
NCR	Nonconformance Report
NIST	National Institute of Standards and Technology
NYSDEC	New York State Department of Environmental Conservation
PE	Performance Evaluation
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCSR	Quality Control Summary Report
RF	Response Factor
RL	Reporting Limit
RPD	Relative Percent Difference
RRF	Relative Response Factor
RSD	Relative Standard Deviation
RT	Retention Time
SOP	Standard Operating Procedure
TIC	Tentatively Identified Compound
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

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°C	Degrees Celsius
$NaHSO_4$	Sodium Bisulfate
HCL	Hydrochloric Acid
≤	Less than or equal to
≥	Greater than or equal to
±	Plus or minus
%R	Percent Recovery

1 Introduction

This Quality Assurance Project Plan (QAPP) has been prepared by AECOM according to the U.S. Environmental Protection Agency's (USEPA) guidance and requirements for preparing QAPPs (USEPA, 2000, USEPA, 2001) and the New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol (ASP, July 2005) for use in conjunction with the Remedial Action for ERP Site 15 at the Hancock Air National Guard Base (HANGB) located in Syracuse, NY

This QAPP contains quality assurance/quality control (QA/QC) procedures necessary to ensure that analytical data collected in support of the remedial actions for soil and groundwater at ERP Site 15 is of adequate quality to support the data quality objectives (DQOs) and specific project objectives. The remedial action work plan and remedial action field sampling plan (FSP) are companion documents to this QAPP.

1.1 Project Background

Section 1 of the Remedial Action Work Plan provides a discussion of the project background.

1.1.1 Site History and Contaminants

Section 1 of the Remedial Action Work Plan provides a discussion of the site history and contaminants.

1.1.2 Summary of Existing Data

Section 1 of the Remedial Action Work Plan summarizes the existing site data.

1.1.3 Project Scope and Objectives

The RAOs for this project are to (1) prevent exposure to contaminated groundwater containing BTEX concentrations above the NYSDEC Ambient Water Quality Standards and Guidance, (2) prevent or minimize further off-site migration of the contaminant plume (plume containment), (3) prevent or minimize further migration of contaminants from source materials to groundwater (source control); and (4) enhance the natural process for the attenuation of Benzene, toluene, Ethyl benzene, and xylene (BTEX) compounds on-site and off-site.

Analytical results will be used to characterize contamination and assess the progress of the remedial actions in addressing BTEX contamination of the groundwater and smear zone soil. Groundwater and soil samples will be collected and analyzed using the methods specified in Table 6-2 in the FSP.

Target analyte lists, along with reporting limits (RLs), NYSDEC Unrestricted Use Soil Cleanup Objectives(Part 375), NYSDEC Ambient Groundwater Quality Standards (TOGS 1.1.1), and Federal Maximum Contaminant Levels (MCLs) (USEPA, 2010b) for drinking water are presented with each method in Attachment A, Section A.3.

1.2 Overview of QAPP

The body of this QAPP is required reading for all project personnel, including field and laboratory personnel, and is organized as follows:

- Section 1.0 Introduction
- Section 2.0 Data Quality Objectives
- Section 3.0 Project Organization, Responsibilities, and Schedule
- Section 4.0 Documents and Records
- Section 5.0 Sample Handling, Labeling, Shipping, and Custody Requirements
- Section 6.0 Statistical Control Procedures and Quality Control Procedures
- Section 7.0 Assessment and Cversight

- Section 8.0 Data Verification, Review, and Validation
- Section 9.0 References
- Attachment A Analytical Laboratory Procedures

Attachment A is required reading for all laboratory personnel.

Appendix C, Part 1 of the work plan contains the FSP and is required reading for all field personnel.

2 Data Quality Objectives

DQOs are qualitative and quantitative statements that clarify the objectives of response actions, define the appropriate type of data need, and specify the tolerable levels of potential decision errors for the data used to support decisions. The DQO development process used at the HANGB is described in the USEPA Publication QA/G-4, *Guidance for the Data Quality Objectives Process* (USEPA, 2000). DQOs are dynamic elements of the remedial process and may be updated in response to input from the Project Delivery Team (PDT)/stakeholders and availability of new data to guide the data collection for subsequent remedial activities. The DQOs established for this project serve to support the RAOs and are listed below:

- Collect sufficient baseline groundwater analytical data to optimize the design of the groundwater remedial action;
- Collect sufficient baseline soil analytical data to optimize the design of the temporary biosparge system;
- Conduct groundwater monitoring with sufficient frequency to observe changes in concentrations of BEX and geochemical parameters, in order to evaluate the effectiveness of the groundwater and biosparge remedial action and adjust the design and implementation if necessary;
- Collect a sufficient quantity of groundwater analytical data to determine trends in BEX concentrations and demonstrate that the BEX plume is not expanding;
- Collect a sufficient quantity of subsurface soil data to demonstrate that soil in the area treated via temporary biosparge will not act as a source of dissolved-phase BEX contamination in groundwater.

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3 Project Organization, Responsibilities, and Schedule

Project organization, responsibilities, and schedule are presented in Section 4.0 of the FSP.

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4 Documents and Records

The following sections describe the types of documents and records that will be produced for this project.

4.1 Quality Assurance Project Plan

The AECOM project manager shall be responsible for ensuring all project team members, including subcontractors, have the most current version of this QAPP by using the distribution list included at the beginning of the document. Each project team member identified on the distribution shall be required to sign a controlled distribution list to show that they have received the recent version of the QAPP. Upon receipt of the most recent revision of this QAPP, the former version will be returned to the project manager for disposal.

4.2 Information and Records to be Included in Data Report Packages

4.2.1 Electronic Data Deliverable (EDD) and Preliminary Data Requirements

The laboratory shall provide an electronic copy of the chemistry data in a version compatible with the most recent version of ERPIMS. The laboratory must provide complete and correct EDDs no later than one month after receipt of the samples at the laboratory. Data will be submitted to the ANG in ERPIMS format.

Laboratory QC data are to be included in the electronic files. This includes, but is not limited to: MS/MSD, laboratory replicates, blank spikes, and surrogates, as required. The laboratory must provide a cross-reference table of laboratory and field sample numbers in electronic format.

4.2.2 Hard Copy Deliverable Requirements

Full NYSDEC Category B laboratory data deliverables (as appropriate to the corresponding methodology) will be provided by the analytical sub-contractor in accordance with the NYSDEC ASP Exhibit B Reporting and Deliverables Requirements.

- Signed, original copies of chain-of-custody forms.
- A narrative by analytical batch of all occurrences of out of control conditions,
- Complete data packages for all definitive analyses. The data package must include raw data, bench worksheets, chromatograms, and corrective action reports.
- A glossary to define the symbols and terms used in the finalized data package.

4.3 Project Reports

The following reports will be prepared during the course of this project:

- Remedial Action Work Plan, FSP and QAPP;
- Annual Periodic Review Reports;
- Site Management Plan;
- Final Closure Report

4.4 Correction to Documentation

If an error (i.e., incorrect date or sample depth) is made on a document (i.e., borehole log, sample collection form), corrections will be made by crossing through the error with a single line so that the original entry can still be read and entering the correct information. All corrections will be initialed and dated.

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5 Sample Handling, Labeling, Shipping, and Custody Requirements

5.1 Sample Containers

Sample containers shall be purchased pre-cleaned and treated according to USEPA specifications for the analytical methods to be performed. Containers shall be stored in clean areas to prevent exposure to fuels, solvents, and other contaminants.

5.2 Sample Volumes, Container Types, and Preservation Requirements

Sample volumes, container types, and preservation requirements by analytical method are listed in **Table 5-1**.

5.3 Sample Labeling and Identification

All samples, including field QC samples, must be labeled and assigned a unique identifier.

5.3.1 Sample Labeling

Sample labels are required for properly identifying samples and evidence. All samples (i.e., each sample container) must be properly labeled with the label affixed to the container prior to transportation to the analytical laboratory. Information on the sample label should include, but not be limited to, the following:

- Project Code: AECOM, project number, and site name.
- Station Number: A unique identifier assigned to a sampling point by the sampling team.
- Sample Identification: See FSP Section 6.5.3.
- Samplers: Each sampler's name or initials and signature.
- Preservative: Whether a preservative is used and the type of preservative.
- Analysis: The type of analysis requested.
- Date/Time: The date and time the sample was collected.
- Type of Sample: The type of sample should be identified as discrete (grab) or composite.

5.3.2 Sample Identification

A sample identification system is used to uniquely identify each sample (including field QC samples) collected and submitted for analysis. The purpose of the numbering system is to assist in the tracking of samples and facilitate retrieval of analytical results. Sample identification numbers should be used on sample labels, chain-of-custody (CoC) forms, field logbooks, and all other applicable documentation. A listing of all sample identification numbers should be recorded in the field logbook.

Section 6.5.3 of the FSP describes how sample identification numbers will be assigned.

Table 5-1: Sample Container, Volume, Preservation and Holding Time Requirements

Analyte	Analytical Method	Container	Preservative	Volume	Maximum Holding Time
VOCs (Soil)	SW8260B	Glass	None, 4°C	2 oz	14 Days
VOCs (Water)	SW8260B	Glass vial with Teflon® lined septum	HCl, 4°C	3 x 40 mL	14 days

5.4 Sample Chain-of-Custody Procedures

CoC procedures provide documentation of the custody and integrity of the samples beginning at the time of sampling and continuing through transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal. Records concerning the custody and condition of the samples are maintained in field and laboratory records. Records concerning the cleaning of empty sample containers, container shipment from the laboratory to the site, and security of empty containers at the site should also be maintained.

The CoC record serves as a legal record and shall be maintained for all field and field QC samples. A sample is defined as being under a person's custody if any of the following conditions exist: (1) it is in their possession, (2) it is in their view, after being in their possession, (3) it was in their possession and they have locked it up or, (4) it is in a designated secure area.

The following information concerning the sample shall be documented on the CoC form:

- Unique sample identification
- Date and time of sample collection
- Source of sample (including name, location, and sample type)
- Designation of matrix spike/matrix spike duplicate (MS/MSD)
- Preservative used
- Analyses required
- Name of collector(s)
- Pertinent field data (pH, temperature, etc.)
- Serial numbers of custody seals and transportation cases (if used)
- Custody transfer signatures and dates and times of sample transfer from the field to transporters and to the laboratory or laboratories
- Bill of lading or transporter tracking number (if applicable)

In addition to the CoC record, there is also a CoC (custody) seal. The CoC seal is an adhesive seal placed on the shipping container in a location where the seal will be broken if the container is opened. The CoC seal ensures that no sample tampering occurred during shipment of samples from the field to the laboratories. Sample custody procedures are also discussed in 6.6 of the FSP.

5.4.1 Transfer of Custody and Shipment

All sample shipments and transfers, including shipment or transfer between laboratories, must be accompanied by the CoC record. The CoC record must be signed and dated (with time) by the person (i.e., sampler, sample manager, etc.) relinquishing custody of the samples and the person receiving the samples at the laboratory. A copy of the CoC record should be retained in the field records and the laboratory records. Transfer of custody and shipment are also discussed in 6.6 of the FSP.

5.5 Sample Handling and Shipping

Samples collected in the field shall be transported to the laboratory or field testing site as expeditiously as possible. When a 4°C requirement for preserving the sample is indicated, the samples shall be packed in ice to keep them cool during collection and transportation. During transit, it is not always possible to rigorously control the temperature of the samples. As a general rule, storage at low temperature is the best way to preserve most samples. A temperature blank (a volatile organic compounds sampling vial filled with tap water) shall be included in every cooler and used to determine the internal temperature of the cooler upon receipt of the cooler at the laboratory. The laboratory also may use a temperature infrared gun to determine the temperature of individual samples and the cooler. If the temperature of the samples upon receipt exceeds the temperature requirements, the exceedance shall be documented in laboratory records and discussed with the client. The decision regarding the potentially affected samples shall also be documented.

The original CoC record and one copy shall be placed in a plastic bag and secured to the inside lid of the shipping container (i.e., cooler). A copy of the CoC record shall be retained in the field. The original CoC record shall be transmitted to the project chemist after samples are accepted at the laboratories. This copy shall become part of the project file.

Shipping containers (i.e., coolers) must be secured with strapping tape and custody seals. The custody seals must be placed on the container so that it cannot be opened without breaking the seals. The seal must be signed and dated by the field investigator.

If samples are sent by mail, the containers shall be registered with return receipt requested. If sent by common carrier, an air bill shall be used. Receipts from post offices and air bills shall be retained as part of the CoC documentation. Air bill numbers or registered mail serial numbers shall be recorded in the remarks section of the CoC record.

Sample shipments including methanol preserved samples, hazardous waste samples, radioactive samples, etc. may have special handling and shipping requirements. Check local, state, and department of transportation (DOT) regulations and with the carrier regarding shipping of these types of samples. The handling and shipping of samples is also discussed in 6.6 of the FSP.

5.6 Sample Receipt

For the safety of the personnel involved, coolers shall be opened in a hood in case there has been any breakage of containers of potentially contaminated sample material. The laboratory shall check the sample shipment for evidence of tampering and be check sample label information and quantities against information on the CoC form for anomalies. The condition, temperature, and appropriate preservation of samples shall be checked and documented on the CoC form. Checking an aliquot of the sample using pH paper is an acceptable procedure except for VOCs where an additional sample is required to check preservation. All sample information shall then be entered into a tracking system, and unique analytical sample identifiers shall be assigned. A copy of this information shall be reviewed by the laboratory project manager for accuracy. Sample holding time tracking begins with the collection of samples and continues until the analysis is complete. Holding times are specified in Table 5-1.

The laboratory shall report occurrences of any anomalies in the received samples to AECOMs project chemist as soon as possible and no later than one working day. The laboratory shall document the resolution of the anomaly in their laboratory records.

Subcontracted analyses shall be documented on the CoC form. Procedures ensuring internal laboratory CoC shall also be implemented and documented by the laboratory. Specific instructions concerning the analysis specified for each sample shall be communicated to the analysts. Analytical batches shall be created, and laboratory QC samples shall be introduced into each batch.

While in the laboratory, samples shall be stored in limited-access, temperature-controlled areas. Refrigerators, coolers, and freezers shall be monitored for temperature. Acceptance criterion for the temperatures of the refrigerators and coolers is 4°C ± 2°C. Acceptance criterion for the temperatures of the freezers shall be less than 0°C. All of the cold storage areas shall be monitored by thermometers that have been calibrated with a National Institute of Standards and Technology (NIST)-traceable thermometer. As indicated by the findings of the calibration, correction factors shall be applied to each thermometer. Records that include acceptance criteria shall be maintained. Samples for volatile organics determination shall be stored separately from other samples, standards, and sample extracts. Samples shall be stored after analysis until disposed of per applicable local, state, and federal regulations. Disposal records shall be maintained by the laboratory. Refrigerators storing volatile organic compound samples shall contain a blank that shall be analyzed on a regular schedule.

SOPs describing sample control and custody shall be maintained by the analytical laboratories.

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6 Statistical Control Procedures and Quality Control/Quality Assurance Samples

The two general categories of data are defined as: (1) screening data and (2) definitive data.

Screening data are generated by rapid methods of analysis with less rigorous sample preparation, calibration, and/or QC requirements than are necessary to produce definitive data. Sample preparation steps may be restricted to simple procedures such as dilution with a solvent, instead of elaborate extraction/digestion and cleanup. Screening data may provide analyte identification and quantitation, although the quantitation may be relatively imprecise. Physical test methods, e.g., dissolved oxygen measurements, temperature and pH measurements, moisture content, turbidity, conductance, etc., have been designated by definition as screening methods.

Definitive data are generated using rigorous analytical methods, such as approved USEPA reference methods. The data can be generated in a mobile or off-site laboratory. Data are analyte-specific, and both identification and quantitation are confirmed. These methods have standardized QC and documentation requirements. Definitive data are not restricted in their use unless quality problems require data qualification.

6.1 Precision, Accuracy, Representativeness, Completeness, and Comparability

The basis for assessing each of these elements of data quality is discussed in the following subsections.

6.1.1 Precision

Precision measures the reproducibility of measurements. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. *Analytical* precision is the measurement of the variability associated with duplicate (two) or replicate (more than two) analyses. The blank spike (BS) or laboratory control sample (LCS) may be used to determine the precision of the analytical method. If the recoveries of analytes in the BS or LCS are within established control limits, then precision is within limits. In this case, the comparison is not between a sample and a duplicate sample analyzed in the same batch, rather the comparison is between the sample and samples analyzed in previous batches. *Total* precision is the measurement of the variability associated with the entire sampling and analysis process. It is determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations. Field duplicate samples and MSD samples shall be analyzed to assess field and analytical precision. Precision is determined using the relative percent difference (RPD) between the duplicate sample results. The formula for the calculation of precision is provided in **Table 6-1** as RPD. For replicate analyses, the relative standard deviation (RSD) is determined. The formula for the calculation of RSD is provided in **Table 6-1**. Precision requirements for each method are listed in Attachment A.

6.1.2 Accuracy

Accuracy is a statistical measurement of correctness and includes components of random error (variability due to imprecision) and systemic error. It therefore reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard. Accuracy is measured by comparing the percent recovery of analytes spiked into a BS, LCS, MS, or MSD to a control limit. For organic compounds, surrogate compound recoveries are also used to assess accuracy and method performance for each sample analyzed. Analysis of performance evaluation (PE) samples may also be used to provide additional information for assessing the accuracy of the analytical data being produced.

The formula for calculation of accuracy is included in Table 6-1 as percent recovery (%R) from pure and sample matrices. Accuracy requirements are listed for each method in Attachment A.

Table 6-1: Statistical Calculations

Statistic	Symbol	Formula	Definition	Uses
Mean	$\overline{X}$	$\frac{\left(\sum_{i=1}^{n} x_i\right)}{n}$	Measure of central tendency	Used to determine average value of measurements
Standard Deviation	S	$\left(\frac{\Sigma(x_i-\overline{x})^2}{(n-1)}\right)^{1/2}$	Measure of relative scatter of the data	Used in calculating variation of measurements
Relative Standard Deviation	RSD	$(S/\overline{X}) \times 100$	Relative standard deviation, adjusts for magnitude of observations	Used to assess precision for replicate results
Percent Difference	%D	$\frac{x_1 - x_2}{x_1} \times 100$	Measure of the difference of 2 observations	Used to assess accuracy
Relative Percent Difference	RPD	$\left(\frac{(X_1 - X_2)}{(X_1 + X_2)/2}\right) \times 100$	Measure of variability that adjusts for the magnitude of observations	Used to assess total and analytical precision of duplicate measurements
Percent Recovery	%R	$\left(\frac{X_{meas}}{X_{true}}\right) \times 100$	Recovery of spiked compound in clean matrix	Used to assess accuracy
Percent Recovery	%R	$\frac{\left(\begin{array}{c}\text{value of}\\ \text{spiked}\\ \text{sample}\end{array} - \begin{array}{c}\text{value of}\\ \text{unspiked}\\ \text{sample}\end{array}\right)}{\text{Value of added spike}} \times 100$	Recovery of spiked compound in sample matrix	Used to assess matrix effects and total precision

x = Observation (concentration)
n = Number of observations

6.1.3 Representativeness

Objectives for representativeness are defined for each sampling and analysis task and are a function of DQOs. Representativeness shall be achieved through use of standard field, sampling, and analytical procedures. Representativeness is also determined by appropriate program design, with consideration of elements such as proper well locations, drilling and installation procedures, and sampling locations.

6.1.4 Completeness

Completeness is calculated for the aggregation of data for each analyte measured for any particular sampling event or other defined set of samples (e.g. by site). Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not qualified with an "R" flag (see Attachment A for an explanation of flagging criteria). The requirement for completeness is 90 percent. For any instances of samples that could not be analyzed for any reason (holding time violations in which resampling and analysis were not possible, samples spilled or broken, etc.), the numerator of this calculation becomes the number of possible results minus the number of possible results not reported.

The formula for calculation of completeness is presented below:

$$\% \text{ completeness} = \frac{\text{number of valid (i.e., non-R flagged) results}}{\text{number of possible results}}$$

6.1.5 Comparability

Comparability is the confidence with which one data set can be compared to another data set. The number of matrices that are sampled and the range of field conditions encountered are considered in determining comparability. Comparability is achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions, and using standard and comprehensive reporting formats. Complete field documentation using standardized data collection forms shall support the assessment of comparability. Analysis of PE samples and reports from audits shall also be used to provide additional information for assessing the comparability of analytical data produced among laboratories. Historical comparability shall be achieved through consistent use of methods and documentation procedures throughout the project.

6.2 Field and Laboratory Quality Control Samples

The scope and application of this instruction is to describe the standard QC samples that shall be included in the project data collection program to support the DQOs. The QC samples described include field QC and laboratory QC samples used to assess sources of error at each stage of the sampling and analytical process. The entire sequence of sample collection, preservation, storage, and shipment has unique errors associated with it, as do the events that occur in the analytical laboratory. To assess the impact these errors have on the resulting data, a combination of unique field and laboratory QC samples shall be incorporated into the data collection program.

6.2.1 Field Quality Control Samples

Principle elements of sampling and field QA/QC strategy include developing a sound sampling approach based upon the intenced use of the data; using sampling methodologies that allow the collection of representative samples based upon data needs; using sampling devices that minimize the disturbance or alteration to the chemical composition of the media; employing decontamination procedures that reduce cross-contamination potential between sampling points; and using proper sample containers and preservation techniques that maximize the integrity of the samples. The applicability and appropriateness of the field sampling protocol shall be verified by the inclusion the field QC samples listed in **Table 6-2**.

All field QC samples shall be handled exactly as the environmental samples. With the exception of the MS/MSDs and trip blanks, the identity of the field QC samples shall be blind to the laboratories. Each field QC sample shall be assigned a unique sample number as described in FSP Section 6.4.3.

6.2.2 Laboratory Quality Control Samples

Laboratory quality QC samples are used to assess errors in the analytical process. In order to ensure that quality data are continuously produced during all analyses, and to allow compliance review, laboratory QC samples are analyzed to show that analytical results remain reproducible and that the analytical method is actually measuring the quantity of target analytes in each sample with acceptable bias.

Refer to Attachment A for details on laboratory QC samples.

Table 6-2: Field Quality Control Samples

Field QC Sample	Description	Frequency of Collection	Evaluation Criteria
Field Duplicate	A field duplicate sample is a second sample collected at the same location as the original sample. Duplicate samples shall be collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis.	10% of environmental samples per matrix per method	*Water*: RPD ≤ 35% *Soil and Waste*: RPD ≤ 50%
Matrix Spike/ Matrix Spike Duplicate	A MS and MSD are aliquots of sample spiked with known concentrations of all target analytes listed for each method in Attachment A. Spiking shall occur prior to sample preparation and analysis. Each analyte in the MS and MSD shall be spiked at a level less than or equal to the midpoint of the calibration curve for each analyte. Only project samples shall be used for spiking. The MS/MSD shall be designated on the chain of custody.	5% of environmental samples per matrix per method	See evaluation criteria for specific analytes in Attachment A
Trip Blank	VOC sample vials filled with ASTM Type II water or equivalent at the analytical laboratory, shipped with empty VOC sample containers to the sampling site, and shipped back to the laboratory with samples for VOC analysis. Trip blanks shall not be opened in field. Trip blanks shall be analyzed for the same analytes as the VOC samples. Trip blanks are used to assess any potential introduction of cross contamination from sample containers or during the storage or transportation process.	Each cooler containing samples for VOC analysis per method.	Target analytes < method detection limit, with the exception of acetone, toluene, 2-butanone, and methylene chloride.
Ambient Blank	VOC vials filled with ASTM Type II water or equivalent during groundwater and/or surface water sampling events. Ambient blanks will be collected for VOC analysis only. Ambient blanks are used to assess any possible cross contamination due to the ambient environment.	One per event or weekly, whichever is more frequent, per method.	Target analytes < method detection limit, with the exception of acetone, toluene, 2-butanone, and methylene chloride.
Equipment Blank	Made by pouring ASTM Type II water or equivalent on non-dedicated or non-disposable field sampling equipment. The equipment blank shall be collected after the field sampling equipment is decontaminated. Equipment blanks shall not be collected from backhoe buckets, shovels, or sample containers. The EB shall be analyzed for the same methods as the environmental samples. The EB is used to assess the effectiveness of the equipment decontamination procedure.	Daily per equipment type, decontamination event, and method	Target analytes < method detection limit, with the exception of phthalate esters, acetone, toluene, 2-butanone, and methylene chloride.
Temperature Blank	A sample container filled with water and labeled "Temperature Blank." The temperature blank is used by the laboratory to verify the temperature of the sample cooler at the time of laboratory receipt.	One per sample cooler	2 – 6 °C

7 Assessment and Oversight

7.1 Peer Review

Peer review will be performed on all planning documents and final reports before delivery. The documents will be reviewed for technical adequacy, accuracy, compliance with technical procedures, contract and regulatory requirements, and editorial quality. Peer review will be documented as well as acceptance of responses to comments.

7.2 Readiness Review

The Program Manager and QA/QC Manager shall conduct a readiness review before beginning field activities. The review will ensure that all plans have been completed and distributed, permits have been acquired, key personnel have been assigned and field personnel have been adequately trained, equipment is available and calibrated, arrangements have been made for waste disposal, and all possible precautions have been taken to prevent problems.

7.3 Nonconformance and Corrective Action

The following sections describe who will be responsible for taking corrective actions to nonconformances identified during assessments or daily field or labcratory activities.

7.3.1 Field Activities

During the course of this project, it shall be the responsibility of the Project Manager, Field Manager, and field team members to see that all procedures are followed as specified in this QAPP and that measurement data meet the prescribed acceptance criteria. If a problem arises, it is imperative that prompt action be taken to correct the problem. Engineering and scientific calculations will be checked and corrected as required by technical personnel, and normally require no QA reporting. A nonconformance exists if there is a deviation from or noncompliance with contract specifications, the quality assurance program, approved procedures, or this QAPP. A nonconformance can also include major errors in documented analysis, data, or results, and deficiencies in documentation or any other aspect of the project that affects quality.

Personnel who identify a nonconformance should report the condition on a Nonconformance Report (NCR) and distribute the NCR to the Project Manager, and QC Manager. The identification numbers of the samples affected by the nonconformance should be notec on the NCR. The Project Manager and QC Manager shall:

- Review the NCR to determine whether ongoing work should be stopped; the nonconformance involves a major deviation from the contract or QAPP; may significantly impact the cost or schedule of the work; and/or the nonconformance has any impact on previously obtained data or reports submitted to the Client or other organization.
- Notify the Client Project Manager as soon as possible of the nonconformance.
- Note impacts to the project in the remarks section of the NCR and notify in writing all individuals and organizations that may be affected by the nonconformance and resulting data.
- Recommend corrective actions to resolve the nonconformance for review by the Client Project Manager. The approved corrective action will be implemented by appropriate personnel, and reviewed and approved by the Client Project Manager, Project Manager, and QC Manager.
- Ensure return to control by reviewing field activities after corrective actions have been implemented.

7.3.2 Laboratory Activities

Corrective actions shall be dictated by the type and extent of nonconformance. Corrective actions may be initiated and carried out by nonsupervisory staff, but final approval and data review by the laboratory QA Manager and

Project Manager are necessary before reporting any information. All potentially affected data must be thoroughly reviewed for acceptance or rejection.

During the course of this project, it shall be the responsibility of the Laboratory Project Manager to see that all procedures are followed as specified in this QAPP and that measurement data meet the prescribed acceptance criteria. If a problem arises, it is imperative that prompt action be taken to correct the problem. A nonconformance exists if there is a deviation from or noncompliance with contract specifications; the laboratory's quality assurance program, approved methods, or procedures; or this QAPP. A nonconformance can also include major errors in documented analysis, data, or results, and deficiencies in documentation or any other aspect of the project that affects quality.

The Laboratory Project Manager shall prepare a Nonconformance Report (NCR) and distribute the NCR to the Project Chemist as soon as possible and no later than one working day after the nonconformance is identified. The identification numbers of the samples affected by the nonconformance should be noted on the NCR. The Project Chemist and QC Manager shall:

- Review the NCR to determine whether resampling is necessary; the nonconformance involves a major deviation from the contract or QAPP; may significantly impact the cost or schedule of the work; and/or the nonconformance has any impact on previously obtained data or reports submitted to the Client or other organization.
- Notify the Client Project Manager and Project Manager as soon as possible of the nonconformance.
- Note impacts to the project in the remarks section of the NCR and notify in writing all individuals and organizations that may be affected by the nonconformance and resulting data.
- Recommend corrective actions to resolve the nonconformance for review by the Client Project Manager and Project Manager. The approved corrective action will be implemented by appropriate personnel, and reviewed and approved by the Client Project Manager, Project Manager, and QC Manager.
- Ensure return to control by reviewing laboratory activities after corrective actions have been implemented.

8 Data Verification, Review, and Validation

The data verification, review, and validation process ensures and documents the quality of analytical data by verifying analytical data against method and QAPP specifications. The Project Chemist shall verify, review, and validate the data to assess the quality and usability of definitive data according to USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA, 1999) and USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA, 2002). Based on the results of the verification, review, and validation and review process, data are categorized as fully usable, usable as qualified, or rejected.

8.1 Data Verification

The project chemist shall verify that all hard copy data packages received from the analytical laboratory are complete. The project chemist or designee shall verify that hard copy results correspond to electronic copy results for 10 percent of the data.

All hard copy data packages shall be checked to verify that the following items are included:

- Case narrative,
- Result and QC summary sheets,
- Initial and continuing calibrations,
- Method blanks (at least one per analytical batch),
- MS/MSD (one per batch),
- LCS/LCSD (one per analytical batch),
- Duplicate analyses (if applicable),
- Holding times,
- Instrument logs and preparation and extraction bench sheets,
- Linear range calculations (correlation coefficient), and
- Raw data.

8.2 Data Review

The data review process includes reviewing and evaluating 100 percent of the hard copy data for (1) extraction and analysis holding times, (2) surrogate recoveries, (3) reporting limits, (4) field duplicate RPDs, (5) blank detections, (6) LCS/LCSD recoveries and RPDs, (7) initial and continuing calibrations, (8) MS/MSD recoveries and RPDs, (9) instrument tuning and instrument performance, and (10) laboratory duplicate RPDs.

8.3 Data Validation

In addition to the data review described in Section 8.2, data validation includes validating 10 percent of hard copy data (per matrix, per method) through (1) recalculating results starting from raw data, (2) verifying identifications through evaluation of spectra and retention times, and (3) checking for omissions, discrepancies, transcription errors, dilution errors, and conversion errors.

8.4 Data Qualification

Based on the data review and validation, the project chemist shall assign final data validation qualifiers to analytical results on both the hard copy results and in the electronic database. Final data validation qualifiers are based on the letter qualifier recommended in USEPA Functional Guidelines.

8.5 Data Validation Reports

Following data review or validation, the project chemist shall prepare a data validation report (DVR) for each hard copy data package. The DVR shall include a list of the samples and analytical methods included in the hard copy data package, a discussion all data qualifiers assigned, and a list of qualified results. All DVRs shall be peer reviewed.

9 References

NYSDEC, 2005. Analytical Service Protocols, September

United States Environmental Protection Agency (USEPA). 1996. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition, and its first, second, and third updates.

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USEPA. 2000. Guidance for the Data Quality Objective Process, EPA QA/G-4. August.

USEPA. 2001. EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5. March.

USEPA. 2010a. Region III Risk-Based Concentration Table. April.

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Attachment A –
Analytical Laboratory Procedures

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A.0 Introduction

Attachment A contains the instructions for the analytical laboratory to produce data of sufficient quality to meet the project data quality objectives (DQOs), as defined in Section 2.0 of the QAPP. Attachment A and the QAPP combine to form the quality assurance project plan (QAPP) for this project. The analytical laboratory project manager shall be responsible for ensuring that all analytical laboratory personnel working on this project have read and understand the QAPP and Attachment A.

Spectrum Analytical Inc, Agawam, Massachusetts; a New York State Department of Health (NYSDOH) approved laboratory, shall provide analytical services according the New York State Department of Environmental Conservation Analytical Services Protocol (NYSDEC ASP)(2005) and this QAPP. This QAPP contains specific quality control requirements, method modifications, and additional methods not included in the NYSDEC ASP which are necessary to meet DQOs.

A.1 General Laboratory Requirements

The contract lab will adhere to the general laboratory requirements in NYSDEC ASP (2005).

A.2 Laboratory QC Procedures

This section presents quality control (QC) requirements for producing data of known quality that satisfies the DQOs and that meets or exceeds the requirements of the standard methods of analysis. This program provides a mechanism for ongoing control and evaluation of data quality measurements through the use of QC materials.

A.2.1 Analytical Batch QC

Laboratory QC samples (e.g., method blanks, matrix spike [MS], matrix spike duplicate [MSD], and blank spikes [BS] for organics shall be included with environmental samples in each analytical batch. An analytical batch contains up to 20 environmental samples (plus the associated laboratory QC samples) that are similar in composition (matrix) and that are extracted or digested at the same time and with the same lot of reagents and analyzed sequentially on the same instrument. The term analytical batch also extends to cover samples that do not need separate extraction or digestion (e.g., volatile analyses by purge and trap). This analytical batch contains up to 20 environmental samples (plus the associated laboratory QC samples) that are similar in composition (matrix) and analyzed sequentially in the same 12- hour shift on the same instrument. The identity of each analytical batch shall be unambiguously reported with the analyses so that a reviewer can identify the QC samples and the associated environmental samples.

For each analysis fraction, the QC samples for an analytical batch must be processed with the associated samples as a set throughout the analytical procedure. The processing of samples through sequential instruments must not be interrupted by alterations to the instrument such as re-calibration or maintenance.

A.2.1.1 Blank Spikes and Laboratory Control Samples

The BS is used in organic methods and the LCS in metal methods to evaluate each analytical batch and to determine if the method is in control. The BS or LCS cannot be used as the continuing calibration verification.

The BS or LCS is analyte-free water for aqueous analyses or a choice of Ottawa sand, sodium sulfate, or glass beads 1 mm or smaller in diameter for soil spiked with all target analytes listed in the QC acceptance criteria table in Section A.3 for the method. Each analyte in the BS or LCS shall be spiked at a level five to ten times the method detection limit for each target analyte. The BS or LCS shall be carried through the complete sample preparation and analysis procedure.

One BS or LCS shall be included in every analytical batch. If more than one BS or LCS (i.e., a LCS duplicate or BS duplicate) is analyzed in an analytical batch, results from all BSs or LCSs analyzed shall be reported.

The performance of the BS or LCS is evaluated against the QC acceptance limits given in the tables in Section - A.3. Whenever recovery of an analyte in a BS or LCS is below the acceptance limit, corrective action shall be performed. If recovery of an analyte in a BS or LCS is above the acceptance criteria and the analyte is detected in an environmental sample associated with the BS or LCS, corrective action shall be performed. If recovery of an analyte in a BS or LCS is above the acceptance criteria, and the analyte is not detected in any environmental samples associated with the BS or LCS, corrective action is not required.

After the system problems have been resolved and system control has been reestablished, all samples in the analytical batch shall be reprepared and reanalyzed for the out-of-control analyte(s). When an analyte in a BS or LCS exceeds the upper or lower control limit and the corrective action was ineffective, the analytical laboratory shall apply the appropriate validation flag to all affected results, as described in Section A.3.

A.2.1.2 Matrix Spike/Matrix Spike Duplicate

A matrix spike (MS) and matrix spike duplicate (MSD) is an aliquot of sample spiked with known concentrations of all target analytes listed in the QC acceptance criteria table in Section A.3 for the method. The spiking must occur prior to sample preparation and analysis. All target analytes listed in Section A.3 shall be spiked at five to ten times the method detection limit into the MS and MSD. Whenever possible, project samples shall be used for spiking. AECOM shall designate the sample for the MS/MSD on the chain of custody. The MS/MSD is used to document the bias of a method due to sample matrix. Thus, for soil samples, laboratories may use the same container for the parent sample, the MS sample, and the MSD sample (except for VOCs), if there is enough sample. Sample replicates will be generated in the field, to be used by the laboratory to prepare the appropriate MS/MSDs.

A.2.1.3 Surrogates

Surrogates are organic compounds that are similar to the target analyte(s) in chemical composition and behavior in the analytical process, but that are not normally found in environmental samples. Surrogates are used to evaluate accuracy, method performance, and extraction efficiency.

Surrogates shall be added to environmental samples, LCSs, MS/MSDs, calibration standards, and blanks, in accordance with the method requirements.

Whenever a surrogate recovery is outside the acceptance limit specified in Section A.3, corrective action shall be performed in accordance with the NYSDEC ASP Exhibit E.

After the system problems have been resolved and system control has been reestablished, reprepare and reanalyze the sample. If corrective actions are ineffective, the analytical laboratory shall apply the appropriate validation flag to the sample results, as described in Section A.3.

Method blanks must generate surrogate recoveries within the limits specified in Section A.3. Because no matrix effects are possible if the method blank is an analyte free matrix, any deviations must be considered to be due to problems within the laboratory's control. For volatiles, sample analyses shall not proceed on any 12-hour shift until a method blank with acceptable surrogate recoveries is analyzed following the successful tune and calibration.

A.2.1.4 Internal Standards

Internal standards (ISs) are measured amounts of certain compounds added after preparation or extraction of a sample. They are used in an IS calibration method to correct sample results affected by column injection losses, purging losses, or viscosity effects.

ISs shall be added to all environmental samples, QC samples, standards, and blanks, in accordance with the method requirements for Methods SW8260B

IS retention times and areas must be evaluated during or immediately after data acquisition of each analysis run to determine acceptability of the results. For each run to be acceptable, the following criteria must be met:

- IS retention times in each method blank, sample, or shift-ending continuing calibration verification standard (CCV) must vary by no more than 30 seconds for the IS retention times in the successful continuing calibration of that instrument run at the start of the 12-hour shift.
- The Percent Relative Standard Deviation (%RSD) of the areas for each IS in the five initial calibration (ICAL) standards must be ≤ 30%. If more than five standards are used for the ICAL, IS areas from the additional standards shall be included in the average.
- IS areas in the successful CCV at the start of the 12-hour shift must vary by no more than a factor of two in either direction (-50% to +100%) from the average of the IS areas in the five IC standard runs. The beginning CCV must meet this requirement before sample analyses can proceed on that instrument under the 12-hour shift.

- IS areas in each method blank, environmental sample, QC sample, and ending CCV must vary by no more than a factor of two in either direction (-50% to –100%) from the IS areas in the successful CCV on that instrument run at the start of the 12-hour shift.

When the IS results are outside of the acceptance limits, corrective actions must be performed according to the NYSDEC ASP Exhibit E. After the system problems have been resolved and system control has been reestablished, all samples analyzed while the system was malfunctioning must be reanalyzed. If corrective actions are ineffective, the analytical laboratory shall apply the appropriate validation flags to the sample results, as described in Section A.3.

Method Blanks must generate IS responses that meet the specified criteria. Because no matrix effects are possible, any deviation must be due to problems within the laboratory's control. For volatiles, sample analyses shall not proceed on any 12-hour shift until a method blank with acceptable IS responses are analyzed following the successful tune and calibration.

A.2.1.5 Retention Time Window

Retention time (RT) windows are used in GC analysis for identification of analytes. The precision of the absolute RTs for each individual analyte in each of the ICAL standards will be a measure of the confidence by which a compound of concern can be identified.

A.2.1.7 Method Blank

A method blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank shall be carried through the complete sample preparation and analytical procedure and included in every analytical batch. The method blank is used to document contamination resulting from the analytical process.

The method blank for an analytical batch must be analyzed with its associated samples, under the same calibration standards. The following rules apply to the order and frequency of method blank analyses for all analysis fractions:

- For SW8260B, a method blank shall be run on every instrument on every 12-hour shift on which samples are run. The SW8260B method blank shall be run after the successful BFB tune and CCV and before any samples are analyzed.

A method blank shall be considered acceptable when the following conditions are met:

- For method SW8260B, the method blank must contain ≤ five times the method detection limit of methylene chloride, acetone, toluene, and 2-butanone. All other target analytes must be ≤ the method detection limit and there shall be no extraneous peaks greater than 10% of the peak height of the nearest IS peak. All surrogate recoveries and internal standards must meet acceptance criteria.

Corrective action shall be performed to eliminate the source of contamination prior to proceeding with analysis. After the source of contamination has been eliminated, all samples containing the analyte(s) found in the method blank shall be reprepared and reanalyzed.

The analytical laboratory shall not correct for the presence of analytes in blanks. When an analyte is detected in the method blank and in the associated samples and corrective actions are not performed or are ineffective, the analytical laboratory shall apply the appropriate validation flag to the sample results, as described in Section A.3.

Reprocessing is not required for environmental samples that contain the analyte detected in the blank at a concentration greater than 5 times (10 times for common laboratory contaminants such as methylene chloride, acetone, 2-butanone, or bis 2-ethylhexyl phthalate) the blank concentration. Reprocessing also is not required for environmental samples that do not contain the analyte(s) detected in the method blank.

A.2.1.8 Laboratory Duplicates

Duplicate samples are analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis.

Laboratory duplicates shall be analyzed at a minimum of 1 in 20 samples per matrix type per samples extraction or preparation method. Laboratory duplicates are not required if a BS duplicate (BSD) or a MSD are prepared within the analytical batch.

A.2.1.9 Storage Blanks

Storage blanks are a special kind of laboratory blank used specifically to evaluate the conditions under which samples for volatiles analysis are stored for cross-contamination potential.

A storage blank consists of 40 mL of laboratory-prepared distilled/deionized water in a VOC sample vial. The vial is sealed and held in the VOC storage refrigerator for a minimum of 24 hours prior to sample analysis. A storage blank for each separate VOC storage area must be analyzed at least once a week. The analytical results for the storage blank(s) associated with the environmental samples in a given project must be included in the deliverables package as described in the NYSDEC ASP Exhibit E Section 1.5 (NYSDEC 2005).

A.2.2 Quality Control Samples

A.2.2.1 Holding Time Compliance

All sample preparation and analysis shall be completed within the method-required holding times. The holding time for a sample begins at the time of sample collection. Some methods have more than one holding time requirement (e.g., methods SW8082, SW8270C etc.). The preparation holding time is calculated from the time of sample collection to the time of beginning the sample preparation process as described in the applicable method, prior to any necessary extract cleanup and/or volume reduction procedures. If no preparation (e.g., extraction or digestion) is required, the analysis holding time is calculated from the time of sample collection to the time of the beginning of the last analytical runs, including dilutions, second column confirmations, and any required reanalyses. In methods requiring sample preparation prior to analysis, the analysis holding time is calculated from the time of preparation completion to the time of the beginning of the last analytical run, including dilutions, second column confirmations, and any required reanalyses.

If holding times are exceeded and the analyses are performed, the results shall be flagged according to the procedures as described in Section A.3.

A.2.2.2 Confirmation of Positive Results

Quantitative confirmation of results at or above the method detection limit for samples analyzed by GC shall be required, unless otherwise specified for the method in Section A.3, and shall be completed within the method-required holding times.

A second column shall be used for confirmation. All criteria for resolution, calibration, retention time windows, surrogates, and QC samples must be met on both columns. The result with the highest concentration shall be reported.

A.2.2.3 Control Charts

The analytical laboratory shall track the performance of BS, BSD, LCS, LCSD, MS, and MSD recoveries over time for all target analytes. These charts are useful in identifying trends and problems in an analytical method. Updating these charts on an annual basis and reviewing them on a quarterly basis for possible trends that could compromise data quality is required.

A.2.2.4 Analytical Standards Preparation

Analytical standards preparation is described in Exhibit E of the NYSDEC ASP

A.2.3 Method Detection Limits, Reporting Limits, and Instrument Calibration Requirements

A.2.3.1 Method Detection Limits

The method detection limit is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. The analytical laboratory shall establish method detection limits for each method and target analyte required in this project.

The analytical laboratory shall, at a minimum, perform method detection limit studies for during initial method and instrument set-up and whenever the basic chemistry of the procedures is changed. The method detection limits shall be preparatory method-specific and include any cleanup methods used. Method detection limits shall be established for all target analytes in an interference-free matrix (reagent water for aqueous samples and a purified solid matrix for solid samples). The laboratory shall determine Method detection limits using procedures presented in 40 CFR, Part 136, Appendix B.

The validity of the method detection limit study, the method detection limit shall be verified per CFR requirements by comparing the actual analyte concentrations in the standard solution to the calculated method detection limit. If the analyte concentrations are below the calculated method detection limit or greater than 10 times the calculated method detection limit, an unacceptable bias may be induced and the method detection limit study shall be repeated at a higher or lower concentration, as appropriate.

The laboratory also shall verify the validity of the calculated method detection limit by analyzing a method detection limit check sample (an interference-free matrix) with all target analytes at about 2 times the calculated method detection limit. The method detection limit check sample shall be taken through all the preparatory and determinative steps used to establish the calculated method detection limit. If any of the target analytes are not detected in the method detection limit check sample, then the concentration of analytes in method detection limit check sample shall be increased and the analysis repeated until the all target analytes are detected. The detectable target analyte concentrations shall then be used in lieu of the calculated method detection limit as method detection limits.

The analytical laboratory shall then demonstrate continued method detection capability by analyzing the method detection limit check sample on a quarterly basis, in lieu of the annual method detection limit study, and after major instrument maintenance.

A.2.3.2 Reporting Limits

The RL is the threshold value for reporting quantitative results. A not detected result shall be reported as "less than the RL" and qualified with a "U" flag.

Target analytes, which are detected between the method detection limit and the RL, shall be reported with a "J" flag to indicate the value is an estimate.

Method detection limits and RLs shall be adjusted for dilutions, percent moisture, and other sample actions.

No results shall be reported below the method detection limit.

Ideally, the RL for a target analyte should be at least 3 times the analytical laboratory's method detection limit for that target analyte. The laboratories shall also verify RLs by including a standard at or below the RL as the lowest point on the calibration curve.

Section A.3 contains RLs for target analytes.

A.2.3.3 Instrument Calibration

Analytical instruments shall be calibrated in accordance with the analytical methods. All target analytes listed in Section A.3 shall be present in the ICAL, ICV, and CCVs and these calibrations shall meet the acceptance criteria specified in Section A.3. All reported results shall be within the calibration range, with the exception of estimated results between the method detection limit and the RL. Results outside the calibration range are unsuitable for quantitative work and will only give an estimate of the true concentration. Records of standard preparation and instrument calibration shall be maintained. Records shall unambiguously trace the preparation of standards and their use in calibration and quantitation of sample results.

All calibration criteria shall satisfy SW-846 requirements at a minimum. The initial calibration shall be checked at the frequency specified in the method using materials prepared independently of the calibration standards. Multipoint calibrations shall contain the minimum number of calibration points specified in the method with all points used for the calibration being contiguous. If more than the minimum number of standards is analyzed for the initial calibration, all of the standards analyzed shall be included in the initial calibration, with the following exceptions:

- A standard that has been statistically determined as being an outlier can be dropped from the calibration, providing the requirement for the minimum number of standards is met.

- A standard at the low or high end of the calibration may be dropped from the calibration as long as the there is a calibration standard at or below the RL for each analyte and the requirement for the minimum number of standards is met.

Acceptance criteria for the calibrations are presented by method in Section A.3.

Analyte concentrations are determined with relative response factors (RRFs) or response factors (RFs). For gas chromatography (GC) and gas chromatography/mass spectroscopy (GC/MS) methods, when using RRFs or RFs to determine analyte concentrations, the RRF or RF from beginning CCV shall be used (or the middle ICAL standard if the ICAL performed in the same 12-hour shift as the samples). The CCV shall not be used to update the RRFs or RFs from the ICAL. The CCV cannot be used as the BS or LCS. In addition, the concentration used for the CCV sample shall be at or below the middle of the calibration curve. Finally, the lowest calibration standard must be at or below the RL for each target analyte listed by method in Section A.3.

A.3 Analytical Methods

Table A.3-1 contains brief descriptions of preparation methods and Table A.3-2 outlines the analytical procedures presented in the subsections.

The following subsections contain requirements for each analytical method. Each subsection contains the following information:

- A brief method description
- A table of target analytes and RLs
- A table of QC acceptance criteria
- A table of calibration procedures, QC procedures, and data validation guidelines

This information was obtained from the *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (USEPA SW-846, Third Edition, and its first, second and third update).

A.3.1 Method SW8260B – Volatile Organics

Volatile (or purgeable) organics in water and soil samples are analyzed using method SW8260B. This method uses a capillary column GC/mass spectrometry technique. Volatile compounds are introduced into the GC by purge and trap (SW5030B or SW5035A) or other approved method. An inert gas is bubbled through the water samples (or a soil-water slurry for soil samples) to transfer the purgeable organic compounds from the liquid to vapor phase. The vapor is then swept through a sorbent trap where the purgeable organics are trapped. The trap is backflushed and heated to desorb the purgeable organics onto a capillary GC column where they are separated and then detected with a mass spectrometer. Table A.3.3-1 presents target analytes and RLs for this method.

Calibration—The mass spectrometer is tuned daily to give an acceptable spectrum for BFB. The tuning acceptance criteria are given in the following list as an ion abundance for each specified mass:

- mass 50 8 percent to 40 percent of mass 95
- mass 75 30 percent to 66 percent of mass 95
- mass 95 base peak, 100 percent relative abundance
- mass 96 5 percent to 9 percent of mass 95
- mass 173 less than 2 percent of mass 174
- mass 174 50 percent to120 percent of mass 95
- mass 175 4 percent to 9 percent of mass 174
- mass 176 93 percent to 101 percent of mass 174
- mass 177 5 percent to 9 percent of mass 176

The IS method is used for quantitation of analytes of interest. For quantitation, RFs are calculated from the base ion peak of a specific IS added to each calibration standard, blank, QC sample, and sample. Tables B.3.6-2 and B.3.6-3 present calibration, QC, corrective action, and data flagging requirements.

Table A.3-1: Preparation Methods

Preparation Method Number	Title	Description
SW1311	Toxicity Characteristic Leaching Procedure	Method SW1311 is used to prepare samples for determination of the concentration of organic (semivolatile and volatile) and inorganic constituents that are leachable from waste or other material. QC is accomplished by preparing a TCLP blank at a rate of one blank for every 20 extractions conducted in the extraction vessel. Additional extract is prepared so one MS is performed for each waste type (samples of similar waste types shall be batched together). One MS must be analyzed in each analytical batch.
Purgeable Organics Preparation Methods		
SW5030B	Purge and Trap for Volatile Organic Compounds	Method SW5030B describes sample preparation and extraction for the analysis of VOCs. This method is applicable to aqueous samples and soil / sediment extracts. An inert gas is then bubbled through the sample solution at ambient temperature to transfer the volatile components to the vapor phase. The vapor is swept through a sorbent column where the volatile components are trapped. After purging is completed, the sorbent column is heated and backflushed with inert gas to desorb the components onto a GC column.
SW5035A	Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples	Method SW5035A describes sample preparation and extraction for the analysis of VOCs in solid matrices. The method involves a heated purge of volatile components followed by analysis on a GC or GC/MS. Several sample preservation options are given in the method. Analyzing the sample unpreserved within the prescribed 48 hour holding time is the preferred option. If this is not possible, an appropriate preservation option must be chosen.

Table A.3-2: Definitive Analytical Methods

Analytical Method	Parameter	Applicable Preparation Methods
SW8260B	Volatile Organics (water and soil)	SW5030B, SW5035A

Table A.3-3: Target Analytes and RLs for Method SW8260B

Analyte	RL	MCL	NYSDEC Ambient Groundwater Standards	Unit	RL	NYSDEC Unrestricted Use Recommended Soil Cleanup Objectives	Unit
Benzene	1	5	1	µg/L	5	60	µg/kg
Ethylbenzene	1	700	5	µg/L	5	1,000	µg/kg
Total xylene	1	10,000	5	µg/L	5	1,600	µg/kg

RL = Reporting Limit

Table A.3-4: Acceptance Criteria for Method SW8260B

Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)	Assoc. IS
Benzene	76-127	≤ 30	70-130	≤ 30	2
Ethylbenzene	70-130	≤ 30	70-130	≤ 30	2
Methyl t-butyl ether (MTBE)	70-130	≤ 30	70-130	≤ 30	2
m,p-Xylene	70-130	≤ 30	70-130	≤ 30	2
o-Xylene	70-130	≤ 30	70-130	≤ 30	2
Toluene	76-125	≤ 30	70-130	≤ 30	2
Total xylene					
Surrogates:					
Toluene-D8	88-119		84-138		2
4-Bromofluorobenzene	86-115		59-113		3
1,2-Dichloroethane-D4	76-114		70-121		1
Internal Standards:					
1,4-difluorobenzene					1
Chlorobenzene-D5					2
1,4-Dichlorobenzene-D4					3

Table A.3-5: Summary of Calibration and QC Procedures for Method SW8260B

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
Method detection limit Study	At initial set-up and subsequently once per 12-month period or quarterly method detection limit verification checks.	Ideally, established method detection limits should be ≤ 1/3 the RL in Table A.3.2-1. See 40 CFR 136B. Verification checks must produce a response at least 3 times greater than the instrument's noise level.	Run method detection limit verification check at higher level and set a higher method detection limit or reconduct method detection limit study.	Samples must not be analyzed without a valid method detection limit.
BFB Tuning	Daily prior to calibration and every 12 hours	Refer to CLP SOW for specific ion criteria	Retune instrument and verify. Rerun affected samples	Apply R flag to all results.
Minimum Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	Average RRF for all analytes ≥ 0.10 RSD for each analyte ≤ 30% %RSD for each internal standard in the five ICAL standards ≤ 30%	Correct problem then repeat initial calibration	An acceptable ICAL is mandatory before sample analysis may proceed.
Continuing Calibration verification (CCV) for all analytes	Immediately following successful BFB tune for each 12-hour shift and	RRF for all analytes ≥ 0.10 %D for each analyte ≤ 25% Area for each internal standard -50% to +100% of average internal standard area from ICAL.	Correct problem then repeat CCV once. If that fails, repeat initial calibration.	An acceptable CCV is mandatory before sample analysis may proceed.
Ending CCV	Immediately following analysis of last sample or t the end of each 12-hour shift, whichever is sooner.	RRF for all analytes ≥ 0.10 %D for each analyte ≤ 25%, four target analytes may be ≤ 50%	Correct problem then repeat CCV once. If that fails, repeat initial calibration and reanalyze all samples since last successful calibration verification.	J for positive results UJ for nondetects. If D > 50%, R all results.
Internal Standards (IS)	All and environmental and QC samples and ending CCV	Retention time ± 30 from retention time of the beginning CCV EICP area within -50% to 100% of CCV	See NYSDEC ASP	For analytes associated with the IS, apply a J flag to all positive results and a R flag to all nondetected results.

Table A.3-5: Summary of Calibration and QC Procedures for Method SW8260B (Continued)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
Method blank	One per analytical batch and one per every instrument for each 12-hour shift	No analytes detected ≥ method detection limit, with the exception of methylene chloride, acetone, toluene, and 2-butanone which may not be ≥ 5 x method detection limit No extraneous peaks > 10% the peak height of the nearest internal standard.	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) above ≥ method detection limit in all samples in the associated analytical batch
Storage blank	Once per week for each VOC sample storage area.	No analytes detected ≥ method detection limit, with the exception of methylene chloride, acetone, toluene, and 2-butanone which may not be ≥ 5 x method detection limit No extraneous peaks > 10% the peak height of the nearest internal standard.	NA	Apply B to all results for the specific analyte(s) above ≥ method detection limit in all samples in the associated analytical batch
BS for all analytes	One BS per analytical batch	QC acceptance criteria, Table A.3.3-2	Correct problem then re-inject BS and associated samples If still out, reprep and reanalyze the BS and all samples in the affected analytical batch	in all samples in the associated analytical batch; if the BS %R > UCL, apply J to all positive results if the BS %R < LCL, apply J to all positive results, apply UJ to all non-detects if the BS %R < 10%, apply R to all non-detects.
Surrogate spikes	All environmental and QC samples	QC acceptance criteria, Table A.3.3-2	See NYSDEC ASP	if the %R > UCL, apply J to all positive results if the %R < LCL, apply J to all positive results, apply UJ to all non-detects if the %R < 10%, apply R to all non-detects.

Table A.3-5: Summary of Calibration and QC Procedures for Method SW8260B (Continued)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
MS/MSD	One MS/MSD per analytical batch. MS/MSD should be performed on project sample.	QC acceptance criteria, Table A.3.3-2	None	in all samples in the associated analytical batch; if the MS and MSD %R > UCL, apply J to all positive results if the MS and MSD %R < LCL, apply J to all positive results, apply UJ to all non-detects if the RPD > CL, apply J to all positive results. if the MS and MSD %R < 10%, apply R to all non-detects.
Tentatively Identified Compounds (TICs)	Each sample and method blank	See NYSDEC ASP	NA	Apply J to results
Results reported between method detection limit and RL	None	None	None	Apply J to all results between method detection limit and RL

a. All corrective actions associated with the project shall be documented, and all records shall be maintained by the laboratory.

b. Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

NA = Not Applicable

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B

Appendix B.
Anticipated Project Schedule

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Remedial Design/Remedial Action Project Schedule
Site 15, Hancock ANG Base, Syracuse, NY
Schedule

ID	Task Name	Duration	Start	Finish
1	Contract Award Date	783 days	Thu 4/14/11	Mon 4/14/14
2	Regulatory meetings/Kick-off meeting	1 day	Mon 5/16/11	Mon 5/16/11
3	Final Remedial Design Work Plan	2 days	Tue 9/20/11	Wed 9/21/11
4	Baseline Groundwater Sampling	4 days	Mon 10/3/11	Thu 10/6/11
5	Biosparge System Installation, Startup	246 days	Mon 10/10/11	Mon 9/17/12
6	System Installtion	15 days	Mon 10/10/11	Fri 10/28/11
7	System Startup	15 days	Mon 10/31/11	Fri 11/18/11
8	Operation, Maintenance & Monitoring	250 days	Mon 10/10/11	Fri 9/21/12
9	Calcium Peroxide Injections	270 days	Mon 4/23/12	Fri 5/3/13
10	1st Round Injections	10 days	Mon 4/30/12	Fri 5/11/12
11	2nd Round Injections	10 days	Mon 9/24/12	Fri 10/5/12
12	3rd Round Injections	10 days	Mon 3/25/13	Fri 4/5/13
13	Groundwater Monitoring	640 days	Mon 8/29/11	Fri 2/7/14
14	1st Quarter Groundwater sampling	5 days	Mon 2/27/12	Fri 3/2/12
15	2nd Quarter Groundwater sampling	5 days	Mon 5/28/12	Fri 6/1/12
16	3rd Quarter Groundwater sampling	5 days	Mon 8/27/12	Fri 8/31/12
17	4th Quarter Groundwater sampling	5 days	Mon 3/11/13	Fri 3/15/13
18	1st Semi-Annual Groundwater sampling	5 days	Mon 11/26/12	Fri 11/30/12
19	2nd Semi-Annual Groundwater sampling	5 days	Mon 5/27/13	Fri 5/31/13
20	3rd Semi-Annual Groundwater sampling	5 days	Mon 11/25/13	Fri 11/29/13
21	Site Management Plan	45 days	Mon 9/24/12	Fri 11/23/12
22	Reporting	560 days	Mon 10/29/12	Fri 12/19/14
23	Periodic Review Report 2012	30 days	Mon 7/2/12	Fri 8/10/12
24	Periodic Review Report 2012	30 days	Mon 6/3/13	Fri 7/12/13
25	Periodic Review Report 2013	30 days	Mon 12/2/13	Fri 1/10/14
26	Final Closure Report	60 days	Mon 1/13/14	Fri 4/4/14

Project: JP 8 Investigation Interim Acti
Date: Tue 9/20/11

Task | Progress | Summary | External Tasks | Split
Split | Milestone | Project Summary | External MileTask

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C

Appendix C.
Health and Safety Plan

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National Guard Bureau
Contract No. DAHA92-02-D-0012
Task/Delivery Order No. 93

S3NA-209-TP1 HEALTH AND SAFETY PLAN

Site 15 Remediation
New York Air National Guard
Hancock Field
Syracuse, NY 13211-7099

Prepared for:

NGB/A7OR
Shepperd Hall
3501 Fetchet Avenue
Joint Base Andrews, MD 20762-5157

Prepared by:

AECOM
675 North Washington Street, Suite 300
Alexandria, VA 22314

Health and Safety Plan Expiration Date: August 2012

Project No: 60214697

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Project Health and Safety Plan

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

By signing below, I acknowledge that I have reviewed and hereby approve the HASP for the New York Air National Guard (NYANG) Hancock Field Site 15 Remediation. This HASP has been written for the exclusive use of AECOM, its employees, and subcontractors. The plan is written for specified site conditions, dates, and personnel, and must be amended if these conditions change.

Prepared by:

Matt Scharf
Environmental Engineer
703-706-9408

Date

Concurrence by:

Sean Liddy, ASP, CHST
District H&S Manager
410-869-6164

August 12, 2011
Date

Aklile Gessesse, P.G.
Project Manager
703-706-9410

Date

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EXECUTIVE SUMMARY

The purpose of this Health and Safety Plan (HASP) is to address health and safety concerns related to AECOM managed activities at Site 15 at the NYANG facility at Hancock Field in Syracuse, NY. The specific roles, responsibilities, authority, and requirements as they pertain to the safety of employees and the scope of services are discussed herein. The document is intended to identify known potential hazards and facilitate communication and control measures to prevent injury or harm. Additionally, provisions to control the potential for environmental impact from these activities are included where applicable.

<table>
<tr><th colspan="6">SUMMARY TABLE</th></tr>
<tr><td colspan="2">AECOM SOW</td><td colspan="4">AECOM will be implementing remedial actions to address soil and groundwater contaminated with benzene, ethylbenzene and xylenes (BEX). Soil and groundwater will be treated using biosparging and calcium peroxide injections, respectively. Major tasks associated with the remedial actions include soil sampling, well installation, groundwater sampling and direct-push calcium peroxide injections.</td></tr>
<tr><td colspan="2">Zebra Environmental</td><td colspan="4">Zebra Environmental has been subcontracted to conduct soil sampling, biosparge well installation, and calcium peroxide injections using direct-push technology.</td></tr>
<tr><td colspan="2">HCI Technologies, LLC.</td><td colspan="4">HCI Technologies, LLC has been subcontracted to extend electrical service from an existing power source at the NYANG facility to the biosparge system at Site 15.</td></tr>
<tr><td colspan="6">PRIMARY PHYSICAL HAZARDS</td></tr>
<tr><td>x</td><td>Underground Utilities</td><td>x</td><td>Traffic Control</td><td>x</td><td>Electrical Hazards</td></tr>
<tr><td>x</td><td>Overhead Utilities</td><td>x</td><td>Slips, Trips/Walking Surface</td><td></td><td>Excavation & Trenching</td></tr>
<tr><td>x</td><td>Drill Rig Operations</td><td>x</td><td>Manual Lifting</td><td></td><td>Working adjacent to Railway</td></tr>
<tr><td colspan="6">CHEMCIAL HAZARDS, MONITORING, ACTION LEVELS</td></tr>
<tr><td colspan="2">COC</td><td colspan="2">MONITORING</td><td colspan="2">ACTION LEVELS</td></tr>
<tr><td colspan="2">BTEX</td><td colspan="2">PID with 10.6eV</td><td colspan="2">Upgrade to Level C at 1 ppm for Benzene</td></tr>
</table>

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

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ATTACHMENTS

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FIGURES

TABLES

1 INTRODUCTION

This Health and Safety Plan (HASP) (including Attachments A-D) provides a general description of the levels of personal protection and safe operating guidelines expected of each employee or subcontractor associated with the environmental services being conducted at Site 15, located at the NYANG facility at Hancock Field in Syracuse, NY. This HASP also identifies chemical and physical hazards known to be associated with the AECOM-managed activities addressed in this document.

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

1.1 GENERAL

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

1.2 PROJECT POLICY STATEMENT

AECOM is committed to protecting the safety and health of our employees and meeting our obligations with respect to the protection of others affected by our activities. We are also committed to protecting and preserving the natural environment in which we operate. The safety of persons and property is of vital importance to the success of this project and accident prevention measures shall be taken toward the avoidance of needless waste and loss. It shall be the policy of this project that all operations be conducted safely. Onsite supervisors are responsible for those they supervise by maintaining a safe and healthy working environment in their areas of responsibility, and by fairly and uniformly enforcing safety and health rules and requirements for all project personnel. Subcontractors shall comply with the requirements of this HASP, provisions contained within the contract document and all applicable rules, requirements and health, safety and environmental regulations. All practical measures shall be taken to promote safety and maintain a safe place to work. Contractors are wholly responsible for the prevention of accidents on work under their direction and shall be responsible for thorough safety and loss control programs and the execution of their own safety plans for the protection of workers.

1.3 REFERENCES

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

- Title 29, Part 1910 of the Code of Federal Regulations (29 CFR 1910), *Occupational Safety and Health Standards* (with special attention to Section 120, *Hazardous Waste Operations and Emergency Response*).
- Title 29, Part 1926 of the Code of Federal Regulations (29 CFR 1926), *Safety and Health Regulations for Construction.*

  National Institute for Occupational Safety and Health (NIOSH)/OSHA/U.S. Coast Guard (USCG)/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, Publication No. 85-115, 1985.

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2 SITE INFORMATION AND SCOPE OF WORK

AECOM will conduct environmental services at Site 15. Work will be performed in accordance with the applicable Statement of Work (SOW) and associated Project Work Plan developed for project site. Deviations from the listed SOW will require that a Safety Professional review and changes made to this HASP, to ensure adequate protection of personnel and other property.

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

2.1 SITE INFORMATION

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

2.1.1 General Description

Site 15 is located at the former petroleum, oil, and lubricant (POL) storage area at the NYANG facility at Hancock Field. The Site is approximately 2.5 acres and area and is comprised primarily of cleared, open land on the Base and open and wooded land in the off Base portions of the Site. The terrain at the Site is generally flat. East Molloy Road bisects the Site in the east-west direction. The off Base portion of the Site is situated on a golf course and commercial and industrial properties.

2.1.2 Site Background/History

Site 15 was formerly used for storage of jet propulsion (JP)-4 and JP-8 military aviation fuels. The facility consisted of a 215,000-gallon aboveground storage tank (AST), The Site was contaminated by numerous releases of JP-4 and JP-8 as well as PCBs. Site 15 was listed as a Class 2 site on the NYS Inactive Hazardous Waste Disposal Site Registry in 1994 as Site Number 734054. PCBs identified at the site have been successfully remediated.

2.1.3 Previous Investigations

Investigations and remediation have been conducted at Site 15 since 1990. The most significant remedial activities consisted of the excavation and off-site disposal of a total of 8,250 tons of petroleum contaminated soil in removal actions conducted in 2003 and 2009. A pilot study was conducted in 2009 to assess the effectiveness of calcium peroxide injections in remediating dissolved-phase BEX contamination in groundwater. As of the most recent groundwater monitoring event, conducted in October 2010, BEX was detected at concentrations in excess of the New York State Department of Environmental Control (NYSDEC) standards in 6 of 30 monitoring wells at the Site. The maximum detected concentrations of BEX compounds in groundwater during the October 2010 monitoring event are presented in Table 2-1, as well as maximum historic detections of BEX compounds in Site soils following the 2008 removal action.

Table 2-1: Previous Investigation Data

Contaminants	Soil (mg/kg)	Groundwater (ug/l)
Benzene	0.46	26
Ethylbenzene	19	100
Xylenes (Total)	18	92

2.2 SCOPE OF WORK

AECOM will be conducting remedial activities to address dissolved-phase BEX contamination in Site 15 groundwater and residual soil contamination in the vadose zone in the source area for dissolved-phase BEX contamination. Groundwater remediation will be accomplished via injection of calcium peroxide. Soil

remediation will be performed by biosparging. Direct-push soil sampling will be performed to characterize the extent of soil contamination prior to installation of the biosparge system and to assess the performance of the system once it is operational. Groundwater monitoring will be conducted to evaluate the effectiveness of the calcium peroxide injections in addressing dissolved-phase BEX contamination.

2.2.1 Mobilization/Demobilization

Mobilization and demobilization represent limited pre and post-task activities. These activities include driving to and from the site; initial site preparations, such as trailer and toilet facilities setup; and post-work activities, such as removing files and office equipment and general housekeeping. This activity does not represent any intrusive activities. Electrical hook-up and disconnect for office trailers must be performed by a licensed electrical subcontractor.

2.2.2 Site Preparation

Site preparation includes construction and maintenance of temporary access roads and construction area entrances, installation of silt fence around the perimeter of disturbance areas, and installation of berms to facilitate the use of existing drainage features and structures. Other pre-work activities, such as the stockpiling of backfill materials, utility mark-out and clearance, and the set-up of other work support related items are included as well. Other site preparation activities will include the verification of utility mark-outs and presence of the clear dig permits (on-site). All utility clearance shall be obtained by the authorizing authority for the subject site. If utility locations cannot be verified on-site by the public authority, then a private utility location contractor may need to be utilized to confirm/deny the presence of private underground utilities on the site. Typically lead time is 3 days and the permits generally valid for 10. Consult the specific clearance dates associated with the permit obtained for the site.

2.2.3 Groundwater Sampling

This activity will include the collection of groundwater samples from existing monitoring well network of 30 wells. Groundwater samples will be collected through low-flow sampling techniques using submersible pumps as well as passive diffusion bags (PDBs). The major activities involved with collecting groundwater samples from the site and surrounding properties include the following:

- Pre-sampling event notifications and approval;
- Set-up for sampling activities;
- Groundwater samples from monitoring wells will be collected low-flow sampling techniques;
- Sample prep and sample shipping. and;
- Administrative activities.

2.2.4 Soil Sampling

Soil samples will be collected using direct-push technology (DPT). During sampling activities, appropriate air monitoring will be conducted and the appropriate chemical resistant PPE will be worn to protect against exposure. The major activities involved with collecting samples from the site and surrounding properties include the following:

- Pre-sampling event notifications and approval
- Set-up for sampling activities
- Soil samples will be collected using DPT.
- Sample prep and sample shipping
- Administrative activities

2.2.5 Temporary Boring and Well Installation Oversight

AECOM personnel will be performing oversight for the installation of temporary injection points using DPT and biosparge wells using hollow-stem auger (HSA) drilling methods. A drilling subcontractor (Zebra Environmental) will be utilized for the installation of biosparge wells to a predetermined depth utilizing an HSA drill rig. Zebra will also perform injections of calcium peroxide injections for treatment of the dissolved-phase BEX plume. The major activities involved with installation of wells and temporary injection points are as follows:

- Pre-sampling event notifications and approval;
- Set-up for boring/well installation;
- Monitor air quality in the workers breathing zone;
- Log soils and screen with a PID, and;
- Administrative activities.

2.2.6 Operations and Maintenance of Biosparging System

AECOM personnel will conduct operation and maintenance activities at the Site 15 biosparging system for the remediation of BEX impacted soil. Activities include blower/line repair and replacement, well head checks, flow measurements and measurement of oxygen levels within biosparge wells. O&M activities will be performed by a technician from the Syracuse, NY AECOM office.

2.2.7 Investigative-Derived Waste (IDW) Management

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

2.2.8 Equipment Decontamination

AECOM and subcontractor personnel will perform decontamination of equipment used to perform work within controlled work areas.

Before any drilling is begun, and at the completion of drilling, the drilling subcontractor shall decontaminate the drill rig, casing, samplers, and all other drilling equipment that will be used on site. The drilling subcontractor shall provide a high-pressure steam cleaner for decontamination of all downhole drilling equipment. The drill rig shall be steam-cleaned between drilling at each site. Soil sampling equipment shall be decontaminated between each use, using a phosphate free detergent and potable water in accordance with ASTM D 5088. The drilling subcontractor shall construct a temporary decontamination pad to contain all decontamination water generated during decontamination of drill rigs and tools.

Pre-cleaned and dedicated sampling materials/equipment will be used to collect the soil and groundwater samples for laboratory analysis. After the samples are collected, any disposable, or one-time use equipment (tubing, bladders) will placed in a plastic bag for disposal per accordance with the paragraph above. Non-disposable sampling and drilling equipment that contacted the soil and/or groundwater will be decontaminated between each sampling location. Gross sediments and/or contamination will first be removed from the sampling and drilling equipment. The equipment will then be washed with DI water and Alconox detergent and then rinsed with DI water, methanol, etc.

2.2.9 Site Restoration

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

2.2.10 Additional Work Operations

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

3 HAZARD ASSESSMENT (SAFETY)

3.1 PHYSICAL HAZARDS

The following physical hazards are anticipated to be present on the site. Additional hazards may be noted on the THA's developed for the individual tasks.

3.1.1 Slips, Trips, Falls, and Protruding Objects

A variety of conditions may exist that may result in injury from slips, trips, falls, and protruding objects. Slips and trips may occur as a result of wet, slippery, or uneven walking surfaces. To prevent injuries from slips and trips, always keep work areas clean; keep walkways free of objects and debris; and report/clean up liquid spills. Special care should be taken during late fall through early spring, as persistent subfreezing temperatures, snow and ice will result in additional slip hazards at the Site. Walkways/work areas should be kept clear of snow and ice melt, salt, and sand should be employed to melt ice and provide additional traction. Serious injuries may occur as a result of falls from elevated heights. Always wear fall protection while working at heights of 6 feet or greater above the next lower level. Protruding objects are any object that extends into the path of travel or working area that may cause injury when contacted by personnel. Always be aware of protruding objects and when feasible remove or label the protruding object with an appropriate warning.

3.1.2 Housekeeping

During site activities, work areas will be continuously policed for identification of excess trash and unnecessary debris. Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal. At no time will debris or trash be intermingled with waste PPE or contaminated materials. Additional information on the requirements of housekeeping can be found in S3NA 307 PR, *Housekeeping, Worksite.*

3.1.3 Manual Lifting

Most materials associated with investigation and remedial activities are moved by hand. Examples of items that may pose hazards associated with lifting include buckets and drums of purge or decontamination water or soil cuttings, bags of sand, bentonite, or concrete, piping, toolboxes and equipment. The human body is subject to severe damage in the forms of back injury, muscle strains, and hernia if caution is not observed in the handling process. Whenever possible, use mechanical assistance to lift or move materials and at a minimum, use at least two people to lift, or roll/lift with your arms as close to the body as possible. For additional requirements, refer to S3NA 308 PR, *Manual Lifting* and S3NA 308 WI, *Manual Lifting Safe Work Practices.*

3.1.4 Utilities

Various forms of underground/overhead utility lines or pipes may be encountered during site activities. Prior to the start of intrusive operations, utility clearance is mandated, as well as obtaining authorization from all concerned public utility department offices. Prior to the initiation of digging, drilling or trenching, AECOM will complete Air Force Form AF103 to obtain clearance of NYANG owned/maintained utilities. AECOM and/or the Subcontractor performing the intrusive work will also notify Dig Safe New York to coordinate marking of public utilities. AECOM will maintain all utility markings in work areas using the appropriate colors of paint and flags until intrusive work has been completed. If insufficient data is available to accurately determine the location of the utility lines, AECOM will hand clear to a depth of at least 5 feet below ground surface in the proposed areas of subsurface investigation. Should intrusive operations cause equipment to come into contact with utility lines, the SSO and an AECOM SH&E Professional will be notified immediately. Work will be suspended until the applicable utility agency is contacted and the appropriate actions for the particular situations can be taken. The phone number for the applicable state agency is provided in the Emergency Contacts list found in Section 8. For additional requirements, refer to S3NA 417 PR, *Utilities Underground.*

Ensure backhoe operator, truck drivers, etc. and signal person are aware of overhead power lines when working around overhead power lines. Overhead power and utility lines may be present on, or adjacent to, the site and represent a potential hazard during the mobe/demobe of equipment and supplies. Maintain a minimum of 10 feet between overhead power lines and the bucket and/or arm of the backhoe bed/cab of trucks, etc. Any deviation

must be approved by the Regional Health & Safety Manager. Additional information on working adjacent to overhead power and utility lines can be found in S3NA 406 PR, *Electrical Lines, Overhead.*

3.1.5 Electrical hazards

Electrical and powered equipment may be used during a variety of site activities. Injuries associated with electrical and powered equipment include electric shock, cuts/lacerations, eye damage (from flying debris), and burns. To reduce the potential of injury from the hazards associated with electrical and powered equipment, always comply with the following:

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

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

3.1.6 Lock-Out/Tag-Out Procedures

Use lockout/tagout procedures when performing maintenance or repairs on equipment.

It is the responsibility of AECOM employees to verify that all remediation equipment is locked out before AECOM employees perform any maintenance or repair work on the system. **The source must be locked out; it is not enough to push the power switch to off and disconnect the breaker. Anyone can re-engage power under these circumstances. Locking out the power source is the only way to guarantee that the power will not be inadvertently reactivated.**

A lock-out/tag-out kit will be located in the treatment shed for the duration of the project. The kit includes standard locks, keys and lock-out notices.

The site specific lock-out/tag-out information must be completed for both the groundwater containment system and the SSD system. These forms will then be placed within the remediation trailer so all field technicians performing operations and maintenance work on the system are familiar with how to lock-out the system when necessary. Refer to S3NA 410 PR, *Hazardous Energy Control*, for additional information and requirements.

3.1.7 Heavy Equipment and Vehicle Operations

Heavy equipment and site vehicles present serious hazards site personnel. Blind spots, failure to yield, and other situations may cause heavy equipment/vehicles to come into contact with personnel. To reduce the possibility of contact between equipment/traffic and personnel, always adhere to the following:

- Personnel must wear a high visibility, reflective safety vest at all times when working near heavy equipment and/or other vehicle traffic.
- Personnel must always yield to equipment/vehicle traffic and stay as far as possible from all equipment/vehicle traffic. Always maintain eye contact with operators.
- When feasible, place barriers between work areas and equipment/vehicle traffic.
- Always ensure reverse warning alarms are working and louder than surrounding noise. Personnel must report inoperative reverse warning alarms.
- Ensure Daily Equipment Safety Inspections are being performed and documentation filed at the site.

For additional requirements, refer to S3NA 309 PR, *Mobile or Heavy Equipment.*

3.1.8 Drilling Operations

Drilling operations, including hollow-stem, rotary and/or direct push drilling, present their own set of hazards. Several basic precautions that should be taken include, but are not limited to, confirming locations of underground and overhead utilities, wearing of appropriate PPE and the avoidance of loose clothing or jewelry, staying clear of moving parts, knowing the locations of emergency shut-off switches. Other operational safety precautions regarding moving the drilling equipment, raising and lowering the derrick (mast), and drilling can be found in S3NA 405 PR, *Drilling and Boring.*

3.1.9 Spill Prevention

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

- All hazardous material will be stored in appropriate containers
- Tops/lids will be placed back on containers after use.
- Containers of hazardous materials will be stored appropriately away from moving equipment.

At least one spill response kit, to include an appropriate empty container, materials to allow for booming or diking the area to minimize the size of the spill, and appropriate clean-up material (i.e. speedy dri) shall be available at each work site (more as needed).

- All hazardous commodities in use (i.e. fuels) shall be properly labeled.
- Containers shall only be lifted using equipment specifically manufactured for that purpose.
- For drums/containers, follow the procedures in S3NA 308 WI, *Manual Lifting Safe Work Practices*, to minimize spillage.

3.1.10 Noise Exposure Monitoring

Site activities, including drilling and operation of blowers for the biosparging system, will result in noise at levels that may be harmful to hearing. The presence of aircraft in close proximity to the Site may also result in hazardous noise levels. Hearing protection will be utilized during drilling operations, biosparging system O&M activities and other times when there is the potential for exposure to hazardous noise levels.

When heavy equipment is in operation, it will be necessary to ensure that each exclusion zone fully encompasses all areas where hazardous noise levels are present (85dBA or greater). Once each work day, the SSO will use a sound level meter to survey the perimeter of each exclusion zone, while all onsite heavy equipment within the zone is being operated simultaneously. If the sound pressure level exceeds 85 dBA at any location along the site perimeter, the SSO will exit the exclusion zone and use the meter to determine the 85 dBA limit. The exclusion zone boundary will then be adjusted to fully encompass this region. Refer to S3NA 510 PR, *Hearing Conservation Program*, for additional information and requirements.

3.1.11 Traffic Control

During certain work tasks, the establishment of traffic control to adequately protect workers and the public may be required on-site. Site specific requirements will be determined by the site supervisor/SSO on a case-by-case basis. Only approved traffic control devices per accordance with the Manual of Uniform Traffic Control Devices (MUTCD) will be used on public road ways per accordance with the applicable State regulatory guidance.

General traffic control precautions include placing a work vehicle between your worksite and oncoming traffic whenever possible. Not only is it a large, visible warning sign, but also if an oncoming car should fail to yield or deviate, the parked vehicle rather than your body would absorb the first impact of a crash. Turn the vehicle wheels so that if it was struck, it would swing away from the worksite. When using cones or other devices to modify traffic flow, ensure use of the proper taper length and device spacing to provide adequate warning distance to on-coming motor vehicles. In addition, proper PPE is to be worn during traffic operations, to include hardhat and high-visibility vests. Refer to S3NA 306 PR, *Highway and Road Work*, for additional requirements.

3.2 BIOLOGICAL HAZARDS

It is anticipated that numerous biological hazards will be present on the project site. Poisonous plants may be found along the tree lines, and adjacent to monitoring wells, along with ticks and other biting insects. Stinging insects, such as bees and wasps may build nests inside of monitoring wells or be within proximity of the work zone. Below is a discussion of the most common biological hazards found on project sites, and those anticipated to be of concern here.

3.2.1 Small Mammals

Working in the field either directly or indirectly with small mammals have inherent risks of injury or exposure to zoonotic diseases (infectious diseases that can be transmitted from animals to humans) that all field staff need to protect themselves against.

The risks are usually higher when there is direct contact with a wild animal, either through a break in the skin (blood), saliva, or excrement; however, there are also risks through air-borne diseases (e.g., Hantavirus).

Obviously, wildlife biologists directly handling wildlife, dead or alive, or working with wildlife feces or in enclosed habitats (such as caves), have an increased risk of exposure to a wider range of zoonotic diseases and should take extra precautions.

3.2.2 Venomous Animals

Some animals have the ability to inject venom. These include: rattlesnakes, black widow spiders, and scorpions. These all have limited distributions, so in most areas you are unlikely to encounter them. Other spiders possess venom but they are not harmful to humans. Shrews have poisonous saliva but the chance of being envenomated by them is extremely unlikely unless they are handled.

If bitten by any of these animals special care should be taken to treat the wound as it may lead to complications due to the toxin.

A bite from a venomous snake, which may inject varying degrees of toxic venom, is rarely fatal but should always be considered a medical emergency.

3.2.3 Poisonous Plants

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

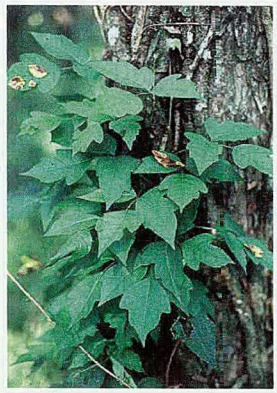
Plants that field staff should recognize and take precautions to avoid include: Poison Sumac, Poison Ivy (terrestrial and climbing), Poison Oak, Giant Hogweed (or Giant Cow Parsnip), Wild Parsnip, Devil's Club and Stinging Nettle. Many others are extremely poisonous to eat (e.g., Poison Hemlock; Water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

A large number of plants are not harmful to touch but may contain poisonous berries or foliage that could cause serious complications or death if they are ingested. It goes without saying not to eat any berries or plants that you are not absolutely sure of their identity. Examples of common poisonous or irritating plant species, common to the United States, are shown in Table 3-1.

Table 3-1: Hazardous Plant Identification Guide

Poison Ivy

- Grows in West, Midwest, Texas, East
- Several forms – vine, trailing shrub, or shrub
- Three leaflets (can vary 3-9)
- Leaves green in summer, red in fall
- Yellow or green flowers
- White berries

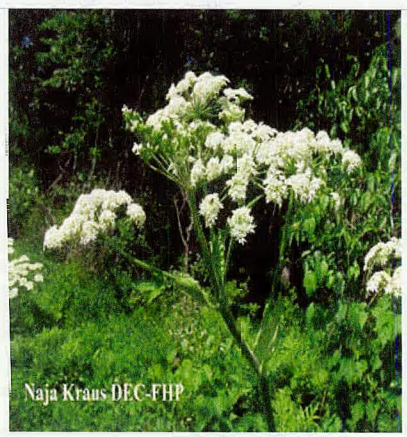


Poison Oak

- Grows in the East (NJ to Texas), Pacific Coast
- 6-foot tall shrubs or long vines
- Oak-like leaves, clusters of three
- Yellow berries

Cow Parsnip

- 3- to 10-feet tall
- 12- to 18-inch rough, hairy leaves
- Leaves are divided into 3 segments with coarsely toothed leaflets and a wing at the base of each stalk.
- White or cream colored flowers with 5 petals.



Giant Hogweed

- Grows from MI to VA, found in western NY
- 8- to 14-feet tall
- Small, white flowers form a large flat-topped umbel
- Leaves up to 5-feet across, lobed and deeply incised

3.2.4 Insects

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

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

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

The European Fire Ant is spreading in Southern Ontario and 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.

3.3 ULTRAVIOLET HAZARDS

Field activities conducted during the spring through fall months represent the greatest risk for exposure to ultraviolet hazards. Exposure to ultraviolet hazards during the winter is also likely due to reflection of sunlight off of snow. Protective measures, such as the use of sunscreen, sunglasses are advisable whenever field activities are being conducted.

3.4 WEATHER HAZARDS

The Site Safety Officer will be attentive to daily weather forecasts for the project area each morning . Predicted weather conditions of potential field impact are to be included in safety briefings and the Task Hazard Analysis (THA) for that day. Weather changes should initiate a review and updates (THA) as necessary. Weather-related hazards will directly correlate to the type of weather involved. Hot, dry weather may cause greater dust emissions, particularly during intrusive activities. Rain may increase slip/trip hazards, particularly for ground workers.

Severe weather can occur with little warning. Employees will be vigilant for the potentials for storms, lightning, high winds, and flash flood events. Additionally, lightning strikes during electrical storms could also be a potential hazard. The following procedures will be implemented once thunder is heard or lightning spotted:

1) If thunder is heard, all site personnel are to be alert of any visible lightning flashes. The SSO will observe the storm front and track the direction it is moving. The SSO will continue to observe the storm front until it passes or until the prevailing direction is determined to be away from the site.

2) If lightning is observed, the SS or SSO are to be notified. When the next lightning flash is observed, a "second" count shall be initiated from the time the lightning is observed until the thunder from the strike is heard.

3) The following action guidelines shall be implemented once the "second" count is ≤ 30 seconds:

   a) "second" count > 30, the SS or SSO will continually observe the storm front. If the front is moving away, work will continue. If the front is moving towards the site, the SS will initially place workers on alert for potential evacuation.

   b) "second" count ≤ 30, the SS will issue the evacuation command and all workers are to report to the break/lunch trailer. Work can be re-initiated once the front has passed by and thunder has not been heard for 30 minutes.

4) If lightning is observed and the storm front is moving away from or around the site and is > 20 miles away, work will be permitted to continue. The location of the storm can be confirmed via internet access to a local weather website that has a Doppler radar tracking system.

3.5 HAZARD ANALYSIS

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

- Mobilization/Demobilization
- Groundwater Sampling
- Drilling/Soil Sampling/Well Installation
- Substrate Injection
- Biosparging System O&M

Unanticipated Work Activities/Conditions

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

3.6 TASK SPECIFC SH&E PROCEDURES

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

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Table 3-2: Applicable SOPs

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

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4 SH&E REQUIRMENTS (SAFETY)

4.1 HAZWOPER QUALIFICATIONS

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

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

4.2 SITE-SPECIFIC SAFETY TRAINING

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

4.2.1 Competent Person Training Requirements

In order to complete the planned scope of work, an (OSHA conformance) competent person must be designated to perform the required daily on site inspections of operations and/or equipment. The competent person may be an AECOM (if responsible for supervising that activity) or the subcontractor's employee. Designated competent person(s) for this project are shown in Table 4-2:

Table 4-1: Task-Specific Competent Persons

Employee Name	Organization	Area of Competency
TBD	AECOM	Lock-Out/Tag-Out (S3NA 410 PR)
TBD	Zebra	Drilling & Boring (S3NA 405 PR)

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

4.3 TAILGATE MEETINGS

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

4.4 HAZARD COMMUNICATION

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

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

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

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

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

4.5 CONFINED SPACE ENTRY

Confined space entry is not anticipated for this site. If confined spaces are identified, the SSO/site supervisor will inform all employees of the location of confined spaces and prevent unauthorized entry. Confined space entry procedures and training requirements are listed in S3NA 301 PR, *Confined Spaces.*

4.6 HAZARDOUS, SOLID, OR MUNICIPAL WASTE

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

4.7 GENERAL SAFETY RULES

All site personnel shall conduct themselves in a safe manner and maintain a working environment that is free of additional hazards, in adherence to *S3NA-001-PR Safe Work Standards and Rules* and *S3NA-307-PR Housekeeping, Worksite.*

4.7.1 Housekeeping

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

4.7.2 Smoking, Eating, or Drinking

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

4.7.3 Personal Hygiene

The following personal hygiene requirements will be observed:

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

> *Potable Water* - An adequate supply of potable water will be available for field personnel consumption. Potable water can be provided in the form of water bottles, canteens, water coolers, or drinking fountains. Where drinking fountains are not available, individual-use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified in order to distinguish them from non-potable water sources.

Non-Potable Water - Non-potable water may be used for hand washing and cleaning activities. Non-potable water will not be used for drinking purposes. All containers of non-potable water will be marked with a label stating:

Non-Potable Water
Not Intended for Drinking Water Consumption

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

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

4.7.4 Buddy System

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

4.8 STOP WORK AUTHORITY

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

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

4.9 CLIENT SPECIFIC SAFETY REQUIREMENTS

The client has specified no additional health and safety requirements.

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5 EXPOSURE MONITORING PROCEDURES (HEALTH)

5.1 CONTAMINANT EXPOSURE HAZARDS

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

Exposure symptoms and applicable first aid information for each suspected site contaminant identified in the Scope of Work are located in the following subsections.

5.1.1 Benzene

CAS 71-43-2; RTECS CY1400000 UN 1114

**Benzene, is a clear, volatile, colorless, highly flammable liquid with a characteristic odor. The odor threshold in air varies from 0.3-5 ppm and 4.9 mg/m^3; the odor threshold in water is 2.0 mg/liter. Benzene's boiling point is 80°C with a flash point of 11°C. Its LEL is 1.4% and UEL is 7.5%. Synonyms are benzol, phenyl hydride, coal naphtha, phene, benxole, and cyclohexatriene.

Benzene is used as a constituent in motor fuels, as a solvent for fats, inks, oils, paints, plastics, and rubber, in the extraction of oils from seeds and nuts, and in photogravure printing. It is also used as a chemical intermediate. By alkylation, chlorination, nitration, and sulfonation, chemicals such as styrene, phenols, and maleic anhydride are produced. Benzene is also used in the manufacturer of detergents, explosives, pharmaceuticals, and dye-stuffs.

Increased concern for benzene as a significant environmental pollutant arises from public exposure to the presence of benzene in gasoline and the increased content in gasoline due to requirements for unleaded fuels for automobiles equipped with catalytic exhaust converters.

The benzene standard 29 (CFR 1910.1028) establishes an action level of 0.5 ppm, a PEL of 1 ppm, and a short-term exposure limit (STEL) of 5 ppm. The ACGIH has designated benzene as an "Industrial Substance Suspect of Carcinogenic Potential for Man" with a 1997 ACGIH TLV of 0.5 ppm (1.6 mg/m^3). The NIOSH recommended exposure limit (REL) is 0.1 ppm. The IDLH is 500 ppm.

Routes of entry consist of inhalation of vapor, ingestion, skin and eye contact. Points of attack consist of the blood, central nervous system, skin, bone marrow, eyes and respiratory system. Harmful effects and symptoms of short-term exposure consist of the following:

Inhalation - Benzene may produce both nerve and blood effects. Irritation of the nose, throat and lungs may occur (3,000 ppm may be tolerated for only 30 to 60 minutes). Lung congestion may occur. Nerve effects may include an exaggerated feeling of well-being, excitement, headache, dizziness and slurred speech. At high levels, slowed breathing and death may result. Death has occurred at exposures of 20,000 ppm for 5 to 10 minutes, or 7,500 ppm for 30 minutes.

Skin - Irritation may occur, with redness and blistering if not promptly removed. Benzene is poorly absorbed. Whole body exposure for 30 minutes has been reported with no health effects.

Eyes - May cause severe irritation.

Ingestion - May cause irritation of the mouth, throat and stomach. Symptoms are similar to those listed under inhalation. One tablespoon may cause collapse, bronchitis, pneumonia and death.

Harmful effects and symptoms of long term exposure may cause loss of appetite, nausea, weight loss, fatigue, muscle weakness, headache, dizziness, nervousness and irritability. Mild anemia has been reported from exposures of 25 ppm for several years and 100 ppm for 3 months. At levels between 100 and 200 ppm for periods of 6 months or more, severe irreversible blood changes and damage to liver and heart may occur. Temporary partial paralysis has been reported. Benzene is a known human carcinogen. Exposure has been linked to increased risk of several forms of leukemia.

Level C (full-face with organic vapor cartridge) protection can be used up to 50 ppm. Above this value, level B is required. Determination in air for personal exposure consists of collection on charcoal adhering to NIOSH Methods 1500, 1501 or 3700.

5.1.2 Ethylbenzene

CAS 100-41-4; RTECS DA0700000; UN 1175

Ethylbenzene is a colorless liquid with a pungent aromatic odor. The odor threshold is 140 ppm in air. The boiling point is 136°C with a flash point of 21°C. The LEL is 1.0%, and the UEL is 6.7%. Synonyms are ethylbenzol, phenylethane and EB.

Ethylbenzene is used in the manufacture of cellulose acetate, styrene, and synthetic rubber. It is also used as a solvent or diluent and as a component of automotive and aviation gasoline. Significant quantities of ethylbenzene are present in mixed xylenes. These are used as diluents in the paint industry, in agricultural sprays for insecticides and in gasoline blends (which may contain as much as 20% ethylbenzene). In light of the large quantities of ethylbenzene produced and the diversity of products in which it is found, there exist many environmental sources for ethylbenzene, e.g., vaporization during solvent use, pyrolysis of gasoline and emitted vapors at filling stations.

The PEL, REL and TLV are 100 ppm (435 mg/m^3 [TLV 434 mg/m^3]). The STEL is 125 ppm (545 mg/m^3). The IDLH level is 800 ppm (10% LEL).

Routes of entry are via inhalation, ingestion, eye and skin contact. Points of attack are the eyes, upper respiratory system, skin and central nervous system.

Kidney disease, liver disease, chronic respiratory disease, and skin disease are associated health effects. The kidney is the primary route of excretion of ethylbenzene and its metabolites. Ethylbenzene is metabolized by the liver, which may potentially damage tissue. Inflammation of the pulmonary system might occur following exposure to ethylbenzene. Individuals with impaired pulmonary function might be at risk. Ethylbenzene is a defatting agent and may cause dermatitis following prolonged exposure. Individuals with pre-existing skin problems may be more sensitive to ethylbenzene. Other symptoms of exposure are irritation of eyes and mucous membranes; headaches, dermatitis; narcosis; and coma. A concentration of 200 ppm can cause irritation.

Air purifying respirators (full-face with an organic vapor cartridge) can be used up to 1000 ppm. Above this value, Level B is required. Determination in air is via collection on charcoal adhering to NIOSH method 1501.

5.1.3 m,o,p-Xylene

CAS 1330-20-7; RTECS ZE2100000; UN 1307

Xylene is a flammable liquid which exists in three isomeric forms, ortho-, meta-and para-xylene. Commercial xylene is a mixture of these three isomers and may also contain ethylbenzene as well as small amounts of toluene, trimethylbenzene, phenol, thiophene, pyridine, and other non-aromatic hydrocarbons. m-Xylene is predominant in commercial xylene. Synonyms are xylol and dimethylbenzene.

Xylene is used as a solvent; as a constituent of paint, lacquers, varnishes, inks, dyes, adhesives, cements, cleaning fluids and aviation fuels; and as a chemical feed-stock for xylidines, benzoic acid,

phthalic anhydride, isophthalic, and terephthalic acids, as well as their esters (which are specifically used in the manufacture of plastic materials and synthetic textile fabrics). Xylene is also used in the manufacture of quartz crystal oscillators, hydrogen peroxide, perfumes, insect repellants, epoxy resins, pharmaceuticals, and in the leather industry.

The OSHA PEL, NIOSH REL and ACGIH TLV are 100 ppm (435 mg/m^3) for all isomers. The ACGIH STEL is 150 ppm. The IDLH is 900 ppm.

Routes of entry are via inhalation of vapor and, to a small extent, percutaneous absorption of liquid, ingestion and skin and eye contact. Harmful effects and symptoms associated with short-term exposure are as follows:

Inhalation - Exposure to vapor can cause irritation to the nose and throat. Inhalation of vapor at concentrations above 200 ppm for 3-5 minutes can lead to xylene intoxication. Symptoms include headache, dizziness and nausea. If exposure should continue, central nervous system depression characterized by shallow breathing and weak pulse can occur. Levels of 230 ppm for 15 minutes may cause lightheadedness without loss of equilibrium. Reversible liver and kidney damage in man has followed exposure to sudden high concentrations of vapor. Such high levels may also give rise to lung congestion. Exposure to extremely high concentrations (10,000 ppm) of xylene vapors can lead to a strong narcotic effect with symptoms of slurred speech, stupor and coma.

Skin – Contact with vapor or liquid can cause drying and defatting which may lead to irritation.

Eyes – Vapor and liquid may be irritating to the eye and eyelids at levels of 100 ppm for 15 minutes.

Ingestion - Swallowing liquid xylene will bring about an immediate burning sensation in the mouth and throat. Irritation of the stomach and intestine can give rise to sharp stomach pains. Symptoms are the same as inhalation, except that lung congestion will not usually develop.

Long term exposure to xylene vapors and skin contact with liquid are the two most probable routes of long term exposure. Symptoms of inhalation are dizziness, headache and nausea. Long term exposure has been associated with liver and kidney damage, intestinal tract disturbances and central nervous system depression. These effects are reversible and disappear once the chemical has been removed. Prolonged contact with skin can lead to irritation.

Level C protection is approved up to 1000 ppm. Above this value, level B is required.[1] Determination in air is via adsorption on charcoal, adhering to NIOSH Method 1501 for aromatic hydrocarbons.

5.2 REAL-TIME EXPOSURE MEASUREMENT

Monitoring shall be performed within the work area on site in order to detect the presence and relative levels of toxic substances. The data collected throughout monitoring shall be used to determine the appropriate levels of PPE. Table 5-1 specifies the real-time monitoring equipment, which will be used for this project.

Table 5-1: Monitoring Parameters and Equipment

INSTRUMENT	MANUFACTURER/MODEL*	SUBSTANCES DETECTED
Photo Ionization Detector (PID)	RAE Systems mini-RAE Photovac Microtip HNu Model Hnu (min. 10.6 eV bulb)	Petroleum hydrocarbons Organic Solvents

*Or similar unit, as approved by the SH&E Professional

Health and Safety Action Levels

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

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

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

Reasons to upgrade:

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

Reasons to downgrade:

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

5.2.1 Monitoring Procedures

Table 5-2: Monitoring Procedures and Action Levels

PARAMETER	LOCATION AND INTERVAL	RESPONSE LEVEL (Meter units/ppm above background)	RESPONSE
Hydrocarbons (Total by PID)	Continuous in the worker's breathing zone or in the immediate work area for sustained reading of 2 minutes in duration.	< 1 ppm	Level D work and continue monitoring (not applicable for initial assessment of unknown drums or containers.
		≥ 1 ppm	Contact the SSO, and if no potential for change in conditions exist (drum/container activities increasing airborne levels), don Level C (GMC/P100 cartridges or equivalent chemical cartridge combined with P100) and continue monitoring.
	Confined spaces will require initial and continuous monitoring.	Initial entry or opening/sampling unknown drums/containers	Level B ensemble as listed in SH&E 701, *Hazardous Waste Operations* and per SSO and SH&E Manager.
		≥ 5 ppm	

5.2.1.1 Monitoring Equipment Calibration

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

5.2.1.2 Personal Sampling

Should site activities warrant performing personal sampling (breathing zone) to better assess chemical exposures experienced by AECOM employees, the SSO, under the direction of a Certified Industrial Hygienist (CIH),

Certified Safety Professional (CSP) will be responsible for specifying the monitoring required. Within five working days after the receipt of monitoring results, the CIH or CSP will notify each employee, in writing, of the results that represent that employee's exposure. Copies of air sampling results will be maintained in the SSO project files.

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

5.3 HEAT AND COLD STRESS

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

Heat stress can be a significant field site hazard, particularly for non-acclimated personnel operating in a hot, humid setting. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim and the prevention of heat stress casualties. Work-rest cycles will be determined and the appropriate measures taken to prevent heat stress as outlined in SH&E 616, *Heat Stress Prevention Program.*

5.3.1 Responding to Heat-Related Illness

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

5.3.1.1 Responding to Cold-Related Illness

If work on this project is conducted in the winter months, thermal injury due to cold exposure can become a problem for field personnel. Work will cease under unusually hazardous conditions (e.g., wind-chill less than 0°F, or wind-chill less than 10°F with precipitation). Systemic cold exposure is referred to as hypothermia. Localized cold exposure is generally labeled frostbite. Recognition of the symptoms of cold related illness will be discussed during the health and safety briefing conducted prior to the onset of site activities. Refer to the 2003 ACGIH TLV for Chemical Substances and Physical Agents for additional information on cold stress prevention, monitoring, and work-warming regimens.

5.3.1.2 Hypothermia

Hypothermia is a life-threatening condition in which the core body temperature falls below 95°F. Hypothermia can occur at temperatures above freezing particularly, when the skin or clothing becomes wet. During exposure to cold, maximum shivering occurs when the core temperature falls to 95°F. As hypothermia progresses, depression of the central nervous system becomes increasingly more severe. This accounts for the progressive signs and symptoms ranging from sluggishness and slurred speech to disorientation and eventually unconsciousness (see Table 4-2).

The ability to sustain metabolic rate and to reduce skin blood flow is diminished by fatigue. Thus, fatigue increases the risk of severe hypothermia by decreasing metabolic heat. Additionally, because blood flow through the skin is reduced to conserve heat, the skin and underlying tissues become more susceptible to frostbite.

5.3.1.3 Frostbite

Frostbite is both the general and medical term given to areas of cold injury. Unlike hypothermia, frostbite rarely occurs unless environmental temperatures are less than freezing and usually less than 20°F. Frostbite injuries occur most commonly on the distal parts of the body (nose, earlobes, hands, and feet) that are subject to intense vasoconstriction. The three general categories of frostbite are:

- Frostnip - A whitened area of the skin, which is slightly burning or painful;
- Superficial frostbite - Waxy, white skin with a firm sensation but with some resiliency. Symptomatically feels "warm" to the victim with a notable cessation of pain; and
- Deep frostbite - Tissue damage deeper than the skin, at times, down to the bone. The skin is cold, numb, and hard.

5.3.1.4 Preventing Cold Related Illness

The following are precautions that will be taken to prevent illness relating to cold stress:

- Educate worker to recognize the symptoms of frostbite and hypothermia;
- Ensure the availability of an enclosed, heated environment within the vehicles. The nearest heated environment will be the interior of the vehicles at the site;
- Ensure the availability of dry changes of clothes;
- Record temperature readings; and
- Ensure the availability of warm beverages, preferably non-caffeinated.

5.3.1.5 Monitoring for Cold Exposure

Cold stress monitoring will be conducted in accordance with the ACGIH cold stress TLV. The TLV objective is to prevent the deep body core temperature from falling below 96.8°F and to prevent cold injury to body extremities. Temperature monitoring and recording will be initiated in the following situations:

- At the SSO discretion when suspicion is based on changes in worker's performance or mental status;
- At worker's request;
- As a screening measure whenever anyone worker on the site develops hypothermia; and
- Any person developing moderate hypothermia (a core temperature of 92°F) cannot return to work for 48 hours.

Table 5-3: Identification and Treatment of Heat-Related Illness

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

Table 4-3: Progressive Clinical Symptoms of Hypothermia

Core Temperature (°F)	Clinical Signs
95°	Maximum shivering
87° - 89°	Consciousness clouded; blood pressure becomes difficult to obtain; pupils dilated
84° - 86°	Progressive loss of consciousness; muscular rigidity; respiratory rate decreases
79°	Victim rarely conscious
70° - 72°	Maximum risk of ventricular fibrillation

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6 ENVIRONMENTAL PROGRAM (ENVIRONMENT)

6.1 ENVIRONMENTAL COMPLIANCE AND MANAGEMENT

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

6.1.1 Air Emissions

In accordance with NYSDEC requirements, AECOM will conduct ambient air monitoring during biosparging O&M events to ensure that biosparging is not mobilizing contaminants in the subsurface to the atmosphere. Monitoring will be conducted by surveying the biosparging area with a PID. The remedial actions being implemented at Site 15 will not require permitting for air emissions.

6.1.2 Hazardous Waste Management

Potentially hazardous waste generated during the implementation of the remedial actions will include soil cuttings, purged groundwater and decontamination fluids. Liquid waste will be staged in labeled drums and tanks and analyzed for characterization and off-site disposal. Solid waste will be staged in labeled drums or roll-offs and characterized for off-site disposal. Waste will be staged in an area approved for such purposes by NYANG personnel. Waste will be characterized and transported off-site within 90 days of generation. Profiles and manifests will be prepared by AECOM and signed by the NYANG Environmental Manager (EM).

6.1.3 Storm Water Pollution Prevention

Implementation of the remedial actions is not anticipated to result in the potential for storm water pollution.

6.1.4 Wetlands Protection

Implementation of the remedial actions at Site 15 will not impact any wetlands areas.

6.1.5 Critical Habitat Protection

Implementation of the remedial actions at Site 15 will not impact any critical habitats or protected species.

6.1.6 Environmental Protection

Environmental protection controls will be limited to air monitoring during drilling, injection, and sampling activities and during operation of the biosparging system. Field work will be conducted in such a manner as to minimize disruption to the natural landscape. All landscape features disturbed by implementation of the remedial actions will be restored to their original condition.

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7 PERSONAL PROTECTIVE EQUIPMENT

7.1 PERSONAL PROTECTIVE EQUIPMENT

The purpose of personal protective equipment (PPE) is to provide a barrier, which will shield or isolate individuals from the chemical and/or physical hazards that may be encountered during work activities. *S3NA-208-PR Personal Protective Equipment Program* lists the general requirements for selection and usage of PPE. Table 7-1 lists the minimum PPE required during site operations and additional PPE that may be necessary. The specific PPE requirements for each work task are specified in the individual THAs.

By signing this HASP the employee agree shaving been trained in the use, limitations, care and maintenance of the protective equipment to be used by the employee at this project. If training has not been provided, request the PM/SSO for the proper training before signing.

Table 7-1: Personal Protective Equipment

TYPE	MATERIAL	ADDITIONAL INFORMATION
Minimum PPE		
Safety Vest	ANSI Type II high-visibility	Must have reflective tape/be visible from all sides
Boots	Leather	ANSI approved safety toe
Safety Glasses		ANSI Approved; ≥98% UV protection
Hard Hat		ANSI Approved; recommended wide-brim
Work Uniform		No shorts/cutoff jeans or sleeveless shirts
Additional PPE:		
Hearing Protection	Ear plugs and/ or muffs	In hazardous noise areas
Leather Gloves		If working with sharp objects or powered equipment.
Protective Chemical Gloves	Outer: Nitrile	When handling samples, contaminated or potentially contaminated media, IDW, and decontaminating equipment.
Protective Chemical Coveralls	Outer: Tyvek or Equivalent	May be required while decontaminating heavy equipment/drill rigs with pressure washer.
Protective Chemical Boots		
Level C Respiratory Protection	MSA (Full Face or equivalent) equipped with GMC/P100	
Face Shield		Safety glasses or goggles must be worn concurrently. May be required while using pressure washer.
Sunscreen	SPF 30 or higher	
Cold Weather Gear	Hard hat liner, hand warmers, insulated gloves	

7.2 PPE DOFFING AND DONNING (UTILIZATION) INFORMATION

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

- Never cut disposable booties from your feet with basic utility knives. This has resulted in workers cutting through the booty and the underlying sturdy leather work boot, resulting in significant cuts to the

legs/ankles. Recommend using a pair of scissors or a package/letter opener (cut above and parallel with the work boot) to start a cut in the edge of the booty, then proceed by manually tearing the material down to the sole of the booty for easy removal.

- When applying duct tape to PPE interfaces (wrist, lower leg, around respirator, etc.) and zippers, leave approximately one inch at the end of the tape to fold over onto itself. This will make it much easier to remove the tape by providing a small handle to grab while still wearing gloves. Without this fold, trying to pull up the tape end with multiple gloves on may be difficult and result in premature tearing of the PPE.
- Have a "buddy" check your ensemble to ensure proper donning before entering controlled work areas. Without mirrors, the most obvious discrepancies can go unnoticed and may result in a potential exposure situation.
- Never perform personal decontamination with a pressure washer.

7.3 DECONTAMINATION

7.3.1 General Requirements

All possible and necessary steps shall be taken to reduce or minimize contact with chemicals and contaminated/impacted materials while performing field activities (e.g., avoid sitting or leaning on, walking through, dragging equipment through or over, tracking, or splashing potential or known contaminated/impacted materials, etc).

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

All persons and equipment entering the EZ shall be considered contaminated, and thus, must be properly decontaminated prior to entering the SZ.

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

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

7.3.2 Decontamination Equipment

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

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

7.3.3 Personal/Equipment Decontamination

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

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

Personnel decontamination should consist of the following glove removal procedure:

- Grasp the cuff of the dominant hand and pull glove over the bulk of the hand, leaving the fingers inside the glove.
- Use the dominant hand to grasp the cuff of the non-dominant hand and pull the glove completely off (inside-out) and place inside of the dominant hand glove.
- Once removed, employee should only touch the inside material of the dominant hand glove.
- Thoroughly wash hands.

For larger equipment, a high-pressure washer may need to be used. Some contaminants require the use of a detergent or chemical solution and scrub brushes to ensure proper decontamination. Before heavy equipment and trucks are taken offsite, the SS and/or SSO will visually inspect them for signs of contamination. If contamination is present, the equipment must be decontaminated

For smaller equipment, use the following steps for decontamination:

1. Remove majority of visible gross contamination in EZ.
2. Wash equipment in decontamination solution with a scrub brush and/or power wash heavy equipment.
3. Rinse equipment.
4. Visually inspect for remaining contamination.
5. Follow appropriate personal decontamination steps outlined above.

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

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8 PROJECT HEALTH AND SAFETY ORGANIZATION

8.1 PROJECT MANAGER – AKLILE GESSESSE, P.G.

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

8.2 SITE SUPERVISOR – JOHN SANTACROCE

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

8.2.1 Responsibilities

The site supervisor is responsible to:

- Discuss deviations from the work plan with the SSO and PM.
- Discuss safety issues with the PM, SSO, and field personnel.
- Assist the SSO with the development and implementation of corrective actions for site safety deficiencies.
- Assist the SSO with the implementation of this HASP and ensuring compliance.
- Assist the SSO with inspections of the site for compliance with this HASP and applicable SOPs.

8.2.2 Authority

The site supervisor has authority to:

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

8.2.3 Qualifications

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

8.3 SITE SAFETY OFFICER – GRETA WHITE

8.3.1 Responsibilities

The SSO is responsible to:

- Update the site-specific HASP to reflect changes in site conditions or the scope of work. HASP updates must be reviewed and approved by the Safety Professional.
- Be aware of changes in AECOM Safety Policy.
- Monitor the lost time incidence rate for this project and work toward improving it.
- Inspect the site for compliance with this HASP and the SOPs using the appropriate audit inspection checklist provided by an AECOM Safety Professional.
- Work with the site supervisor and PM to develop and implement corrective action plans to correct deficiencies discovered during site inspections. Deficiencies will be discussed with project management to determine appropriate corrective action(s).

- Contact the Safety Professional for technical advice regarding safety issues.
- Provide a means for employees to communicate safety issues to management in a discreet manner (i.e., suggestion box, etc.).
- Determine emergency evacuation routes, establishing and posting local emergency telephone numbers, and arranging emergency transportation.
- Check that all site personnel and visitors have received the proper training and medical clearance prior to entering the site.
- Establish any necessary controlled work areas (as designated in this HASP or other safety documentation).
- Present tailgate safety meetings and maintain attendance logs and records.
- Discuss potential health and safety hazards with the Site Supervisor, the Safety Professional, and the PM.
- Select an alternate SSO by name and inform him/her of their duties, in the event that the SSO must leave or is absent from the site. The alternate SSO must be approved by the PM.

8.3.2 Authority

The SSO has authority to:

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

8.3.3 Qualifications

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

8.4 EMPLOYEES

8.4.1 Employee Responsibilities

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

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

8.4.2 Employee Authority

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

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

8.5 SAFETY PROFESSIONAL – SEAN LIDDY

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

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

8.6 SUBCONTRACTORS

The requirements for subcontractor selection and subcontractor safety responsibilities are outlined in *S3NA-213-PR Subcontractors*. Each AECOM subcontractor is responsible for assigning specific work tasks to their employees. Each subcontractor's management will provide qualified employees and allocate sufficient time, materials, and equipment to safely complete assigned tasks. In particular, each subcontractor is responsible for equipping its personnel with any required personnel protective equipment (PPE and all required training.

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

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

8.7 VISITORS

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

8.7.1 Visitor Access

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

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

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

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

9 SITE CONTROL

9.1 GENERAL

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

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

9.2 CONTROLLED WORK AREAS

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

- Exclusion Zone: Contaminated work area.
- Contamination Reduction Zone: Decontamination area.
- Support Zone: Uncontaminated or "clean area" where personnel should not be exposed to hazardous conditions.

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

9.2.1 Exclusion Zone

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

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

- **Direct Push & Drilling Activities**. A distance equivalent to the height of the drill rig mast will be cleared in all directions from the rig. The cleared area will be sufficient to accommodate movement of necessary equipment and soil sampling or injection supplies. Vehicles and other hard barriers should be used where applicable to protect employees and public.
- **HSA Drilling**. Determine the mast height of the drill rig. This height will be cleared, if practical, in all directions from the bore-hole location and designated as the exclusion zone. The cleared area will be sufficient to accommodate movement of necessary equipment and the stockpiling of spoils piles. Vehicles and other hard barriers should be used where applicable to protect employees and public.
- **GW and Soil Sampling**. A distance of 10 feet (minimum) will be cleared in all directions from the sampling location in order to accommodate additional sampling equipment. Vehicles and other hard barriers should be used where applicable to protect employees and public.

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

9.2.2 Contamination Reduction Zone

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

9.2.3 Support Zone

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

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

9.3 SITE ACCESS DOCUMENTATION

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

9.4 SITE SECURITY

Site security is necessary to:

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

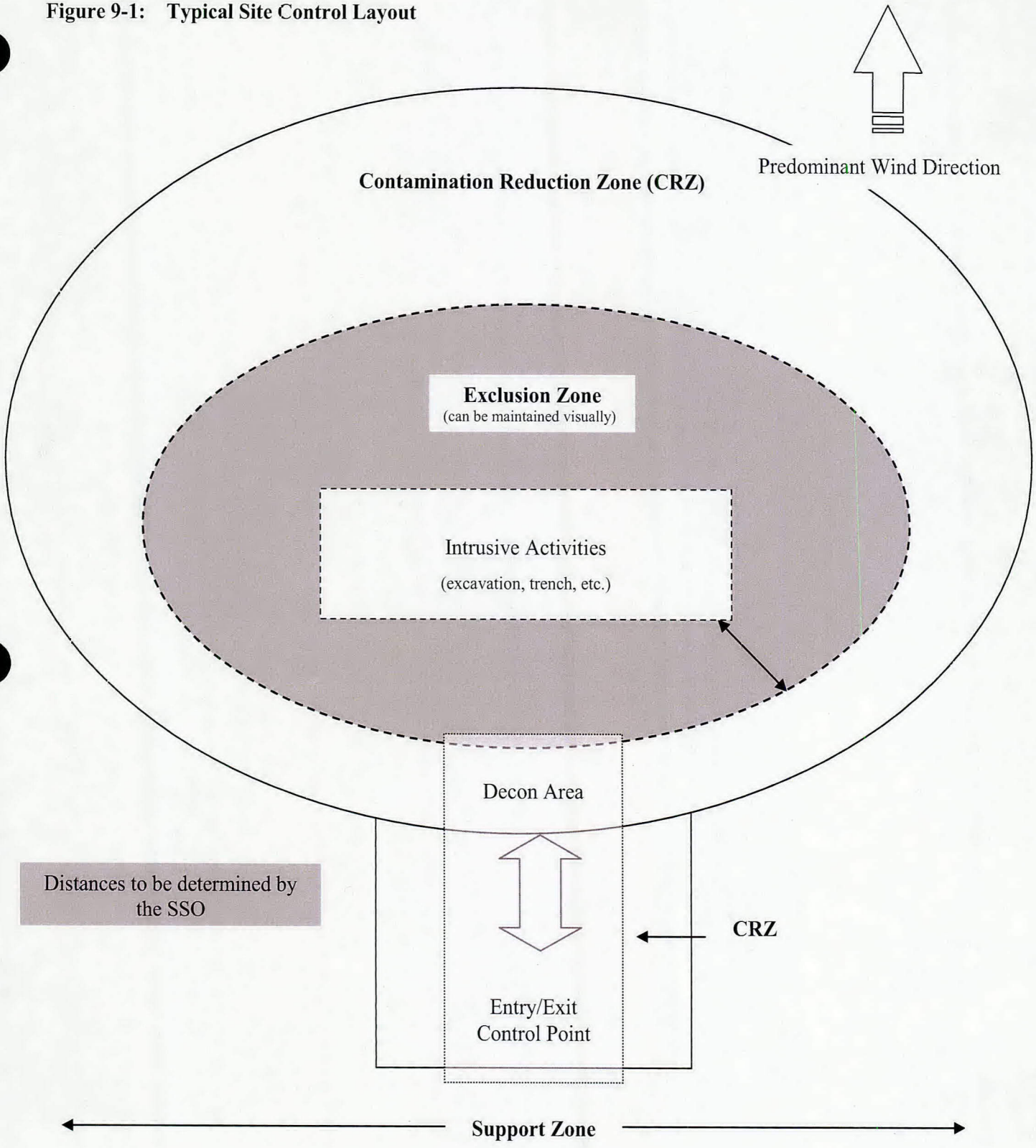
To maintain site security during working hours:

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

To maintain site security during off-duty hours:

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

Figure 9-1: Typical Site Control Layout



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10 EMERGENCY RESPONSE PLANNING

10.1 EMERGENCY ACTION PLAN

Although the potential for an emergency to occur is remote, an emergency action plan has been prepared for this project should such critical situations arise. The only significant type of onsite emergency that may occur is physical injury or illness to a member of the AECOM team. The Emergency Action Plan (EAP) will be reviewed by all personnel prior to the start of field activities. A test of the EAP will be performed within the first three (3) days of the project field operations. This test will be evaluated and documented in the project records.

Three major categories of emergencies could occur during site operations:

1. Illnesses and physical injuries (including injury-causing chemical exposure)
2. Catastrophic events (fire, explosion, earthquake, or chemical)
3. Workplace Violence, Bomb Threat
4. Safety equipment problems

10.1.1 Emergency Coordinator

The duties of the Emergency Coordinator (EC) include:

- Implement the EAP based on the identified emergency condition
- Notify the appropriate project and SH&E Department personnel of the emergency (Table 9-3)
- Verify emergency evacuation routes and muster points are accessible
- Conduct routine EAP drills and evaluate compliance with the EAP

10.1.2 Site-Specific Emergency Procedures

Prior to the start of site operations, the EC will complete Table 9-1 with any site-specific information regarding evacuations, muster points, communication, and other site-specific emergency procedures.

10.1.3 Spill Containment Procedure

Work activities may involve the use of hazardous materials (i.e. fuels, solvents) or work involving drums or other containers. State specific spill reporting procedures have been included in Attachment C. If anything beyond these procedures are required, a site specific spill reporting card/procedure must be developed for the site. Procedures outlined below will be used to prevent or contain spills:

- All hazardous material will be stored in appropriate containers
- Tops/lids will be placed back on containers after use.
- Containers of hazardous materials will be stored appropriately away from moving equipment.

At least one spill response kit, to include an appropriate empty container, materials to allow for booming or diking the area to minimize the size of the spill, and appropriate clean-up material (i.e. speedy dri) shall be available at each work site (more as needed).

- All hazardous commodities in use (i.e. fuels) shall be properly labeled.
- Containers shall only be lifted using equipment specifically manufactured for that purpose.
- Drums/containers will be secured and handled in a manner which minimizes spillage and reduces the risk of musculoskeletal injuries.

Table 10-1: Emergency Planning

Emergency	Evacuation Route	Muster Location
Chemical Spill	• Upwind	• [insert location]
Fire/Explosion	• Dependent on location of fire/explosion.	• [insert location]
Tornado/Severe Weather	• Shelter in Place	• [insert location]
Lightning	• Get inside vehicle or building.	• Vehicle
Additional Information		
Communication Procedures	Communication at the Site will be via cell phone. All AECOM personnel and Subcontractors will exchange cell phone numbers at the beginning of a field effort. Direct verbal communications, however; must be supplemented anytime voices cannot be clearly perceived above ambient noise levels (i.e., noise from heavy equipment; drilling rigs, backhoes, etc.) and anytime a clear line-of-sight cannot be easily maintained amongst all AECOM personnel because of distance, terrain or other obstructions. Verbal communications will be adequate to warn employees of hazards associated with the immediate work area. AECOM personnel will bring a mobile phone to the site to ensure that communications with local emergency responders is maintained, when necessary.	
CPR/First Aid Trained Personnel	All AECOM field personnel will be trained in First Aid/CPR.	
Site-Specific Spill Response Procedures	The potential for spills at the Site is limited to purged groundwater, decontamination fluids, gasoline, diesel fuel, and calcium peroxide solution. Spills, if they were to occur, would be small in volume. A spill kit will be kept on site and utilized to contain any spills. Spills will be cleaned up in accordance with the spill response procedures on the MSDS and NY State Spill Reporting Procedures.	

10.1.4 Safety Accident/Incident Reporting

All accidents and incidents that occur on-site during any field activity will be promptly reported to the SSO and the immediate supervisor.

If any AECOM employee is injured and requires medical treatment, the Site Supervisor will report the incident in accordance with AECOM's incident reporting procedures. A copy of the final Supervisor's Report of Incident will be provided to the SH&E Professional before the end of the following shift.

If any employee of a subcontractor is injured, documentation of the incident will be accomplished in accordance with the subcontractor's procedures; however, copies of all documentation (which at a minimum must include the OSHA Form 301 or equivalent) must be provided to the SSO within 24 hours after the accident has occurred.

All accidents/incidents will be investigated Copies of all subcontractor accident investigations will be provided to the SSO within five (5) days of the accident/incident.

10.1.5 Environmental Spill/Release Reporting

All environmental spills or releases of hazardous materials (e.g., fuels, solvents, etc.), whether in excess of the Reportable Quantity or not, will be reported according to the sequence identified in the *Site-Specific Spill Reporting Card (if applicable)*. In determining whether a spill or release must be reported to a regulatory agency, the Site Supervisor will assess the quantity of the spill or release and evaluate the reporting criteria against the state-specific reporting requirements, your applicable regulatory permit, and/or client-specific reporting procedures. **If reporting to a US state or Federal regulatory agency is required, AECOM has 15 minutes from the time of the spill/release to officially report it.**

Table 10-2: Emergency Contacts

Emergency Coordinators / Key Personnel			
Name	**Title/Workstation**	**Telephone Number**	**Mobile Phone**
2nd Lt. Brett Lynch	Client Contact	315-233-2111	
Jody Murata	Account/Client Manager	301-836-8120	
Aklile Gessesse	Project Manager	703-706-9410	703-627-0157
John Santracroce	Site Supervisor	518-951-2265	
Greta White	Site Safety Officer		518-698-3012
Phil Platcow	Regional SH&E Manager		617-899-5403
Sean Liddy	District SH&E Manager		410-869-6164
Incident Reporting	**Incident Reporting Line**	**(800) 348-5046**	
Matt Scharf	TDG/IATA Shipping Expert, Level 1 Shipper	703-706-9408	703-626-3086
Kim Alvestad	TDG/IATA Shipping Expert, Level 2 Shipper	804-515-8558	

Organization / Agency	
Name	**Telephone Number**
Police Department (local)	911
Fire Department (local)	911
Ambulance Service ***(EMT will determine appropriate hospital for treatment)***	911
Emergency Hospital ***(Use by site personnel is only for emergency cases)***	315-470-7411
Crouse Hospital	
736 Irving Avenue	
Syracuse, NY 13210	
Emergency Hospital Route: See Figure 10-1	
WorkCare: 24-hr On-Call Occupational Nurse (***Non-Emergency assistance only – Employees must notify SH&E prior to calling***)	(800) 455-6155
Poison Control Center	(800) 222-1222
Pollution Emergency	(800) 292-4706
National Response Center	(800) 424-8802
Info-Trac: 24-hr Response Services– Account # 74984	(800) 355-5053
Title 3 Hotline	(800) 424-9346

Public Utilities	
Name	**Telephone Number**
Dig Safely New York	811 or 1-800-962-7962

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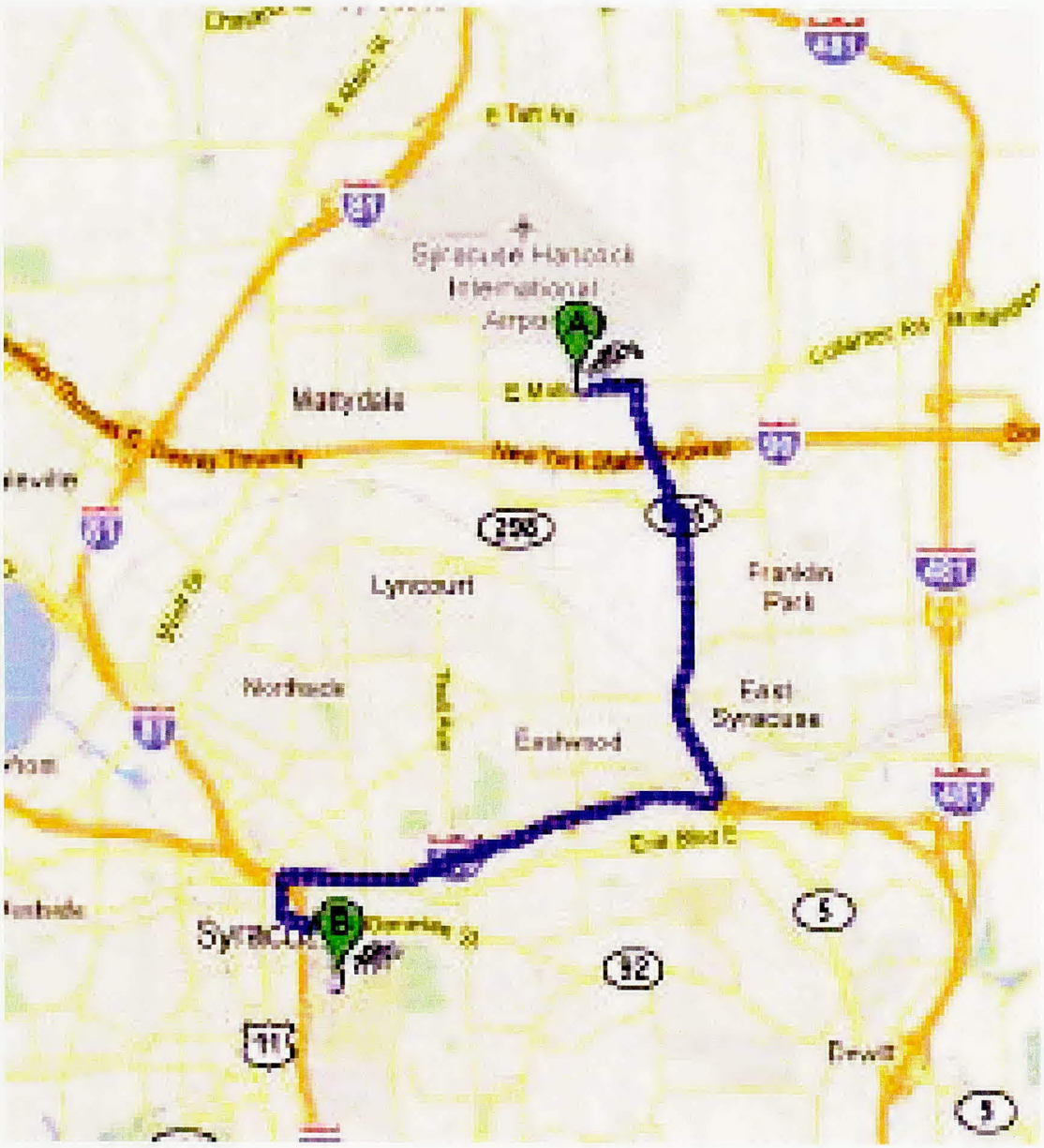
Figure 10-1: -Emergency Occupational Hospital Route/Detail Map

Directions to Crouse Hospital
736 Irving Avenue, Syracuse, NY 13210 - (315) 470-7111
7.5 mi – about 15 mins



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11 : PERSONNEL ACKNOWLEDGEMENT

By signing below, the undersigned acknowledges that he/she has read and reviewed the AECOM Health and Safety Plan for Site 15 at the NYANG facility at Hancock Field, Syracuse, NY. The undersigned also acknowledges that he/she has been instructed in the contents of this document and understands the information pertaining to the specified work, and will comply with the provisions contained therein.

PRINT NAME	SIGNATURE	ORGANIZATION	DATE

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Attachment A

Task Hazard Analyses

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AECOM

TASK HAZARD ANALYSIS (THA)
ERP Site 15
Hancock ANGB, Syracuse, New York

Evaluated by: Sean Liddy, CHST **Date: July 2011**

TASK NAME

Mobilization/Demobilization
AECOM Technical Services, Inc. Project 60214697

TASK DESCRIPTION	HAZARD IDENTIFICATION	HAZARD CONTROL
Check the weather	– Unexpected storm lightning, rain, snow (slip hazard), wind – Heat and cold stress	– Check local weather forecast, have a weather radio for remote sites, observation and communication among team members. Discuss weather issues during tailgate safety meeting. At the first sign of lightning, thunder or strong winds, immediately move away and take shelter. Do not resume work until 30 minutes have passed without signs of storm. – Know the symptoms of heat and/or cold stress, and the potential for their occurrence based on expected weather conditions. Take precautions to avoid them. Refer to the HASP or ask your supervisor if you have questions.
Perform perimeter walk around of vehicle for damage or unusual conditions	– Low air pressure, flat tire, blowout, impaired vision, collision, injury or death – Slip/Trip/Fall	– Complete Vehicle Inspection Checklist. Assure tires are properly inflated and there is sufficient tread (including spare). Assure there are no cuts or bulges in the sidewalls, all wheels/rims are in good condition. Assure windshield and window glass is clean and free from obstructions. Lift wiper arms and check wiper blades for damage or deterioration. Check to see that all lights work. Check for fluid leaks under vehicle. Check oil, radiator, brake, transmission and washer fluid levels. Check behind vehicle for obstructions.
Mobilize with equipment and supplies	– Vehicle accident – Accidents caused by use of improper equipment/tools – Injuries caused by improper lifting techniques – Damage to equipment/tools and/or accidents with loose objects – Pinch points	– Follow safe driving procedures. Always use the buddy system when moving vehicles. Plan your travel path ahead of time. Use maps and known construction zones to make your selection. Consult with the other team members before making any changes to travel path. – Use an equipment checklist to verify you have the appropriate equipment/tools for your tasks. – Use proper bending/lifting techniques by bending and lifting with legs and not with back. – When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible. – Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed of the truck. It can cause property damage or serious injuries to others or yourself by falling-off from vehicle.
Slowly pull out of parking space	– Collision with other vehicles, pedestrians, or stationary objects	– Release parking brake. Check mirrors and over shoulder in all directions prior to slowly pulling out of parking space. Signal if parallel parked along a street. Use a spotter if available.
Driving to/from site/sample locations	– Damage to equipment or vehicles due to surface/subsurface obstructions – Fixed facilities – Slip/Trip/Fall	– Inspect area before driving and/or walking. Identify possible hazards such as holes, obstructions protruding from the ground, or debris that may be scattered on the ground. Contact site manager immediately and do not proceed if any conditions are observed that could make driving/walking in the area unsafe and that cannot be fixed with the equipment or personnel onsite. – When parked near a fixed facility (building, monitoring well, bollards, etc…) use the buddy system when backing-up vehicle.

Keep your eyes moving	– Collision, injury or death to occupants or other parties	– DRIVE DEFENSIVELY. Move eyes at least every 2 seconds. Scan major and minor intersections before entry (left-right-left). Check mirrors when slowing or stopping vehicle. Scan mirrors frequently, at least one mirror every 5-8 seconds. Avoid staring while evaluating road conditions. – Do not use cell phones or perform other distracting activities while car is in motion. If necessary, pull off the roadway and park prior to performing other activities. – Be cautious about the use of cruise control if available on vehicle - never use in inclement weather, within cities and towns, or during hours without daylight. – Maintain 12 second eye lead time (1 1/2 blocks in city traffic, 1/4 mile in highway traffic). Assess information from distant objects (i.e., flashers on?). Adjust eye lead distance to speed.
Set up equipment at each location	– Biologic hazards such as insects, poison ivy, spiders, and snakes. – Injuries caused by improper lifting techniques. – Injury/Damage from fencing and gates – Slip/Trip/Fall	– Check immediate area for potential hazards such as poison ivy, spiders, wasps, snakes, etc. Use bug repellent and sunscreen as necessary. Use a bar to clear out objects and/or vegetation from spiders and/or snakes (don't use your hands or feet). – Use proper bending/lifting techniques by bending and lifting with legs and not with back. Use buddy system to lift heavy objects. – Ensure fencing and/or gates are secured to prevent injury or damage from accidental closing. Use cables, locks, or drop pins to prevent accidental closure.

ADDITIONAL SAFETY CONSIDERATIONS

1. No Chemical Hazards anticipated.
2. Use caution around trucks and stay clear if not involved in spotting operation. Use one person to communicate with driver via hand signals to avoid unnecessary confusion. Watch for overhead utilities. Wear high visibility reflective vest at all times.
3. Do not approach running equipment unless eye contact is made, and acknowledgment is received from operator. Use proper hand signals.
4. Maintain good housekeeping practices. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.
5. Avoid the use of chains for lifting. If necessary, ensure chain is equipped with annual load rating certification and proper hooks are being used. For synthetic slings, ensure red warning line is not showing and item is in good condition. For wire ropes, inspect for broken wires (6 in a lay, 3 in a strand).
6. Keep line of site with co-worker and ensure regular verbal contact. If out of the line of site, ensure radio or cell phone contact is established and maintained.

APPLICABLE OPERATIONAL SAFETY PROCEDURES	PPE
SH&E 313, Wildlife, Plants, Insects SH&E 517, Non-Ionizing Radiation SH&E 505, Cold Stress Prevention SH&E 511, Heat Stress	**LEVEL D** • ANSI approved hard hat • ANSI approved safety glasses • Shirts with sleeves and full-length pants • ANSI approved steel safety-toe boots or approved equivalent • High visibility reflective traffic vest • Nitrile Gloves • Leather work gloves • Hearing protection required when around operating machines (85 dba OSHA PEL) • First aid kit (located in vehicle) • Fire extinguisher (located in vehicle)

Acknowledgement

All employees, subcontractors, and visitors must sign the Acknowledgement form, in this section, before conducting field activities at this site.

By signing this form, AECOM employees agree that:

- I have read this Task Hazard Analysis and I understand the requirements of the THA.
- I will conduct work at this site in accordance with the requirements of the THA.

By signing this form, subcontractors and visitors agree that:

- I have read and understood the potential hazards associated with the site.
- I will ensure compliance with my company's policies on health and safety.

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AECOM

TASK HAZARD ANALYSIS (THA)
ERP Site 15
Hancock ANGB, Syracuse, New York

Evaluated by: Sean Liddy, CHST **Date: July 2011**

TASK NAME

Drilling Operation Oversight and Soil Sampling
AECOM Technical Services, Inc. Project 60214697

TASK DESCRIPTION	HAZARD IDENTIFICATION	HAZARD CONTROL
General Physical Hazards	– Slip/Trip/Fall – Cold/Heat Stress – Biological Hazards – Cuts/Scrapes/Bruises – Manual lifting – Adverse Weather	– Level D PPE required. – Maintain a clean and organized work area. – Watch your step and ensure proper footing. – Provide drinking water and first aid kit. – Wear appropriate clothing for weather conditions. – Assess work area for poisonous plants and animals and communicate observations to avoid them. – Wear appropriate work gloves for task. – Use proper lifting techniques by bending and lifting with legs and not back, and do not over extend or twist (Do not lift over 49lb. without assistance). – Be aware of changing weather condition and provide appropriate weather gear. – When work is halted due to inclement weather, personnel are to seek shelter in vehicles or building designated Shelter in Place (SIP).
Utility Clearances	– See General Physical Hazards	– In addition to General Physical Hazards: – Review available maps and have utility locate performed by Dig Safely New York or CES and receive Form AF-103. Valid permit must be on-site during all intrusive operations.
Establish exclusion zone/site setup	– Traffic in adjacent roadway	– Use combination of vehicles, cones, traffic barriers and caution tape.
Drill Rig operation	– Overhead and underground utilities – Noise Hazard – Pinch points/swing radius – Chemical exposure potential – Eye Injury – Fire	– Confirm utility locations. – Inspect vehicles and equipment daily (Checklists provided in HASP). – Maintain clean and organized work area. – Wear appropriate clothing and PPE, (no loose clothing or jewelry). – Earplugs and/or ear muffs required in EZ. – Position the drill rig and personnel up wind of drilling location. – Monitoring breathing zone with PID and upgrade PPE as required. – Avoid creating splash hazards while drilling. – Keep a safe distance from drill rig. – Use hand signals, keep clear of moving equipment, and ensure eye contact with operator prior to approaching. – Have fire extinguisher on site.
Sample collection and packaging	– Chemical exposure potential – Cuts/Scrapes – Manual lifting of equipment	– Inspect glassware for breakage and avoid sharp edges and wear gloves (nitrile and cut resistant leather or Kevlar) – Follow proper decontamination procedures. – Use proper lifting techniques and do not over-extend.
Drill Rig Decontamination	– High pressure water – Splash Hazard	– Spray away from body. – Wear full-face shield, gloves, rubber boots and tyvek or other suitable attire.

AECOM

TASK HAZARD ANALYSIS (THA)
ERP Site 15
Hancock ANGB, Syracuse, New York

Evaluated by: Sean Liddy, CHST **Date: July 2011**

TASK DESCRIPTION	HAZARD IDENTIFICATION	HAZARD CONTROL
Material Handling	– Chemical Exposure – Splash Hazard – Spills	– Wear modified level D PPE when necessary (Tyvek and face shields or dust masks). – Have portable eyewash on site. – Inspect Drums/Containers prior to use for integrity and contaminants. – Place soil in drums/containers as soon as practicable. – Store drums/containers in designated area.

CHEMICAL HAZARDS & MONITORING PROCEDURES

Petroleum Hydrocarbons (BEX) - Refer to Section 5 of the HASP for additional information.
Note - Area monitoring with PID (Mini Rae). ≥ 5 ppm requires potential upgrade to Level C.

ADDITIONAL SAFETY CONSIDERATIONS

1. Ensure all personnel have read the HASP.
2. Ensure all equipment is equipped with necessary fire extinguishers (min 5 lbs BC). Ensure equipment has a working kill switch and back-up alarms, and follow equipment inspection procedures.
3. Ensure underground utilities are verified with facility, marked, markings maintained, and operator aware of locations.
4. All equipment operators must be Competent Persons for the task/equipment being performed/operated.
5. All ground personnel must stay clear of equipment and make eye contact (and receive confirmation) with operator prior to approaching. Wear high visibility reflective vests and stay out of travel lanes and swing radius of heavy equipment.
6. If visible emissions of dust observed, then dust suppression techniques will be implemented.
7. Follow safe driving procedures. Always use the buddy system when moving vehicles. Plan your travel path ahead of time. Use maps and known construction zones to make your selection. Consult with the other team members before making any changes to travel path.
8. Use an equipment checklist to verify you have the appropriate equipment/tools for your tasks. Consult appropriate THAs or SOPs.
9. Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed of the truck. It can cause property damage or serious injuries to others or yourself by falling-off from vehicle.
10. When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible.
11. Conduct equipment inspection of all hoses and switches. Stay clear of running equipment.
12. Maintain good housekeeping practices. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.
13. Stay clear of moving rig, do not move rig with mast raised, do not drive on slopes greater than 30 degrees, avoid soft areas when moving rig and setting up, chock wheels. Use spotter when moving rig, check for overhead obstructions.
14. Wear nitrile gloves when collecting samples to avoid dermal contact with potential contaminants. Be observant for tripping hazards, holes, stickups, vines, old fence lines, etc.
15. Always decontaminate materials between locations and at the site. Do not bring equipment back to the office without proper decontamination.

APPLICABLE OPERATIONAL SAFETY PROCEDURES	PPE
SH&E 305, Hand & Power Tools SH&E 308, Manual Lifting SH&E 313, Wildlife, Plants, Insects SH&E 405, Drilling and Boring SH&E 406, Overhead Electrical Lines SH&E 417, Identifying Underground Utilities SH&E 508, Hazardous Materials and Sample Shipping SH&E 511, Heat Stress	**LEVEL D** • ANSI approved hard hat • ANSI approved safety glasses • Shirts with sleeves and full-length pants • ANSI approved steel safety-toe boots or approved equivalent • High visibility reflective traffic vest • Nitrile Gloves • Leather work gloves • Hearing protection required when around operating machines (85 dba OSHA PEL) • First aid kit (located in vehicle) • Fire extinguisher (located in vehicle) **Modified LEVEL D (biohazard avoidance)** • Tyvek suit **LEVEL C (upgrade per Air Monitoring Requirements)** • APR with GMC/P100 cartridges

Acknowledgement

All employees, subcontractors, and visitors must sign the Acknowledgement form, in this section, before conducting field activities at this site.

By signing this form, AECOM employees agree that:

- I have read this Task Hazard Analysis and I understand the requirements of the THA.
- I will conduct work at this site in accordance with the requirements of the THA.

By signing this form, subcontractors and visitors agree that:

- I have read and understood the potential hazards associated with the site.
- I will ensure compliance with my company's policies on health and safety.

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AECOM

TASK HAZARD ANALYSIS (THA)
ERP Site 15
Hancock ANGB, Syracuse, New York

Evaluated by: Sean Liddy, CHST **Date: July 2011**

TASK NAME

Substrate (Calcium Peroxide) Injection
AECOM Technical Services, Inc. Project 60214697

TASK DESCRIPTION	HAZARD IDENTIFICATION	HAZARD CONTROL
General Physical Hazards	– Slip/Trip/Fall – Cold/Heat Stress – Biological Hazards – Cuts/Scrapes/Bruises – Manual lifting/drum moving – Adverse Weather	– Level D PPE required. – Maintain a clean and organized work area. – Watch your step and ensure proper footing. – Provide drinking water and first aid kit. – Wear appropriate clothing for weather conditions. – Assess work area for poisonous plants and animals and communicate observations to avoid them. – Wear appropriate work gloves for task. – Use proper lifting techniques by bending and lifting with legs and not back, and do not over extend or twist (Do not lift over 49lb. without assistance). – Use mechanical means of moving drums/containers (drum dolly). – Be aware of changing weather conditions and provide appropriate weather gear. – When work is halted due to inclement weather, personnel are to seek shelter in vehicles or building designated Shelter in Place (SIP). – Avoid spilling substrate. If substrate is spilled contain and clean up spill immediately using sorbent booms and pads.
Establish exclusion zone/site setup	– Traffic in adjacent roadway	– Use combination of vehicles, cones, traffic barriers and caution tape. Ensure personnel are wearing high-vis vests. – A traffic plan may be necessary depending on location.
Substrate preparation (mixing calcium peroxide powder with potable water)	– Noise Hazard – Chemical exposure potential – Eye Injury – Pressurized water	– Inspect vehicles and equipment daily (Checklists provided in HASP). – Maintain clean and organized work area. – Earplugs and/or ear muffs required in EZ. – Use eye protection. – Use backflow preventer. Make sure backflow preventer has been inspected and approved by owner of hydrant. – Check fittings on hoses prior to opening hydrant. – Ensure properly trained personnel perform task. – Ensure work zone properly delineated and use cones and barricades where necessary to control traffic. Use vehicle to block/protect workers from oncoming traffic. – Avoid spilling substrate. – Clean up all spills immediately. – Check electrical cords on pumps for damage. Do not use equipment with damaged cords. Keep cords dry and use GFI devices. – Monitoring breathing zone with PID and upgrade PPE as required. – Avoid creating splash hazards while pumping. – Keep a safe distance from pump. – Have fire extinguisher on site.
Material Handling	– Chemical Exposure – Splash Hazard – Spills	– Wear modified level D PPE when necessary (Tyvek and face shields or dust masks). – Have portable eyewash on site. – Store drums/containers in designated area.

AECOM

TASK HAZARD ANALYSIS (THA)
ERP Site 15
Hancock ANGB, Syracuse, New York

Evaluated by: Sean Liddy, CHST **Date: July 2011**

TASK DESCRIPTION	HAZARD IDENTIFICATION	HAZARD CONTROL
Injection with direct-push rig	– High Pressure – Mechanical hazards (pinch points) – Slips/trips/falls	– Level D PPE. – Wear ear plugs when DPT rig is in use. – No where the emergency shut-off switches are located on the injection pump and DPT rig. – Inspect all hoses and fittings prior to injection. – Maintain a clean work area. Do not leave DPT rods on ground when not in use. Minimize the amount of hose being used. – Know the locations of pinch points on the DPT rig. – Monitor for surfacing of substrate.
Drill Rig/substrate pump Decontamination	– High pressure water – Splash Hazard	– Spray away from body. – Wear full-face shield, gloves, rubber boots and tyvek or other suitable attire.

CHEMICAL HAZARDS & MONITORING PROCEDURES

Petroleum Hydrocarbons (BEX) - Refer to Section 5 of the HASP for additional information.
Note - Area monitoring with PID (Mini Rae). ≥ 5 ppm requires potential upgrade to Level C.

ADDITIONAL SAFETY CONSIDERATIONS

1. Ensure all personnel have read the HASP and reviewed MSDS for substrate.
2. Ensure all equipment is equipped with necessary fire extinguishers (min 5 lbs BC). Ensure equipment has a working kill switch and back-up alarms, and follow equipment inspection procedures.
3. Ensure underground utilities are verified with facility, marked, markings maintained, and operator aware of location.
4. All equipment operators must be Competent Persons for the task/equipment being performed/operated.
5. All ground personnel must stay clear of equipment and make eye contact (and receive confirmation) with operator prior to approaching. Wear high visibility reflective vests and stay out of travel lanes and swing radius of heavy equipment.
6. Follow safe driving procedures. Always use the buddy system when moving vehicles. Plan your travel path ahead of time. Use maps and known construction zones to make your selection. Consult with the other team members before making any changes to travel path.
7. Use an equipment checklist to verify you have the appropriate equipment/tools for your tasks. Consult appropriate THAs or SOPs.
8. Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed of the truck. It can cause property damage or serious injuries to others or yourself by falling-off from vehicle.
9. When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible.
10. Conduct equipment inspection of all hoses and switches. Stay clear of running equipment.
11. Maintain good housekeeping practices. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.
12. Wear nitrile gloves when collecting samples in soil to avoid dermal contact with potential contaminants. Be observant for tripping hazards, holes, stickups, vines, old fence lines, etc.
13. Always decontaminate materials between locations and at the site. Do not bring equipment back to the office without proper decontamination.
14. For Incidental spills, absorb material with dry absorbent and flush area with water.

APPLICABLE OPERATIONAL SAFETY PROCEDURES	PPE
List SOPs in 500-700 series that apply: SH&E 502, Hazardous Materials and Sample Shipping SH&E 509, Biological Hazards SH&E 607, Manual Lifting SH&E 608, Handling Drums and Large Containers SH&E 610, Hand & Power Tools SH&E 615/616, Cold/Heat Stress Prevention Program SH&E 705, Highway and Road Work SH&E 716, Drilling & Boring	**LEVEL D** • ANSI approved hard hat • ANSI approved safety glasses • Shirts with sleeves and full-length pants • ANSI approved steel safety-toe boots or approved equivalent • High visibility reflective traffic vest • Nitrile Gloves • Leather work gloves • Hearing protection required when around operating machines (85 dba OSHA PEL) • First aid kit (located in vehicle) • Fire extinguisher (located in vehicle)

Evaluated by: Sean Liddy, CHST

Date: July 2011

APPLICABLE OPERATIONAL SAFETY PROCEDURES	PPE
	Modified LEVEL D (splash/dermal protection) • Tyvek Suit and facesheild/chemical goggles **LEVEL C (upgrade based on air monitoring)** • APR with GMC/P100 cartridges

Acknowledgement

All employees, subcontractors, and visitors must sign the Acknowledgement form, in this section, before conducting field activities at this site.

By signing this form, AECOM employees agree that:

- I have read this Task Hazard Analysis and I understand the requirements of the THA.
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By signing this form, subcontractors and visitors agree that:

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AECOM

TASK HAZARD ANALYSIS (THA)
ERP Site 15
Hancock ANGB, Syracuse, New York

Evaluated by: Sean Liddy, CHST **Date: July 2011**

TASK NAME

Remediation System – Operation and Maintenance (O&M)
AECOM Technical Services, Inc. Project 60214697

TASK DESCRIPTION	HAZARD IDENTIFICATION	HAZARD CONTROL
Shutting down the system; Performing lockout/tagout (LOTO); Restarting the system	– Hazardous noise – Uncontrolled hazardous energy – Cuts/lacerations and abrasions – Pinch Points	– Use hearing protection during shut-down operations. – Use proper LOTO procedures. – Watch hand placement and avoid pinch points.
Removing inlet /outlet piping; Removing each shallow tray component; Washing out accumulated sludge inside the clarifier; Pumping out wash-water and sludge; Washing and scraping the components in a temporary decontamination pad; Removing scale from shallow tray holes, as needed; General system repairs, as needed; Reassembling the components	– Exposure potential – Manual lifting of pump and trays – Cuts/lacerations – Slips/trips/falls	– Use ventilation procedures in work space, monitoring breathing zone and use dermal protection. – Use proper lifting techniques and ergonomics awareness. – Use only approved cutting devices and proper tools for repairs/maintenance of parts and components. – Use Modified Level D PPE for splash protection. – Watch hand placement and avoid pinch points. – Ensure proper footing during all work and look out for obstructions, holes, etc in your path.

CHEMICAL HAZARDS & MONITORING PROCEDURES

Petroleum Hydrocarbons (BEX) - Refer to Section 5 of the HASP for additional information.
Note - Area monitoring with PID (Mini Rae). ≥ 5 ppm requires potential upgrade to Level C.

ADDITIONAL SAFETY CONSIDERATIONS

1. An area 20 feet in all directions from the where O&M activities will occur will be the controlled work area to maintain area of spill control and prevent entry by unauthorized personnel.
2. Debris and/or obstacles in work area shall be removed to eliminate slip/trip/fall hazards.
3. Review O&M Plan and ensure operating/maintenance personnel are familiar with equipment.
4. Use LOTO procedures if working (repair/replace) on process equipment.
5. Be aware of moving site vehicles in and around remediation trailers, buildings, and facilities.

APPLICABLE OPERATIONAL SAFETY PROCEDURES	PPE
	LEVEL D • ANSI approved hard hat • High visibility reflective traffic vest • Shirts with sleeves and full-length pants • ANSI approved steel safety-toe boots or approved equivalent • ANSI approved safety glasses • Nitrile Gloves • Hearing protection required when around operating machines (85 dba OSHA PEL) • First aid kit (located in vehicle. • Fire extinguisher (located in vehicle) **Modified LEVEL D (splash/dermal protection)** • Tyvek Suit and facesheild/chemical goggles **LEVEL C (upgrade based on air monitoring)** • APR with GMC/P100 cartridges

AECOM

TASK HAZARD ANALYSIS (THA)
ERP Site 15
Hancock ANGB, Syracuse, New York

Evaluated by: Sean Liddy, CHST **Date: July 2011**

Acknowledgement

All employees, subcontractors, and visitors must sign the Acknowledgement form, in this section, before conducting field activities at this site.

By signing this form, AECOM employees agree that:

- I have read this Task Hazard Analysis and I understand the requirements of the THA.
- I will conduct work at this site in accordance with the requirements of the THA.

By signing this form, subcontractors and visitors agree that:

- I have read and understood the potential hazards associated with the site.
- I will ensure compliance with my company's policies on health and safety.

Print Name & Company	Date	Signature
Print Name & Company	Date	Signature
Print Name & Company	Date	Signature
Print Name & Company	Date	Signature
Print Name & Company	Date	Signature
Print Name & Company	Date	Signature
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Attachment B

Material Safety Data Sheets

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Material Safety Data Sheet
Calcium peroxide MSDS

Section 1: Chemical Product and Company Identification

Product Name: Calcium peroxide

Catalog Codes: SLC1243

CAS#: 1305-79-9

RTECS: EW3865000

TSCA: TSCA 8(b) inventory: Calcium peroxide

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: CaO2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Calcium peroxide	1305-79-9	100

Toxicological Data on Ingredients: Calcium peroxide: ORAL (LD50): Acute: >5000 mg/kg [Rat]. DERMAL (LD50): Acute: >10000 mg/kg [Rat]. DUST (LC50): Acute: 23066 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Extremely hazardous in case of skin contact (irritant), of eye contact (irritant). Very hazardous in case of ingestion, of inhalation (lung irritant). Hazardous in case of skin contact (corrosive). Prolonged exposure may result in skin burns and ulcerations. Over-exposure by inhalation may cause respiratory irritation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:
If the chemical got onto the clothed portion of the body, remove the contaminated clothes as quickly as possible, protecting your own hands and body. Place the victim under a deluge shower. If the chemical got on the victim's exposed skin, such as the hands : Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. If necessary: Neutralize the residue with a dilute solution of acetic acid.

Large Spill:
Oxidizing material. Stop leak if without risk. Avoid contact with a combustible material (wood, paper, oil, clothing...). Keep substance damp using water spray. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of acetic acid.

Section 7: Handling and Storage

Precautions:

Keep container dry. Keep away from heat. Keep away from sources of ignition. Keep away from combustible material Do not ingest. Do not breathe dust. Never add water to this product In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes Keep away from incompatibles such as reducing agents, combustible materials, organic materials, acids, moisture.

Storage: Oxidizing materials should be stored in a separate safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Odorless.

Taste: Not available.

Molecular Weight: 72.08 g/mole

Color: White to yellowish.

pH (1% soln/water): 12.5 [Basic.]

Boiling Point: Not available.

Melting Point: Decomposes.

Critical Temperature: Not available.

Specific Gravity: Not available.

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with reducing agents, combustible materials, organic materials, acids, moisture.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): >5000 mg/kg [Rat]. Acute dermal toxicity (LD50): >10000 mg/kg [Rat]. Acute toxicity of the dust (LC50): 68000 mg/m3 4 hour(s) [Rat].

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans:
Extremely hazardous in case of skin contact (irritant). Very hazardous in case of ingestion, of inhalation (lung irritant). Hazardous in case of skin contact (corrosive).

Special Remarks on Toxicity to Animals: Not available

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 5.1: Oxidizing material.

Identification: : Calcium Peroxide : UN1457 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
New Jersey: Calcium peroxide TSCA 8(b) inventory: Calcium peroxide

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS C: Oxidizing material. CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R37/38- Irritating to respiratory system and skin. R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 2

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 2

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 04:32 PM

Last Updated: 11/01/2010 12:00 PM

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Material Safety Data Sheet
Instant FAME/Instant Anaerobe Methods
Methanol

SECTION 1 – CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MSDS Name: Methanol
MSDS Preparation Date: 06/19/2009
Synonyms or Generic ID for Methanol: Carbinol; Methyl alcohol; Methyl hydroxide; Monohydroxymethane; Wood alcohol; Wood naptha; Wood spirits; Columbian spirits; Methanol.
Chemical Family: Methanol Family
Formula: CH_3OH
Molecular Weight: N/A
PIN (UN#/ NA#): UN1230
Company Identification:

Microbial ID.
125 Sandy Drive
Newark, DE 19713

For Information, call: (800)276-8068, (302)737-4297
For Domestic CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

SECTION 2 – COMPOSITION, INFORMATION ON INGREDIENTS

67-56-1	Methanol	<99%	200-659-6	Irritant, Flammable

NFPA Rating: (estimated) Health: 1; Flammability: 3; Instability: 0

State: Liquid	Appearance: colorless	Odor: Alcohol-like, weak odor
Boiling Point: 64.7°C@760mmHg	pH: Not available	Specific Gravity: 7910g/cm3@20°C
Vapor Pressure (mm Hg): 128mmHg @20°C	Vapor Density (AIR=1): 1.11	
Flash Point: 12°C	Solubility in Water: miscible	

SECTION 3 – HAZARDS IDENTIFICATION

Appearance: Colorless liquid, Flash Point: 12°C, 53.6°F.

Danger! Poison! May be fatal or cause blindness if swallowed. Vapor harmful. **Flammable liquid and vapor.** Harmful if swallowed, inhaled, or absorbed through the skin. Causes eye, skin, and respiratory tract irritation. May cause central nervous system depression. Cannot be made non-poisonous.
Target Organs: Eyes, nervous system, optic nerve.

Potential Health Effects
Eye: May cause painful sensitization to light. Methanol is a mild to moderate eye irritant. Inhalation, ingestion or skin absorption of methanol can cause significant disturbance in vision, including blindness.
Skin: Causes moderate skin irritation. May be absorbed through the skin in harmful amounts. Prolonged and or repeated contact may cause defatting of skin and dermatitis. Methanol can be absorbed through the skin, producing systemic effects that include visual disturbances.
Ingestion: May be fatal or cause blindness if swallowed. Aspiration hazard. Cannot be made non-poisonous. May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May cause systematic toxicity with acidosis. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma, and possible death due to failed respiratory failure. May cause cardiopulmonary system effects.

Inhalation: Methanol is toxic and can very readily form extremely high vapor concentrations at room temperature. Inhalation is the most common route of occupational exposure. At first, methanol causes CNS depression with nausea, headache, vomiting, dizziness and incoordination. A time period with no obvious symptoms follows (typically 8-24 hrs). This latent period is followed by metabolic acidosis and severe visual effects which may include reduced reactivity and/or increased sensitivity to light, blurred, doubl and/or snowy vision, and blindness. Depending on the severity of exposure and the promptness of treatment, survivors may recover completely or may have permanent blindness, vision disturbances and/or nervous system effects.
Chronic: Prolonged or repeated skin contact may cause dermatitis. Chronic exposure may cause effects similar to those of acute exposure. Methanol is only very slowly eliminated from the body. Because of this slow elimination, methanol should be regarded as a cumulative poison. Though a single exposure may cause no effect, daily exposures may result in the accumulation of a harmful amount. Methanol has produced fetotoxicity in rats and teratogenicity in mice exposed by inhalation to high concentrations that did not produce significant maternal toxicity.

SECTION 4 – FIRST AID MEASURES

Eyes: In case of contact, immediately flush eyes with plenty of water for a t least 15 minutes. Get medical aid.
Skin: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid immediately. Wash clothing before reuse.
Ingestion: Potential for aspiration if swallowed. Get medical aid immediately. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If vomiting occurs naturally, have victim lean forward.
Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Effects may be delayed.
Antidote: Ethanol may inhibit methanol metabolism.

SECTION 5 – FIRE FIGHTING MEASURES

General Information: Ethanol may inhibit methanol metabolism. As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Water may be ineffective. Material is lighter than water and a fire may be spread by the use of water. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas.
Extinguishing Media: For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. Water may be ineffective. For large fires, use water spray, fog or alcohol-resistant foam. Do NOT use straight streams of water.
Flash Point: 12 deg C (53.60 deg F)
Autoignition Temperature: 455 deg C (851.00 deg F)
Explosion Limits, Lower:6.0 vol %
Upper: 31.00 vol %
NFPA Rating: (estimated) Health: 1; Flammability: 3; Instability: 0

SECTION 6 – ACCIDENTAL RELEASE MEASURES

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Use water spray to disperse the gas/vapor. Remove all sources of ignition. Absorb spill using an absorbent, non-combustible material such as earth, sand, or vermiculite. Do not use combustible materials such as sawdust. Use a spark-proof tool. Provide ventilation. A vapor suppressing foam may be used to reduce vapors. Water spray may reduce vapor but may not prevent ignition in closed spaces.

SECTION 7-HANDLING AND STORAGE

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Use spark-proof tools and explosion proof equipment. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Do not ingest or inhale. Do not pressurize, cut, weld, braze, solder, drill, grind or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Keep away from heat, sparks and flame. Avoid use in confined spaces.
Storage: Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a cool, dry, well-ventilated area away from incompatible substances. Flammables-area. Keep containers tightly closed.

SECTION 8 – EXPOSURE CONTROL/ PERSONAL PROTECTION

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

Chemical Name	ACGIH	NIOSH	OSHA – Final PELs
Methanol	200 ppm TWA; 250 ppm STEL; Skin - potential significant contribution to overall exposure by the cutaneous route	200 ppm TWA; 260 mg/m3 TWA 6000 ppm IDLH	200 ppm TWA; 260 mg/m3 TWA

OSHA Vacated PELs: Methanol: 200 ppm TWA; 260 mg/m3 TWA
Personal Protective Equipment
Eyes: Wear chemical splash goggles.
Skin: Wear butyl rubber gloves, apron, and/or clothing.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Clear liquid
Appearance: clear, colorless - APHA: 10 max
Odor: alcohol-like - weak odor
pH: Not available.
Vapor Pressure: 128 mm Hg @ 20 deg C
Vapor Density: 1.11 (Air=1)
Evaporation Rate:5.2 (Ether=1)
Viscosity: 0.55 cP 20 deg C
Boiling Point: 64.7 deg C @ 760 mmHg
Freezing/Melting Point:-98 deg C
Decomposition Temperature: Not available.
Solubility: miscible
Specific Gravity/Density: 7910 g/cm3 @ 20°C
Molecular Formula:CH4O
Molecular Weight:32.04

SECTON 10 – STABILITY AND REACTIVITY

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: High temperatures, ignition sources, confined spaces.
Incompatibilities with Other Materials: Oxidizing agents, reducing agents, acids, alkali metals, potassium, sodium, metals as powders (e.g. hafnium, raney nickel), acid anhydrides, acid chlorides, powdered aluminum, powdered magnesium.
Hazardous Decomposition Products: Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide, formaldehyde.
Hazardous Polymerization: Will not occur.

SECTION 11 – TOXICOLOGICAL INFORMATION

RTECS#:
CAS# 67-56-1: PC1400000
LD50/LC50:
CAS# 67-56-1:

Draize test, rabbit, eye: 40 mg Moderate;
Draize test, rabbit, eye: 100 mg/24H Moderate;
Draize test, rabbit, skin: 20 mg/24H Moderate;
Inhalation, rabbit: LC50 = 81000 mg/m3/14H;
Inhalation, rat: LC50 = 64000 ppm/4H;
Oral, mouse: LD50 = 7300 mg/kg;
Oral, rabbit: LD50 = 14200 mg/kg;
Oral, rat: LD50 = 5600 mg/kg;
Skin, rabbit: LD50 = 15800 mg/kg;

Human LDLo Oral: 143 mg/kg; Human LDLo Oral: 428 mg/kg; Human TCLo Inhalation; 300 ppm caused visual field changes & headache; Monkey LDLo Skin: 393 mg/kg. Methanol is significantly less toxic to most experimental animals than humans, because most animal species metabolize methanol differently. Non-primate species do not ordinarily show symptoms of metabolic acidosis or the visual effects which have been observed in primates and humans.
Carcinogenicity:
CAS# 67-56-1: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No information found
Teratogenicity: There is no human information available. Methanol is considered to be a potential developmental hazard based on animal data. In animal experiments, methanol has caused fetotoxic or teratogenic effects without maternal toxicity.
Reproductive Effects: See actual entry in RTECS for complete information.
Mutagenicity: See actual entry in RTECS for complete information.
Neurotoxicity: ACGIH cites neuropathy, vision and CNS under TLV basis.

SECTION 12 – ECOLOGICAL INFORMATION

Ecotoxicity: Fish: Fathead Minnow: 29.4 g/L; 96 Hr; LC50 (unspecified)Fish: Goldfish: 250 ppm; 11 Hr; resulted in deathFish: Rainbow trout: 8000 mg/L; 48 Hr; LC50 (unspecified)Fish: Rainbow trout: LC50 = 13-68 mg/L; 96 Hr.; 12 degrees CFish: Fathead Minnow: LC50 = 29400 mg/L; 96 Hr.; 25 degrees C, pH 7.63Fish: Rainbow trout: LC50 = 8000 mg/L; 48 Hr.; UnspecifiedBacteria: Phytobacterium phosphoreum: EC50 = 51,000-320,000 mg/L; 30 minutes; Microtox test No data available.
Environmental: Dangerous to aquatic life in high concentrations. Aquatic toxicity rating: TLm 96>1000 ppm. May be dangerous if it enters water intakes. Methyl alcohol is expected to biodegrade in soil and water very rapidly. This product will show high soil mobility and will be degraded from the ambient atmosphere by the reaction with photochemically produced hyroxyl radicals with an estimated half-life of 17.8 days. Bioconcentration factor for fish (golden ide) < 10. Based on a log Kow of -0.77, the BCF value for methanol can be estimated to be 0.2.
Physical: No information available.
Other: No information available.

SECTION 13 – DISPOSAL CONSIDERATIONS

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

RCRA P-Series: None listed.

RCRA U-Series:

CAS# 67-56-1: waste number U154 (Ignitable waste).

SECTION 14 – TRANSPORT INFORMATION

	US DOT	CANADA TDG
Shipping Name:	Methanol	Methanol
Hazard Class:	3	3
UN Number:	UN1230	UN1230
Packing Group:	II	II
Additional Information		Flash Point 12°C

SECTION 15 – REGULATORY INFORMATION

US FEDERAL

TSCA

CAS# 67-56-1 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

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

TSCA Significant New Use Rule

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

CERCLA Hazardous Substances and corresponding RQs

CAS# 67-56-1: 5000 lb final RQ; 2270 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 67-56-1: immediate, fire.

Section 313

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

Clean Air Act:

CAS# 67-56-1 is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

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

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

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

OSHA:

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

STATE

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

California Prop 65
California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols:
T F
Risk Phrases:
R 11 Highly flammable.
R 23/24/25 Toxic by inhalation, in contact with skin and if swallowed.
R 39/23/24/25 Toxic : danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.

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

WGK (Water Danger/Protection)
CAS# 67-56-1: 1
Canada - DSL/NDSL
CAS# 67-56-1 is listed on Canada's DSL List.
Canada - WHMIS
This product has a WHMIS classification of B2, D1B, D2B.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.
Canadian Ingredient Disclosure List
CAS# 67-56-1 is listed on the Canadian Ingredient Disclosure List.

SECTION 16 – Other Information

This Material Safety Data Sheet has been prepared in accordance with 29 CFR 1910.1200 and contains information believed to be accurate and complete at the date of preparation. The statements contained herein are offered for informational purposes only and are based upon technical data. MIDI Inc. believes them to be accurate but does not purport to be all-inclusive. The above-stated product is intended for use only by persons having the necessary technical skills and facilities for handling the product at their discretion and risk. Since conditions and manner of use are outside our control, we (MIDI Inc.) make no warranty of merchantability or any such warranty, express or implied with respect to information and we assume no liability resulting from the above product or its use. Users should make their own investigations to determine suitability of information and product for their particular purposes.

MATERIAL SAFETY DATA SHEET

Gasoline, All Grades **MSDS No. 9950**

EMERGENCY OVERVIEW
DANGER!
EXTREMELY FLAMMABLE - EYE AND MUCOUS MEMBRANE IRRITANT - EFFECTS CENTRAL NERVOUS SYSTEM - HARMFUL OR FATAL IF SWALLOWED - ASPIRATION HAZARD

NFPA 704 (Section 16)

High fire hazard. Keep away from heat, spark, open flame, and other ignition sources.

If ingested, do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs). Contact may cause eye, skin and mucous membrane irritation. Harmful if absorbed through the skin. Avoid prolonged breathing of vapors or mists. Inhalation may cause irritation, anesthetic effects (dizziness, nausea, headache, intoxication), and respiratory system effects.

Long-term exposure may cause effects to specific organs, such as to the liver, kidneys, blood, nervous system, and skin. Contains benzene, which can cause blood disease, including anemia and leukemia.

1. CHEMICAL PRODUCT and COMPANY INFORMATION

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

EMERGENCY TELEPHONE NUMBER (24 hrs): **CHEMTREC (800)424-9300**
COMPANY CONTACT (business hours): Corporate Safety (732)750-6000
MSDS (Environment, Health, Safety) Internet Website www.hess.com

SYNONYMS: Hess Conventional (Oxygenated and Non-oxygenated) Gasoline; Reformulated Gasoline (RFG); Reformulated Gasoline Blendstock for Oxygenate Blending (RBOB); Unleaded Motor or Automotive Gasoline

See Section 16 for abbreviations and acronyms.

2. COMPOSITION and INFORMATION ON INGREDIENTS *

INGREDIENT NAME (CAS No.)	CONCENTRATION PERCENT BY WEIGHT
Gasoline (86290-81-5)	100
Benzene (71-43-2)	0.1 - 4.9 (0.1 - 1.3 reformulated gasoline)
n-Butane (106-97-8)	< 10
Ethyl Alcohol (Ethanol) (64-17-5)	0 - 10
Ethyl benzene (100-41-4)	< 3
n-Hexane (110-54-3)	0.5 to 4
Methyl-tertiary butyl ether (MTBE) (1634-04-4)	0 to 15.0
Tertiary-amyl methyl ether (TAME) (994-05-8)	0 to 17.2
Toluene (108-88-3)	1 - 25
1,2,4- Trimethylbenzene (95-63-6)	< 6
Xylene, mixed isomers (1330-20-7)	1 - 15

A complex blend of petroleum-derived normal and branched-chain alkane, cycloalkane, alkene, and aromatic hydrocarbons. May contain antioxidant and multifunctional additives. Non-oxygenated Conventional Gasoline and RBOB do not have oxygenates (Ethanol or MTBE and/or TAME).

Oxygenated Conventional and Reformulated Gasoline will have oxygenates for octane enhancement or as legally required.

3. HAZARDS IDENTIFICATION

EYES
Moderate irritant. Contact with liquid or vapor may cause irritation.

SKIN
Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are exposed repeatedly.

INGESTION
The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

INHALATION
Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

CHRONIC EFFECTS and CARCINOGENICITY
Contains benzene, a regulated human carcinogen. Benzene has the potential to cause anemia and other blood diseases, including leukemia, after repeated and prolonged exposure. Exposure to light hydrocarbons in the same boiling range as this product has been associated in animal studies with systemic toxicity. See also Section 11 - Toxicological Information.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
Irritation from skin exposure may aggravate existing open wounds, skin disorders, and dermatitis (rash). Chronic respiratory disease, liver or kidney dysfunction, or pre-existing central nervous system disorders may be aggravated by exposure.

4. FIRST AID MEASURES

EYES
In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

SKIN
Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops.

INGESTION

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

INHALATION

Remove person to fresh air. If person is not breathing, ensure an open airway and provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES:

FLASH POINT:	-45 °F (-43°C)
AUTOIGNITION TEMPERATURE:	highly variable; > 530 °F (>280 °C)
OSHA/NFPA FLAMMABILITY CLASS:	1A (flammable liquid)
LOWER EXPLOSIVE LIMIT (%):	1.4%
UPPER EXPLOSIVE LIMIT (%):	7.6%

FIRE AND EXPLOSION HAZARDS

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. Flowing product may be ignited by self-generated static electricity. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

EXTINGUISHING MEDIA

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or Halon.

LARGE FIRES: Water spray fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

During certain times of the year and/or in certain geographical locations, gasoline may contain MTBE and/or TAME. Firefighting foam suitable for polar solvents is recommended for fuel with greater than 10% oxygenate concentration - refer to NFPA 11 "Low Expansion Foam - 1994 Edition."

FIRE FIGHTING INSTRUCTIONS

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

See Section 16 for the NFPA 704 Hazard Rating.

6. ACCIDENTAL RELEASE MEASURES

ACTIVATE FACILITY SPILL CONTINGENCY or EMERGENCY PLAN.

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Carefully contain and stop the source of the spill, if safe to do so. Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal - caution, flammable vapors may accumulate in closed containers. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

7. HANDLING and STORAGE

HANDLING PRECAUTIONS

******USE ONLY AS A MOTOR FUEL******
******DO NOT SIPHON BY MOUTH******

Handle as a flammable liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents.

STORAGE PRECAUTIONS

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

WORK/HYGIENIC PRACTICES

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

8. EXPOSURE CONTROLS and PERSONAL PROTECTION

EXPOSURE LIMITS

Component (CAS No.)	Source	Exposure Limits TWA (ppm)	STEL (ppm)	Note
Gasoline (86290-81-5)	ACGIH	300	500	A3
Benzene (71-43-2)	OSHA	1	5	Carcinogen
	ACGIH	0.5	2.5	A1, skin
	USCG	1	5	
n-Butane (106-97-8)	ACGIH	1000	--	Aliphatic Hydrocarbon Gases Alkane (C1-C4)
Ethyl Alcohol (ethanol) (64-17-5)	OSHA	1000	--	
	ACGIH	1000	--	A4
Ethyl benzene (100-41-4)	OSHA	100	--	
	ACGIH	100	125	A3
n-Hexane (110-54-3)	OSHA	500	--	
	ACGIH	50	--	Skin
Methyl-tertiary butyl ether [MTBE] (1634-04-4)	ACGIH	50		A3
Tertiary-amyl methyl ether [TAME] (994-05-8)				None established
Toluene (108-88-3)	OSHA	200		Ceiling: 300 ppm; Peak: 500 ppm (10 min.)
	ACGIH	20	--	A4
1,2,4- Trimethylbenzene (95-63-6)	ACGIH	25	--	
Xylene, mixed isomers (1330-20-7)	OSHA	100	--	
	ACGIH	100	150	A4

ENGINEERING CONTROLS

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

EYE/FACE PROTECTION

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

SKIN PROTECTION

Gloves constructed of nitrile or neoprene are recommended. Chemical protective clothing such as that made of of E.I. DuPont Tychem ®, products or equivalent is recommended based on degree of exposure.

Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

RESPIRATORY PROTECTION

A NIOSH-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection and limitations.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

9. PHYSICAL and CHEMICAL PROPERTIES

APPEARANCE

A translucent, straw-colored or light yellow liquid

ODOR
A strong, characteristic aromatic hydrocarbon odor. Oxygenated gasoline with MTBE and/or TAME may have a sweet, ether-like odor and is detectable at a lower concentration than non-oxygenated gasoline.

ODOR THRESHOLD

	Odor Detection	Odor Recognition
Non-oxygenated gasoline:	0.5 - 0.6 ppm	0.8 - 1.1 ppm
Gasoline with 15% MTBE:	0.2 - 0.3 ppm	0.4 - 0.7 ppm
Gasoline with 15% TAME:	0.1 ppm	0.2 ppm

BASIC PHYSICAL PROPERTIES

BOILING RANGE:	85 to 437 °F (39 to 200 °C)
VAPOR PRESSURE:	6.4 - 15 RVP @ 100 °F (38 °C) (275-475 mm Hg @ 68 °F (20 °C)
VAPOR DENSITY (air = 1):	AP 3 to 4
SPECIFIC GRAVITY (H_2O = 1):	0.70 – 0.78
EVAPORATION RATE:	10-11 (n-butyl acetate = 1)
PERCENT VOLATILES:	100 %
SOLUBILITY (H_2O):	Non-oxygenated gasoline - negligible (< 0.1% @ 77 °F). Gasoline with 15% MTBE - slight (0.1 - 3% @ 77 °F); ethanol is readily soluble in water

10. STABILITY and REACTIVITY)

STABILITY: Stable. Hazardous polymerization will not occur.

CONDITIONS TO AVOID
Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources

INCOMPATIBLE MATERIALS
Keep away from strong oxidizers.

HAZARDOUS DECOMPOSITION PRODUCTS
Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.

11. TOXICOLOGICAL PROPERTIES

ACUTE TOXICITY
Acute Dermal LD50 (rabbits): > 5 ml/kg
Acute Oral LD50 (rat): 18.75 ml/kg
Primary dermal irritation (rabbits): slightly irritating
Draize eye irritation (rabbits): non-irritating
Guinea pig sensitization: negative

CHRONIC EFFECTS AND CARCINOGENICITY
Carcinogenicity: OSHA: NO IARC: YES - 2B NTP: NO ACGIH: YES (A3)

IARC has determined that gasoline and gasoline exhaust are possibly carcinogenic in humans. Inhalation exposure to completely vaporized unleaded gasoline caused kidney cancers in male rats and liver tumors in female mice. The U.S. EPA has determined that the male kidney tumors are species-specific and are irrelevant for human health risk assessment. The significance of the tumors seen in female mice is not known. Exposure to light hydrocarbons in the same boiling range as this product has been associated in animal studies with effects to the central and peripheral nervous systems, liver, and kidneys. The significance of these animal models to predict similar human response to gasoline is uncertain.

This product contains benzene. Human health studies indicate that prolonged and/or repeated overexposure to benzene may cause damage to the blood-forming system (particularly bone marrow), and serious blood disorders such as aplastic anemia and leukemia. Benzene is listed as a human carcinogen by the NTP, IARC, OSHA and ACGIH.

This product may contain methyl tertiary butyl ether (MTBE): animal and human health effects studies indicate that MTBE may cause eye, skin, and respiratory tract irritation, central nervous system depression and neurotoxicity. MTBE is classified as an animal carcinogen (A3) by the ACGIH.

12. ECOLOGICAL INFORMATION

Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations. If released, oxygenates such as ethers and alcohols will be expected to exhibit fairly high mobility in soil, and therefore may leach into groundwater. The API (www.api.org) provides a number of useful references addressing petroleum and oxygenate contamination of groundwater.

13. DISPOSAL CONSIDERATIONS

Consult federal, state and local waste regulations to determine appropriate disposal options.

14. TRANSPORTATION INFORMATION

DOT PROPER SHIPPING NAME:	Gasoline
DOT HAZARD CLASS and PACKING GROUP:	3, PG II
DOT IDENTIFICATION NUMBER:	UN 1203
DOT SHIPPING LABEL:	FLAMMABLE LIQUID

PLACARD:

15. REGULATORY INFORMATION

U.S. FEDERAL, STATE, and LOCAL REGULATORY INFORMATION

This product and its constituents listed herein are on the EPA TSCA Inventory. Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, state and/or local reporting requirements. This product and/or its constituents may also be subject to other federal, state, or local regulations; consult those regulations applicable to your facility/operation.

CLEAN WATER ACT (OIL SPILLS)

Any spill or release of this product to "navigable waters" (essentially any surface water, including certain wetlands) or adjoining shorelines sufficient to cause a visible sheen or deposit of a sludge or emulsion must be reported immediately to the National Response Center (1-800-424-8802) as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies as required.

CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIRONMENT)

The CERCLA definition of hazardous substances contains a "petroleum exclusion" clause which exempts crude oil, refined, and unrefined petroleum products and any indigenous components of such. However, other federal reporting requirements (e.g., SARA Section 304 as well as the Clean Water Act if the spill occurs on navigable waters) may still apply.

SARA SECTION 311/312 - HAZARD CLASSES

ACUTE HEALTH	CHRONIC HEALTH	FIRE	SUDDEN RELEASE OF PRESSURE	REACTIVE
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

INGREDIENT NAME (CAS NUMBER)	CONCENTRATION WT. PERCENT
Benzene (71-43-2)	0.1 to 4.9 (0.1 to 1.3 for reformulated gasoline)
Ethyl benzene (100-41-4)	< 3

n-Hexane (110-54-3)	0.5 to 4
Methyl-tertiary butyl ether (MTBE) (1634-04-4)	0 to 15.0
Toluene (108-88-3)	1 to 15
1,2,4- Trimethylbenzene (95-63-6)	< 6
Xylene, mixed isomers (1330-20-7)	1 to 15

US EPA guidance documents (www.epa.gov/tri) for reporting Persistent Bioaccumulating Toxics (PBTs) indicate this product may contain the following deminimis levels of toxic chemicals subject to Section 313 reporting:

INGREDIENT NAME (CAS NUMBER)	CONCENTRATION - Parts per million (ppm) by weight
Polycyclic aromatic compounds (PACs)	17
Benzo (g,h,i) perylene (191-24-2)	2.55
Lead (7439-92-1)	0.079

CALIFORNIA PROPOSITION 65 LIST OF CHEMICALS

This product contains the following chemicals that are included on the Proposition 65 "List of Chemicals" required by the California Safe Drinking Water and Toxic Enforcement Act of 1986:

INGREDIENT NAME (CAS NUMBER)	Date Listed
Benzene	2/27/1987
Ethyl benzene	6/11/2004
Toluene	1/1/1991

CANADIAN REGULATORY INFORMATION (WHMIS)

Class B, Division 2 (Flammable Liquid)
Class D, Division 2A (Very toxic by other means) and Class D, Division 2B (Toxic by other means)

16. OTHER INFORMATION

NFPA® HAZARD RATING	HEALTH:	1	Slight
	FIRE:	3	Serious
	REACTIVITY:	0	Minimal
HMIS® HAZARD RATING	HEALTH:	1 *	Slight
	FIRE:	3	Serious
	PHYSICAL:	0	Minimal
			* CHRONIC

SUPERSEDES MSDS DATED: 07/01/06

ABBREVIATIONS:

AP = Approximately < = Less than > = Greater than
N/A = Not Applicable N/D = Not Determined ppm = parts per million

ACRONYMS:

ACGIH	American Conference of Governmental Industrial Hygienists	CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
AIHA	American Industrial Hygiene Association	DOT	U.S. Department of Transportation [General Info: (800)467-4922]
ANSI	American National Standards Institute (212)642-4900	EPA	U.S. Environmental Protection Agency
API	American Petroleum Institute (202)682-8000	HMIS	Hazardous Materials Information System

IARC	International Agency For Research On Cancer
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association (617)770-3000
NIOSH	National Institute of Occupational Safety and Health
NOIC	Notice of Intended Change (proposed change to ACGIH TLV)
NTP	National Toxicology Program
OPA	Oil Pollution Act of 1990
OSHA	U.S. Occupational Safety & Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit (NIOSH)
SARA	Superfund Amendments and Reauthorization Act of 1986 Title III
SCBA	Self-Contained Breathing Apparatus
SPCC	Spill Prevention, Control, and Countermeasures
STEL	Short-Term Exposure Limit (generally 15 minutes)
TLV	Threshold Limit Value (ACGIH)
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average (8 hr.)
WEEL	Workplace Environmental Exposure Level (AIHA)
WHMIS	Workplace Hazardous Materials Information System (Canada)

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

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MATERIAL SAFETY DATA SHEET

Diesel Fuel (All Types) **MSDS No. 9909**

EMERGENCY OVERVIEW
CAUTION!
OSHA/NFPA COMBUSTIBLE LIQUID - SLIGHT TO MODERATE IRRITANT
EFFECTS CENTRAL NERVOUS SYSTEM
HARMFUL OR FATAL IF SWALLOWED

Moderate fire hazard. Avoid breathing vapors or mists. May cause dizziness and drowsiness. May cause moderate eye irritation and skin irritation (rash). Long-term, repeated exposure may cause skin cancer.
If ingested, do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs).

NFPA 704 (Section 16)

1. CHEMICAL PRODUCT AND COMPANY INFORMATION

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

EMERGENCY TELEPHONE NUMBER (24 hrs): **CHEMTREC (800) 424-9300**
COMPANY CONTACT (business hours): Corporate Safety (732) 750-6000
MSDS INTERNET WEBSITE: www.hess.com (See Environment, Health, Safety & Social Responsibility)

SYNONYMS: Ultra Low Sulfur Diesel (ULSD); Low Sulfur Diesel; Motor Vehicle Diesel Fuel; Diesel Fuel #2; Dyed Diesel Fuel; Non-Road, Locomotive and Marine Diesel Fuel; Tax-exempt Diesel Fuel

See Section 16 for abbreviations and acronyms.

2. COMPOSITION and CHEMICAL INFORMATION ON INGREDIENTS

INGREDIENT NAME (CAS No.)	CONCENTRATION PERCENT BY WEIGHT
Diesel Fuel (68476-34-6)	100
Naphthalene (91-20-3)	Typically < 0.01

A complex mixture of hydrocarbons with carbon numbers in the range C9 and higher. Diesel fuel may be dyed (red) for tax purposes. May contain a multifunctional additive.

3. HAZARDS IDENTIFICATION

EYES
Contact with liquid or vapor may cause mild irritation.

SKIN
May cause skin irritation with prolonged or repeated contact. Practically non-toxic if absorbed following acute (single) exposure. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are repeatedly exposed.

INGESTION
The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

INHALATION
Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

CHRONIC EFFECTS and CARCINOGENICITY
Similar products produced skin cancer and systemic toxicity in laboratory animals following repeated applications. The significance of these results to human exposures has not been determined - see Section 11 Toxicological Information.

IARC classifies whole diesel fuel exhaust particulates as probably carcinogenic to humans (Group 2A). NIOSH regards whole diesel fuel exhaust particulates as a potential cause of occupational lung cancer based on animal studies and limited evidence in humans.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
Irritation from skin exposure may aggravate existing open wounds, skin disorders, and dermatitis (rash).

4. FIRST AID MEASURES

EYES
In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

SKIN
Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops.

INGESTION
DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

INHALATION
Remove person to fresh air. If person is not breathing provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES:

FLASH POINT:	> 125 °F (> 52 °C) minimum PMCC
AUTOIGNITION POINT:	494 °F (257 °C)
OSHA/NFPA FLAMMABILITY CLASS:	2 (COMBUSTIBLE)
LOWER EXPLOSIVE LIMIT (%):	0.6
UPPER EXPLOSIVE LIMIT (%):	7.5

FIRE AND EXPLOSION HAZARDS
Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

EXTINGUISHING MEDIA
SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or Halon.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

FIRE FIGHTING INSTRUCTIONS

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further m nimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

See Section 16 for the NFPA 704 Hazard Rating.

6. ACCIDENTAL RELEASE MEASURES

ACTIVATE FACILITY'S SPILL CONTINGENCY OR EMERGENCY RESPONSE PLAN.

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Carefully contain and stop the source of the spill, if safe to do so. Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal - caution, flammable vapors may accumulate in closed containers. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

7. HANDLING and STORAGE

HANDLING PRECAUTIONS

Handle as a combustible liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Diesel fuel, and in particular low and ultra low sulfur diesel fuel, has the capability of accumulating a static electrical charge of sufficient energy to cause a fire/explosion in the presence of lower flashpoint products such as gasoline. The accumulation of such a static charge occurs as the diesel flows through pipelines, filters, nozzles and various work tasks such as tank/container filling, splash loading, tank cleaning; product sampling; tank gauging; cleaning, mixing, vacuum truck operations, switch loading, and product agitation. There is a greater potential for static charge accumulation in cold temperature, low humidity conditions.

Documents such as 29 CFR OSHA 1910.106 "Flammable and Combustible Liquids, NFPA 77 Recommended Practice on Static Electricity, API 2003 "Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents and ASTM D4865 "Standard Guide for Generation and Dissipation of Static

Electricity in Petroleum Fuel Systems" address special precautions and design requirements involving loading rates, grounding, bonding, filter installation, conductivity additives and especially the hazards associated with "switch loading." ["Switch Loading" is when a higher flash point product (such as diesel) is loaded into tanks previously containing a low flash point product (such as gasoline) and the electrical charge generated during loading of the diesel results in a static ignition of the vapor from the previous cargo (gasoline).]

Note: When conductivity additives are used or are necessary the product should achieve 25 picosiemens/meter or greater at the handling temperature.

STORAGE PRECAUTIONS

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

WORK/HYGIENIC PRACTICES

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

8. EXPOSURE CONTROLS and PERSONAL PROTECTION

EXPOSURE LIMITS

Components (CAS No.)	Source	Exposure Limits TWA/STEL	Note
Diesel Fuel: (68476-34-6)	OSHA	5 mg/m, as mineral oil mist	
	ACGIH	100 mg/m^3 (as totally hydrocarbon vapor) TWA	A3, skin
Naphthalene (91-20-3)	OSHA	10 ppm TWA	
	ACGIH	10 ppm TWA / 15 ppm STEL	A4, Skin

ENGINEERING CONTROLS

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

EYE/FACE PROTECTION

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

SKIN PROTECTION

Gloves constructed of nitrile, neoprene, or PVC are recommended. Chemical protective clothing such as of E.I. DuPont TyChem®, Saranex® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

RESPIRATORY PROTECTION
A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

9. PHYSICAL and CHEMICAL PROPERTIES

APPEARANCE
Clear, straw-yellow liquid. Dyed fuel oil will be red or reddish-colored.

ODOR
Mild, petroleum distillate odor

BASIC PHYSICAL PROPERTIES

BOILING RANGE:	320 to 690 oF (160 to 366 °C)
VAPOR PRESSURE:	0.009 psia @ 70 °F (21 °C)
VAPOR DENSITY (air = 1):	> 1.0
SPECIFIC GRAVITY (H_2O = 1):	0.83 to 0.88 @ 60 °F (16 °C)
PERCENT VOLATILES:	100 %
EVAPORATION RATE:	Slow; varies with conditions
SOLUBILITY (H_2O):	Negligible

10. STABILITY and REACTIVITY

STABILITY: Stable. Hazardous polymerization will not occur.

CONDITIONS TO AVOID and INCOMPATIBLE MATERIALS
Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources. Keep away from strong oxidizers; Viton ®; Fluorel ®

HAZARDOUS DECOMPOSITION PRODUCTS
Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

11. TOXICOLOGICAL PROPERTIES

ACUTE TOXICITY
Acute dermal LD50 (rabbits) > 5 ml/kg
Acute oral LD50 (rats): 9 ml/kg
Primary dermal irritation: extremely irritating (rabbits)
Draize eye irritation: non-irritating (rabbits)
Guinea pig sensitization: negative

CHRONIC EFFECTS AND CARCINOGENICITY
Carcinogenic: OSHA: NO IARC: NO NTP: NO ACGIH: A3

Studies have shown that similar products produce skin tumors in laboratory animals following repeated applications without washing or removal. The significance of this finding to human exposure has not been determined. Other studies with active skin carcinogens have shown that washing the animal's skin with soap and water between applications reduced tumor formation.

MUTAGENICITY (genetic effects)
This material has been positive in a mutagenicity study.

12. ECOLOGICAL INFORMATION

Keep out of sewers, drainage areas, and waterways. Report spills and releases, as applicable, under Federal and State regulations.

13. DISPOSAL CONSIDERATIONS

Consult federal, state and local waste regulations to determine appropriate disposal options.

14. TRANSPORTATION INFORMATION

PROPER SHIPPING NAME:	Diesel Fuel	Placard (International Only):
HAZARD CLASS and PACKING GROUP:	3, PG III	
DOT IDENTIFICATION NUMBER:	NA 1993 (Domestic) UN 1202 (International)	
DOT SHIPPING LABEL:	None	

Use Combustible Placard if shipping in bulk domestically

15. REGULATORY INFORMATION

U.S. FEDERAL, STATE, and LOCAL REGULATORY INFORMATION

This product and its constituents listed herein are on the EPA TSCA Inventory. Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, state and/or local reporting requirements. This product and/or its constituents may also be subject to other regulations at the state and/or local level. Consult those regulations applicable to your facility/operation.

CLEAN WATER ACT (OIL SPILLS)

Any spill or release of this product to "navigable waters" (essentially any surface water, including certain wetlands) or adjoining shorelines sufficient to cause a visible sheen or deposit of a sludge or emulsion must be reported immediately to the National Response Center (1-800-424-8802) as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies as required.

CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIRONMENT)

The CERCLA definition of hazardous substances contains a "petroleum exclusion" clause which exempts crude oil, refined, and unrefined petroleum products and any indigenous components of such. However, other federal reporting requirements (e.g., SARA Section 304 as well as the Clean Water Act if the spill occurs on navigable waters) may still apply.

SARA SECTION 311/312 - HAZARD CLASSES

ACUTE HEALTH	CHRONIC HEALTH	FIRE	SUDDEN RELEASE OF PRESSURE	REACTIVE
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product may contain listed chemicals below the *de minimis* levels which therefore are not subject to the supplier notification requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372. If you may be required to report releases of chemicals listed in 40 CFR 372.28, you may contact Hess Corporate Safety if you require additional information regarding this product.

CALIFORNIA PROPOSITON 65 LIST OF CHEMICALS

This product contains the following chemicals that are included on the Proposition 65 "List of Chemicals" required by the California Safe Drinking Water and Toxic Enforcement Act of 1986:

INGREDIENT NAME (CAS NUMBER)	Date Listed
Diesel Engine Exhaust (no CAS Number listed)	10/01/1990

CANADIAN REGULATORY INFORMATION (WHMIS)

Class B, Division 3 (Combustible Liquid) and Class D, Division 2, Subdivision B (Toxic by other means)

16. OTHER INFORMATION

NFPA® HAZARD RATING

HEALTH:	0
FIRE:	2
REACTIVITY:	0

Refer to NFPA 704 "Identification of the Fire Hazards of Materials" for further information

HMIS® HAZARD RATING

HEALTH:	1 *	* Chronic
FIRE:	2	
PHYSICAL:	0	

SUPERSEDES MSDS DATED: 02/28/2001

ABBREVIATIONS:

AP = Approximately	< = Less than	> = Greater than
N/A = Not Applicable	N/D = Not Determined	ppm = parts per million

ACRONYMS:

ACGIH	American Conference of Governmental Industrial Hygien sts
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute (212) 642-4900
API	American Petroleum Institute (202) 682-8000
CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
DOT	U.S. Department of Transportation [General info: (800) 467-4922]
EPA	U.S. Environmental Protection Agency
HMIS	Hazardous Materials Information System
IARC	International Agency For Research On Cancer
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association (617)770-3000
NIOSH	National Institute of Occupational Safety and Health
NOIC	Notice of Intended Change (proposed change to ACGIH TLV)
NTP	National Toxicology Program
OPA	Oil Pollution Act of 1990
OSHA	U.S. Occupational Safety & Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit (NIOSH)
SARA	Superfund Amendments and Reauthorization Act of 1986 Title III
SCBA	Self-Contained Breathing Apparatus
SPCC	Spill Prevention, Control, and Countermeasures
STEL	Short-Term Exposure Limit (generally 15 minutes)
TLV	Threshold Limit Value (ACGIH)
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average (8 hr.)
WEEL	Workplace Environmental Exposure Level (AIHA)
WHMIS	Canadian Workplace Hazardous Materials Information System

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Attachment C

State Specific Spill Reporting Requirements

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1.0 Excess Air Emissions

Report excess emissions to the appropriate regional office of the New York State Department of Environmental Conservation, Division of Air, as soon as possible during normal working hours, but not later than 2 working days after onset of the event. (See **New York DEC Listing**.) A written report may be requested by the DEC, to be submitted within 30 days, describing:

1. Why the malfunction was unavoidable.
2. The nature, cause, time, and duration of the problem.
3. Corrective action taken.
4. Identification of air contaminants and emissions rates.
5. Maximum ground level concentration of each air contaminant emitted and the effect of such emissions.

Citation: New York Codes, Rules, and Regulations, Title 6, Chapter III, Subchapter A, Part 200, Section 201-1.4(b)

Excess emissions caused by an emergency condition must be reported as soon as possible, but no later than 2 working days of the time when emission limitations were exceeded due to the emergency. The notice must contain a description of the emergency, any steps taken to mitigate emissions, and corrective actions taken.

Citation: New York Codes, Rules, and Regulations, Title 6, Chapter III, Subchapter A, Part 201, Sections 201-1.5, 201-6.6(c)

Sources subject to federal Part V operating permits will be required to report permit deviations and incidences of noncompliance, stating the probable cause of such deviations and any corrective actions or preventive measures taken. Include the information as part of the semiannual emissions report required of the facility. If the violation was unavoidable or due to an emergency, the facility owner/operator will need to report the incident as required above.

Citation: New York Codes, Rules, and Regulations, Title 6, Chapter III, Subchapter A, Part 201, Section 201-6.5(c)(3)

In addition, sources subject to continuous emission monitoring are required to report quarterly on excess emissions. The operating permit for the facility will specify the types of emissions to be monitored and the measurements to be used in calculating excess emissions.

In addition, solid waste incineration facilities must report excess emissions or noncomplying operating parameters to the regional DEC office within 1 working day. The report must include a program for immediate correction of the conditions.

Citation: New York Codes, Rules, and Regulations, Title 6, Chapter III, Subchapter A, Part 219, Section 219-2.7(a), Part 223, Section 223.9(a), Part 224, Section 224.4

2.0 Hazardous Materials

Same as Oil.

All carriers and persons engaged in the transportation of hazardous materials shall report immediately any incident that occurs during the course of transportation (including loading, unloading, and temporary storage) as a direct result of hazardous materials. Report to:

Local Fire or Police Department
911

New York Department of Environmental Conservation
Bureau of Spill Prevention and Response
(800) 457-7362 (24-hour, In-state)
(518) 457-7362 (24-hour, Outside New York)

1. Report the following incidents:
    a. A person is killed.
    b. A person receives injuries requiring hospitalization.
    c. Estimated carrier or other property damage exceeds $50,000.
    d. Fire, breakage, spillage, or suspected radioactive contamination occurs involving shipment of radioactive material.
    e. Fire, breakage, spillage, or suspected contamination occurs involving shipment of etiologic agents.
    f. A situation exists of such nature that in the judgment of the carrier a continuing danger to life or property exists at the scene of the incident.
2. Provide the following information:
    a. Name of reporter.
    b. Name and address of carrier represented by the reporter.
    c. Telephone number where the reporter can be contacted.
    d. Date, time, and location of incident.
    e. The extent of injuries, if any.
    f. Classification, name, and quantity of hazardous materials involved, if available.
    g. Type of incident and nature of hazardous materials involved and whether a continuing danger to life exists at the scene.

3.0 Hazardous Substances

Report any release of a Reportable Quantity (see the Reportable Quantities section on ETConnect – US SH&E page/Resources page) of a hazardous substance within 2 hours to:

New York Department of Environmental Conservation
Spill Hotline
(800) 457-7362 (In-state)
(518) 457-7362 (Outside New York)

Local Emergency Planning Committee

1. Persons required to report include:
    h. An owner or operator.
    i. Those who own or are in actual or constructive possession or control of a hazardous substance prior to its release.
    j. Persons in a contractual relationship with the owner who inspects, tests, or repairs any portion of a hazardous substance storage facility.
    k. Any employee, agent, or representative of the above.

Employees of storage facilities may report releases under a facility-specific centralized reporting protocol, if the protocol is in writing and has been incorporated into the facility's spill prevention report prepared under state regulations.

2. If the release of the hazardous substance is less than the Reportable Quantity, report anyway if:
    a. Such release may result in a fire with potential off-site impacts.
    b. Such release may cause an explosion.
    c. Such release may cause a violation of air quality standards.
    d. Such release may result in vapors, dust, and/or gases that may cause illness or injury to persons, not including persons in a building at the facility where a release originates.
    e. Runoff from fire control or dilution waters may cause or contribute to a violation of water quality standards.
3. A spill or overfill to a secondary containment system does not have to be reported if:
    a. The containment system meets state requirements.
    b. Within 24 hours the spill or overfill is completely contained.
    c. There is complete control over the spill or overfill, and
    d. The total volume of the incident is recovered or accounted for.

However, spills or overfills that meet any of the conditions in Note 2 must be reported within 2 hours.

4. Report within 24 hours suspected releases of a hazardous substance from a storage facility if any of the following conditions are met:

    a. Test, sampling, or monitoring results from a release detection method indicate a release may have occurred.

    b. There are unusual operating conditions such as the erratic behavior of product dispensing equipment, the sudden loss of product from a storage tank, an unexpected presence of water in a tank, or the physical presence of a hazardous substance or an unusual level of vapors on a site that are of unknown origin.

    c. There are impacts in the surrounding area, such as evidence of hazardous substances or resulting vapors in soils, basements, sewer or utility lines, and nearby surface waters.

    d. There are any other conditions or indications of a suspected release.

If within 24 hours of the discovery of a suspected release it is confirmed that there was no release, then do not report the suspected incident.

5. Reporting is not required for a release that is continuous and stable in quantity and rate, provided that written notification that meets **Federal — Hazardous Substances** requirements has been provided to DEC.

6. Provide the following information in reporting a release that meets or exceeds the RQ for a substance:

    a. Chemical name or identity of any substance involved in the release.

    b. Indication of whether the substance is an extremely hazardous substance.

    c. An estimate of the quantity released.

    d. Time and duration of the release.

    e. Medium or media into which the release occurred.

    f. Known health risks associated with the emergency and, when appropriate, medical advice regarding medical attention for those exposed.

    g. Proper precautions/actions that should be taken, including evacuation.

    h. Names and telephone numbers of persons to be contacted for further information.

    i. As soon as practicable after the release, provide the following information:

        (1) Actions taken to respond to and contain the release.

        (2) Health risks.

        (3) Advice on medical attention for exposed individuals.

Citation: New York Codes, Rules, and Regulations, Title 6, Part 595, Section 595.3

4.0 Hazardous Wastes

If a release could threaten human health outside the facility or the generator knows the spill has reached surface water, notify:

National Response Center
(800) 424-8802

New York Department of Environmental Conservation
Division of Spills Management
(518) 457-7362 (24-hour, Outside New York)
(800) 457-7362 (24-hour, In-state)

The report, to be made immediately, should indicate:

1. Name and telephone number of the reporter.
2. Name and address of the facility.
3. Time and type of incident.
4. Name and quantity of materials involved, and the estimated quantity and disposition of recovered materials, if any.
5. The extent of injuries, if any.
6. Possible hazards to human health or the environment, outside the facility.

For large-quantity generators, within 15 days a written report must be submitted to:

New York Department of Environmental Conservation
Commissioner
625 Broadway
Albany, NY 12233
(518) 402-8540 (Central Office)
(518) 402-9016 (Fax)

Provide the above information and describe the quantity and disposition of any material recovered from the incident.

Citation: New York Codes, Rules, and Regulations, Title 6, Part 372, Section 372.2(a)(8)(iii)(e); Chapter 373, Section 373.3.4(g)(4)(ii)

5.0 Oil

Report within 2 hours all petroleum spills unless they meet all of the following criteria:

1. The spill is known to be less than 5 gallons.
2. The spill is contained and under the control of the spiller.
3. The spill has not and will not reach state waters or any land.
4. The spill is cleaned up within 2 hours of discovery.

Report spills (discharges) of any liquid likely to pollute waters of the state from any bulk storage of 1,100 gallons or more of any liquid to:

New York Department of Environmental Conservation
Bureau of Spill Prevention and Response
(800) 457-7362 (24-hour, In-state)
(518) 457-7362 (24-hour, Outside New York)

1. "Discharge" means any intentional or unintentional action or omission resulting in the releasing, spilling, leaking, pumping, pouring, emitting, emptying, or dumping of petroleum into the waters of the state or onto lands from which it might flow or drain into said waters, or into waters outside the jurisdiction of the state when damage may result to the lands, waters, or natural resources within the jurisdiction of the state.
2. Waters include oceans and their estuaries to the seaward limit of the state's jurisdiction, and surface and groundwaters.
3. The spill report shall include the following:
    a. The name of the person making the report and his or her relationship (agent, employee, etc.) to any person (corporation, company, etc.) which might be responsible for causing such discharge and the reporter's telephone number.
    b. Time and date of the discharge.
    c. Probable source of the discharge.
    d. Location, both geographic and water body.
    e. Type of petroleum discharged.
    f. Possible health or fire hazards.
    g. Amount of petroleum discharged.
    h. All actions being taken or that will be taken to clean up and remove the discharge.
    i. Personnel presently on the scene.
    j. Other government agencies which have been or will be notified.
4. As a general policy, the state exhibits a considerably greater enthusiasm in any legal action that it deems necessary, if and when a spiller neglects to notify the appropriate agencies.

5. Notifying the state does not relieve the spiller of the responsibility to notify the federal government, where applicable under federal law.

6. The New York Division of Mineral Resources currently has no reporting requirements. However, it has proposed reporting requirements for "nonroutine" incidents involving spills of 5 gallons or greater of oil. Such incidents would have to be immediately reported to:

New York Division of Mineral Resources
(518) 402-8056 (Bureau of Oil and Gas Regulation)
(518) 402-8076 (Central Office)
(518) 402-8060 (Fax, Albany Office)

Citation: New York Codes, Rules, and Regulations, Title 6, Chapter V, Part 613, Section 613.8; Title 17, Chapter I, Part 32

6.0 SARA Title III

Report releases and submit written follow-up emergency notice(s) to:
Immediate notification:

New York State Department of Environmental Conservation
Spill Hotline
NYS Department of Environmental Conservation, Albany
Bureau of Spill Prevention and Response
(518) 457-7362 (24-hour, Outside New York)
(800) 457-7362 (24-hour, In-state)

Written follow-up notification:

New York State Emergency Response Commission
c/o New York State Department of Environmental Conservation
Bureau of Spill Prevention and Response
625 Broadway, 11th Floor
Albany, NY 12233-7020
(518) 402-9546

7.0 Tank Leaks

For tanks holding hazardous substances, see Hazardous Substances.

Evidence of a leaking underground petroleum storage tank must be reported under the same reporting requirements as an Oil spill. In addition, report within 2 hours the results of any inventory record, test, or inspection that shows a facility is leaking.

Citation: New York Codes, Rules, and Regulations, Title 6, Chapter V, Part 613, Section 613.8

8.0 Wastewater Excursions

Report excursions to the appropriate regional office of the New York State Department of Environmental Conservation, Division of Water. (See **New York DEC Listing**.)

Two-hour oral reporting is required for any bypass, upset, or other incident that would affect bathing areas during the bathing season, shellfishing, or public drinking water intakes, unless the discharge is in accordance with an NYDEC-approved plan for managing wastewater. Provide the following information in the verbal report:

1. A brief description of the bypass, upset, or other incident.
2. The location of the bypass, upset, or other incident including the receiving water affected by the incident.
3. The estimated volume and characteristics of the discharge at the time of the oral report.
4. A brief description of the measures taken to end the bypass, upset, or other incident.
5. An estimate of when the bypass, upset, or other incident will be over and the total expected volume of the discharge.

Twenty four-hour oral reporting is required for the following incidents, and the report should include the information listed above:

1. A discharge of untreated or partially treated sewage that would otherwise be treated, except a discharge in accordance with an NYDEC-approved wastewater management plan.
2. A discharge of untreated wastewater and/or stormwater that would otherwise be treated, except a discharge in accordance with an NYDEC-approved wastewater management plan.
3. A spill that may result in a discharge that may:
    a. Violate permit limitations of pollutants limited in the state discharge permit.
    b. Exceed an action level or more than 1 action level in the state discharge permit.
    c. Cause discharges of pollutants not explicitly listed in the state discharge permit, in amounts in excess of normal effluent variability of the level of discharge that may reasonably be expected for the pollutant from information provided in the state permit application record.
    d. Result in dilution in lieu of treatment of a discharge authorized by the state permit.
4. A spill to waters of the state of greater than the reportable quantity for releases to water.
5. A bypass, upset, or other incident that a reasonable practitioner in water pollution control would consider to be similar in severity and consequences to the incidents described above.

A written submission shall also be provided within 5 days of becoming aware of the noncompliance. See **New York DEC Listing** for address information, or contact:

New York State Department of Environmental Conservation
Division of Water
Bureau of Water Compliance Programs
Chief, Compliance Assurance Section
525 Broadway
Albany, NY 12233-3500
(518) 402-8173

The written submission shall include the following (see **New York Water Spill Form**):

1. A description of the noncompliance and its cause.
2. The period of noncompliance, including exact dates and times.
3. If the noncompliance has not been corrected, the anticipated time it is expected to continue.
4. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

Citation: New York Codes, Rules, and Regulations, Title 6, Chapter X, Part 750, Section 750-2.7(a)

9.0 Internet Resources

Agency	Internet Address
Department of Environmental Conservation	www.dec.state.ny.us
Division of Mineral Resources	www.dec.state.ny.us/website/dmn

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
REGIONAL OFFICES

Central Office
625 Broadway
Albany, NY 12233-1010
(518) 402-9706
Fax: (518) 402-9020

Region 1
SUNY at Stony Brook
50 Circle Road
Stony Brook, NY 11790
(631) 444-0345
Fax: (631) 444-0349

Region 2
1 Hunter's Point Plaza
47-40 21st Street
Long Island City, NY 11101
(718) 482-4949

Region 3
21 South Putt Corners Road
New Paltz, NY 12561-1696
(845) 256-3003
Fax: (845) 255-3042

Region 4
1130 North Westcott Road
Schenectady, NY 12306
(518) 357-2068
Fax: (518) 357-2087

Region 5
1115 NYS Route 86
P.O. Box 296
Ray Brook, NY 12977
(518) 897-1200

Region 6
State Office Building
317 Washington Street
Watertown, NY 13601-3787
(315) 785-2239
Fax: (315) 785-2242

Region 7
615 Erie Boulevard West
Syracuse, NY 13204-2400
(315) 426-7403
Fax: (315) 426-7408

Region 8
6274 East Avon-Lima Road
Avon, NY 14414-9519
(585) 226-2466
Fax: (585) 226-9485

Region 9
270 Michigan Avenue
Buffalo, NY 14203-2999
(716) 851-7000

1.0 Hazardous Substances

Report any release equal to or exceeding the Reportable Quantity in any 24-hour period into the environment to:

National Response Center
(800) 424-8802 (24-hour)
(202) 267-2675 (24-hour)

1. Release means any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment, but excludes:
    a. Any release which results in exposure to persons solely within a workplace, with respect to a claim which such persons may assert against the employer of such persons.
    b. Emissions from the engine exhaust of a motor vehicle, rolling stock, aircraft, vessel, or pipeline pumping station engine.
    c. Release of source, byproduct, or special nuclear material from a nuclear incident, as those terms are defined in the Atomic Energy Act of 1954, if such release is subject to requirements with respect to financial protection established by the Nuclear Regulatory Commission under Section 170 of such act, or, for the purpose of Section 104 of CERCLA or any other response action, any release of source, byproduct, or special nuclear material from any processing site designated under Section 102(a)(1) or 302(a) of the Uranium Mill Tailings Radiation Control Act of 1978.
    d. The normal application of fertilizer.

For the purpose of this Guide, release also means substantial threat of release.

2. Environment means all surface and groundwater, land surface, or subsurface strata and ambient air within or under the jurisdiction of the United States.

3. Reportable Quantities of hazardous substances can be found in the Reportable Quantities section and at 40 CFR 302 (Table 302.4).

4. Releases of mixtures or solutions (including hazardous waste streams) of hazardous substances are subject to the following reporting requirements:
    a. If the quantity of all of the hazardous constituent(s) of the mixture of solution is known, notification is required where a Reportable Quantity or more of any hazardous constituent is released; or if the quantity of 1 or more of the hazardous constituent(s) of the mixture or solution released equals or exceeds the Reportable Quantity for the hazardous constituent with the lowest RQ.
    b. For waste streams K169, K170, K171, K172, K174, and K175, knowledge of the quantity of all of the hazardous constituent(s) may be assumed, based on the following maximum observed constituent concentrations identified by EPA:

Waste	Constituent	Max ppm
K174	2,3,7,8-TCDD	0.000039
	1,2,3,7,8-PeCDD	0.0000108
	1,2,3,4,7,8-HxCDD	0.0000241
	1,2,3,6,7,8-HxCDD	0.000083
	1,2,3,7,8,9-HxCDD	0.000062
	1,2,3,4,6,7,8-HpCDD	0.00123
	OCDD	0.0129
	2,3,7,8-TCDF	0.000145
	1,2,3,7,8-PeCDF	0.0000777
	2,3,4,7,8-PeCDF	0.000127
	1,2,3,4,7,8-HxCDF	0.001425
	1,2,3,6,7,8-HxCDF	0.000281
	1,2,3,7,8,9-HxCDF	0.00014
	2,3,4,6,7,8-HxCDF	0.000648
	1,2,3,4,6,7,8-HpCDF	0.0207
	1,2,3,4,7,8,9-HpCDF	0.0135
	OCDF	0.212
K175	Mercury	9200.0

5. Releases of mixtures or solutions containing radionuclides must be reported under the following circumstances:
    a. If the identity and quantity (in curies) of each radionuclide in a released mixture of solution is known, the ratio between the quantity released (in curies) and the Reportable Quantity for the radionuclide must be determined for each radionuclide. The only such releases subject to these reporting requirements are those in which the sum of the ratios for the radionuclides in the mixture or solution released is equal to or greater than 1.
    b. If the identity of each radionuclide in a released mixture or solution is known but the quantity released (in curies) of 1 or more of the radionuclides is unknown, the only such releases that must be reported are those in which the total quantity (in curies) of the mixture or solution released is equal to or greater than the lowest Reportable Quantity of any individual radionuclide in the mixture or solution.
    c. If the identity of 1 or more radionuclides in a released mixture or solution is unknown (or if the identity of a radionuclide released by itself is unknown), the only such releases subject to reporting requirements are those in which the total quantity (in curies) released is equal to or greater than either 1 curie or the lowest Reportable Quantity of any known individual radionuclide in the mixture or solution, whichever is lower.
6. For releases of a hazardous substance that are continuous and stable in quantity and rate:
    a. A release is continuous if it occurs without interruption or abatement or that is routine, anticipated, and intermittent and incidental to normal operations or treatment processes.
    b. Provide initial notice to the National Response Center at the above numbers.
    c. Written notice must also be provided to the appropriate EPA Regional Office (see **EPA Regional Offices listing**) within 30 days of the telephone notification to the NRC.
    d. A follow-up notification should be submitted within 30 days of the first anniversary date of the initial written notice.

e. Provide notice of a change in the composition or sources of the release or in any other information provided in prior written notifications.
f. Provide notice when an increase in the quantity of the hazardous substance being released during any 24-hour period represents a statistically significant increase.

7. The following categories of releases are **exempt** from the reporting requirements of this section:

   a. Releases of those radionuclides that occur naturally in the soil from land holdings such as parks, golf courses, or other large tracts of land.
   b. Releases of naturally occurring radionuclides from land disturbance activities, including farming, construction, and land disturbance incidental to extraction during mining activities, except that which occurs at uranium, phosphate, tin, zircon, hafnium, vanadium, monazite, and rare earth mines. Land disturbance incidental to extraction includes: land clearing; overburden removal and stockpiling; excavating, handling, transporting, and storing ores and other raw (not beneficiated or processed) materials; and replacing materials in mined-out areas, coal ash, earthen materials generated from the exempted mining activities.
   c. Releases of radionuclides from the dumping and transportation of coal and coal ash (including fly ash, bottom ash, and boiler slags), including the dumping and land spreading operations that occur during coal ash uses.
   d. Releases of radionuclides from piles of coal and coal ash, including fly ash, bottom ash, and boiler slags.

8. Except for releases of radionuclides, notification of the release of a Reportable Quantity of solid particles of antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, or zinc is not required if the mean diameter of the particles released is larger than 100 micrometers (0.004 inches).

9. The following releases are also **exempt** from the notification requirements of this section:

   a. Releases in amounts less than 1,000 pounds per 24 hours of nitrogen oxide to the air which are the result of combustion and combustion-related activities.
   b. Releases in amounts less than 1,000 pounds per 24 hours of nitrogen dioxide to the air which are the result of combustion and combustion-related activities.

10. See also PCBs.

Citation: 33 CFR Part 153, Subpart B; 40 CFR 302.6

EPA Regional Offices

Region I	John F. Kennedy Federal Building 1 Congress Street, Suite 1100 Boston, MA 02114-2023 (617) 918-1111 (Outside New England) (888) 372-7341 (New England states)	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
Region II	290 Broadway, 26th Floor New York, NY 10007-1866 (212) 637-5000	New Jersey, New York, Puerto Rico, Virgin Islands
Region III	1650 Arch Street Philadelphia, PA 19103 (215) 814-5000	Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia
Region IV	Sam Nunn Atlanta Federal Center 61 Forsyth Street SW Atlanta, GA 30303 (404) 562-9900	Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee
Region V	77 West Jackson Boulevard Chicago, IL 60604 (312) 353-2000	Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin
Region VI	1445 Ross Avenue, Suite 1200 Dallas, TX 75202-2733 (214) 665-6444	Arkansas, Louisiana, New Mexico, Oklahoma, Texas
Region VII	901 North 5th Street Kansas City, KS 66101 (913) 551-7003	Iowa, Kansas, Missouri, Nebraska
Region VIII	1595 Wynkoop Street Denver, CO 80202-1129 (303) 312-6312	Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming
Region IX	75 Hawthorne Street San Francisco, CA 94105 (415) 947-8000	American Samoa, Arizona, California, Guam, Hawaii, Mariana Islands, Nevada, Northern Mariana Islands
Region X	1200 6th Avenue Seattle, WA 98101 (206) 553-1200	Alaska, Idaho, Oregon, Washington

Appendix B

SECTION 1

New York State Department of Environmental Conservation
Division of Water

Report of Noncompliance Event

To: DEC Water Contact _____ ***DEC Region:*** _____

Report Type: ___ *5 Day* ___ *Permit Violation* ___ *Order Violation* ___ *Anticipated Noncompliance* ___ *Bypass/Overflow* ___ *Other*

SECTION 2

SPDES #: NY-_____ **Facility:**_____

Date of noncompliance:___/___/___ **Location (Outfall, Treatment Unit, or Pump Station):**_____

Description of noncompliance(s) and cause(s):_____

_____

_____

_____

Has event ceased? (Yes) (No) **If so, when?** _____ **Was event due to plant upset?** (Yes) (No) **SPDES limits violated?** (Yes) (No)

Start date, time of event:___/___/___, ___:___ (AM) (PM) **End date, time of event:** ___/___/___, ___:___ (AM) (PM)

Date, time oral notification made to DEC? ___/___/___, ___:___ (AM) (PM) **DEC Official contacted:** _____

Immediate corrective actions:_____

_____

_____

_____

Preventive (long term) corrective actions:_____

_____

_____

_____

SECTION 3

Complete this section if event was a bypass:

Bypass amount: _____ Was prior DEC authorization received for this event? (Yes) (No)

DEC Official contacted: _____ Date of DEC approval: ___/___/___

Describe event in "Description of noncompliance and cause" area in Section 2. Detail the start and end dates and times in Section 2 also.

SECTION 4

Facility Representative: _____ **Title:**_____ **Date:** ___/___/___

Phone #: (___) ___-_____ **Fax #:** (___) ___-_____

I Certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

X _____

Signature of Principal Executive Officer or Authorized Agent

INSTRUCTIONS

The Division of Water developed this standardized form to simplify the reporting of noncompliance events. The SPDES Permit General Conditions, require that certain discharges of untreated or partially treated sewage must be reported orally within either 2 hours[1] or 24 hours and also in writing within five (5) days as required by the appropriate regulation. All other permit noncompliance shall be reported as attachments to the Discharge Monitoring Report (DMR). This form should be used for these events as well as to report noncompliance relating to consent orders, scheduled events and bypass events.

All necessary information can readily be reported to DEC on this form. Additional information required to describe the event can be attached. **Please make additional copies of this form and use as needed**. Instructions are provided below. For questions on form use please contact the appropriate office listed below for the county where your permitted facility is located. Thank you for your cooperation.

Instructions to complete and submit Noncompliance Report

1. Provide facility information and all applicable event details in Sections 1 through 3. Dates should be completed in month/day/year format.

2. Provide your name, title, business phone number, and date report was completed in Section 4. Use additional sheets as needed to provide full detail of the event in Section 2.

3. For 5-day written reports, mail or fax the completed form to the appropriate DEC Regional Office listed below. Attach all other noncompliance reports to the DMR submittal (be sure to attach to each set of DMR copies) or mail separately if related to consent order/scheduled event noncompliance. After hours and weekend reporting of unusual discharge events of other noncompliance must be reported through the DEC Telephone Hotline, which is 1-800-457-7362.

DEC Regional Offices:

REGION 1 Regional Water Engineer NYS SUNY , Bldg. 40 Loop Road Stony Brook, NY 11790-2356 Phone: 631-444-0405 Fax: 631-444-0373 **Counties:** Nassau Suffolk	**REGION 2** Regional Water Engineer One Hunters Point Plaza 47-40 21st St. Long Island City, NY 11101-5407 Phone: 718-482-4900 Fax: 718-482-6516 **Counties:** Queens Bronx New York Richmond Kings	**REGION 3** ** Regional Water Engineer 21 So. Putt Corners Rd New Paltz, NY 12561-1696 Phone: 845-256-3000 Fax: 845-255-0714 **Counties:** Rockland Dutchess Sullivan Orange Ulster Putnam Westchester
REGION 4 Regional Water Engineer 1150 North Westcott Rd. Schenectady, NY 12306-2014 Phone: 518-357-2045 Fax: 518-357-2398 **Counties:** Montgomery Albany Otsego Rensselaer Columbia Delaware Schoharie Greene Schenectady	**REGION 5** ** Regional Water Engineer Route 86, P.O. Box 296 Ray Brook N.Y. 12977-0296 Phone: 518-897-1241 Fax: 518-897-1245 **Counties:** Clinton Hamilton Franklin Essex Saratoga Warren Fulton Washington	**REGION 6** ** Regional Water Engineer Region 6 Suboffice State Office Bldg. 207 Genesee St. Utica, NY 13500 Phone: 315-793-2554 Fax: 315-793-2748 **Counties:** Lewis Jefferson Herkimer Oneida St. Lawrence
REGION 7 Regional Water Engineer 615 Erie Blvd West Syracuse, NY 13204-2400 Phone: 315-426-7506 Fax: 315-426-7402 **Counties:** Madison Cayuga Broome Onondaga Oswego Chenango Tioga Tompkins Cortland	**REGION 8** Regional Water Engineer 6274 East Avon-Lima Rd Avon, NY 14414-9519 Phone: 585-226-2466 Fax: 585-226-2830 **Counties:** Orleans Genessee Chemung Schuyler Seneca Livingston Steuben Ontario Monroe Wayne Yates	**REGION 9** Regional Water Engineer 270 Michigan Avenue Buffalo, NY 14203-2999 Phone: 716-851-7070 Fax: 716-851-7009 **Counties:** Allegany Erie Cattaraugus Niagara Wyoming Chautauqua

** **REGION 3 Suboffice**
Regional Water Staff
200 White Plains Rd.., 5th Floor
Tarrytown, NY 10591-5805
Phone: 914-332-1835
Fax: 914-332-4670

REGION 5 Suboffice
Regional Water Staff
Box 220, Hudson St Extension
Warrensburg, NY 12885-0220
Phone: 518-623-1200
Fax: 518-623-4193

REGION 6 Suboffice
Regional Water Staff
317 Washington St.
Watertown, NY 13601-3787
Phone: 315-785-2513
Fax: 315-785-2422

[1] This requirement reflects proposed pending regulations.

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Attachment D

Applicable SH&E SOPs

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S3NA-307-PR Housekeeping, Worksite

1.0 Purpose and Scope

1.1 This procedure provides AECOM's work practices as well as personal hygiene and work site sanitation standards for housekeeping.

1.2 Applies to all AECOM North America-based staff and field worksites.

2.0 Terms and Definitions

None.

3.0 References

None.

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Project Manager (Field Task Manager, Supervisor)** is responsible for the procedure's implementation and the details of addressing housekeeping policy within the construction/demolition worksite.

4.1.2 **SH&E Department** personnel will monitor, assess, and report on project housekeeping when visiting locations.

4.1.3 Employees are responsible for reporting any areas of concern to the Site Supervisor for prompt resolution as well as for maintaining worksites that are free from debris, clutter, and slipping or tripping hazards.

4.2 Smoking, Eating, and Drinking

4.2.1 Eating and drinking will be permitted in designated areas at AECOM project sites and as specified on client sites. Smoking will be permitted only in areas designated in compliance with applicable local laws, regulations, legislation, and ordinances, by the Field Supervisior and situated in locations that are not in the immediate vicinity of activities associated with work site activities. Additionally, Field Supervisior wil designate each smoking area giving primary consideration to those personnel who do not smoke.

4.2.2 Personnel involved in the performance of certain activities will not be permitted to smoke, eat, drink, or use smokeless tobacco, except during breaks (e.g., HAZWOPER-controlled work areas).

4.2.3 Site personnel will first wash hands and face after completing work activities and prior to eating or drinking.

4.3 Water Supply

4.3.1 Water supplies will be available for use on site and will comply with the following requirements:

4.3.2 Potable Water: An adequate supply of drinking water will be available for site personnel consumption. Potable water can be provided in the form of approved well or city water, bottled water, or drinking fountains. Where drinking fountains are not available, individual use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified in order to distinguish them from nonpotable water sources.

4.3.3 Nonpotable Water: Nonpotable water will not be used for drinking purposes. Nonpotable water may not be used for hand washing or other personal hygiene activities but may be used for other types of cleaning activities. All containers/supplies of nonpotable water used will be properly identified and labeled as such.

4.4 Toilet Facilities

4.4.1 Toilet facilities will be available for site personnel and visitors. Should subcontractor personnel be located on-site for extended periods, it may become necessary to obtain temporary toilet facilities.

Exceptions to this requirement will apply to mobile crews where work activities and locations permit transportation to nearby toilet facilities.

4.4.2 A minimum of one toilet will be provided for every 20 site personnel, with separate toilets maintained for each sex, except where there are less than five total personnel on site. For mobile crews where work activities and locations permit use of nearby toilet facilities (e.g., gas station, or rest stop), on-site facilities are not required.

4.4.3 Washing Facilities

4.4.4 Hand and Face: Site personnel will wash hands and face after completing work activities and prior to breaks, lunch, or completion of workday.

4.4.5 Personal Cleaning Supplies: Cleaning supplies at AECOM project sites will consist of soap, water, and disposable paper towels or items of equal use/application (e.g., anti-bacteria gels, wipes, etc.).

4.5 Clothing and Personal Protective Equipment (PPE)

4.5.1 All PPE will be kept clean at all times and maintained in accordance with the manufacturer's, AECOM's. and applicable regulatory, legislative, or provincial requirements.

4.5.2 General Work Areas

4.5.3 At all times work areas will be kept free of dirt and debris that may impact the safety of site personnel and visitors. All trash receptacles will be emptied regularly.

4.5.4 Break Areas and Lunchrooms

Site personnel will observe the following requirements when using break areas and lunchrooms at AECOM project sites:

4.5.5 All food and drink items will be properly stored when not in use.

4.5.6 Food items will not be stored in personal lockers for extended periods in order to prevent the potential for vermin infestation.

4.5.7 Perishable foods will be refrigerated whenever possible.

4.5.8 All waste food containers will be discarded in trash receptacles.

4.5.9 All tables, chairs, counters, sinks, and similar surfaces will be kept clean and free of dirt, waste food, and food containers at all times.

4.5.10 Refrigerators used to store food items will be maintained at 45 degrees Fahrenheit and emptied of all unclaimed food items weekly. Refrigerators used to store food will be labeled as such so that only food and drinks are stored within the refrigerator.

4.5.11 Routine cleaning of refrigerators will also be performed on a regular basis.

4.6 Vermin Control

4.6.1 Every enclosed workplace shall be constructed, equipped, and maintained, so far as reasonably practicable, to prevent the entrance or harborage of rodents, insects, and other vermin.

4.6.2 A continuing and effective extermination program shall be instituted where the presence of rodents, insects, or other vermin is detected.

4.7 General Housekeeping

4.7.1 All work areas shall be kept clean to the extent that the nature of the work allows.

4.7.2 Every work area shall be maintained, so far as practicable, in a dry condition. Where wet processes are used, drainage shall be maintained and platforms, mats, or other dry standing places shall be provided, where practicable, or appropriate waterproof footgear shall be provided.

4.7.3 Protruding objects or placement of materials on paths or foot traffic areas present a problem with regard to slips, trips, falls, and puncture wounds. Personnel will use a reasonable amount of effort to keep slip, trip, and fall hazards to a minimum.

4.7.4 Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal.

4.7.5 At no time will debris or trash be intermingled with waste PPE or contaminated materials.

4.7.6 Material and equipment must be placed, stacked, or stored in a stable and secure manner. Stacked material or containers must be stabilized as necessary by interlocking, strapping, or other effective means of restraint to protect the safety of workers.

4.7.7 An area in which material may be dropped, dumped, or spilled must be guarded to prevent inadvertent entry by workers or protected by adequate covers and guarding.

4.7.8 Floors, platforms, ramps, stairs, and walkways available for use by workers must be maintained in a state of good repair and kept free of slipping and tripping hazards. If such areas are taken cut of service, the employer must take reasonable means for preventing entry or use.

4.7.9 Hazardous areas not intended to be accessible to workers must be secured by locked doors or equivalent means of security and must not be entered unless safe work procedures are developed and followed.

4.8 Worksite Offices and Trailers

Worksite offices and trailers will be maintained in accordance with *S3NA-103-PR Housekeeping, Office.*

5.0 Records

None.

6.0 Attachments

None.

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S3NA-308-PR Manual Lifting, Field

1.0 Purpose and Scope

1.1 This procedure provides the requirements for use when performing manual materials handling activities (e.g., lifting/handling of items or materials).

1.2 This procedure applies to all field staff for AECOM North America-based operations.

2.0 Terms and Definitions

2.1 **Manual Materials Handling:** Moving or handling things by lifting, lowering, pushing, pulling, carrying, holding, or restraining.

2.2 **Team Handling:** Team handling occurs when more than one person is involved during the lift.

3.0 References

3.1 OSHA Technical Manual: http://www.osha.gov/dts/osta/otm/otm_vii/otm_vii_1.html

3.3 National Safety Council: www.nsc.org

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 The **Project Manager** will effectively implement the procedure, providing resources as required, and providing direction on proper lifting/handling techniques.

4.1.2 The **Regional SH&E Manager** will assist in identifying activities with a high potential for lifting/handling strains/injuries as well as the associated mitigation strategies and training on proper lifting/manual materials handling techniques.

4.1.3 **Employees** are responsible for reviewing and following *S3NA-308-WI Manual Lifting Safe Work Practices*.

4.2 Mechanical Controls

4.2.1 Mechanical equipment or assistance such as dollies, carts, come-alongs, or rollers are preferable to be used whenever possible rather than the employee physically moving materials.

4.2.2 Mechanical assistance will be of proper size, have wheels sized for the terrain, and be designed to prevent pinching or undue stress on wrists.

4.2.3 Objects to be moved will be secured to prevent falling and properly balanced to prevent tipping.

4.3 Administrative Controls

4.4 When significant, sustained lifting work is required, it is desirable to rotate employees to spread the work load among several people and thereby avoid fatigue.

4.5 Rotation is not simply performing a different job but instead is performing a job that utilizes a completely different muscle group from the ones that have been overexerted.

5.0 Records

None.

6.0 Attachments

6.1 S3NA-308-WI Manual Lifting Safe Work Practices

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S3NA-309-PR Mobile or Heavy Equipment

1.0 Purpose and Scope

1.1 Outline the safe working requirements for working with and near mobile equipment and heavy equipment operation.

1.2 This procedure applies to all AECOM North America based employees and operations.

2.0 Terms and Definitions

2.1 **Heavy equipment:** All excavating equipment include scrapers, loaders, crawler or wheel tractors, excavators, backhoes, bulldozers, off-highway trucks, graders, agricultural and industrial tractors, and similar equipment.

2.2 **Operator:** Any person who operates the controls while the heavy equipment in is motion or the engine is running.

2.3 **Ground personnel/workers:** Personnel performing work on the ground around heavy equipment (note: operators are considered ground personnel when outside of the equipment cab).

3.0 References

3.1 S3NA-205-PR Equipment Inspections & Maintenance

4.0 Procedure

4.1 For work under AECOM's control, Project Managers are responsible for ensuring all equipment is in good working order and all equipment operators are qualified on the piece of machinery they are assigned.

4.2 Staff will confirm that all rented equipment arrives in proper working order with the manufacturer's operating manual before acceptance from the supplier.

4.3 The operator of mobile equipment is the only worker permitted to ride the equipment unless the equipment is a worker transportation vehicle.

4.4 A person will not operate mobile equipment unless the person has received adequate instruction and training in the safe use of the equipment, has demonstrated to a qualified supervisor or instructor competency in operating the equipment.

4.5 The operator of mobile equipment will operate the equipment safely, maintain full control of the equipment, and comply with the laws governing the operation of the equipment

4.6 Communication

4.6.1 Communication between site supervisors/managers, heavy equipment operators, and other site personnel is a key method of preventing serious injury or death during heavy equipment operations.

4.6.2 The following outline the communication requirements during heavy equipment operations:

- Site supervisors/managers shall confirm that all operators are notified/informed of when, where, and how many ground personnel will be working on site.
- Site supervisors/managers shall inform all ground personnel before changes are made in the locations of designated work areas.
- Prior to work initiating onsite the site supervisor/manager is to confirm all operators and ground personnel are trained on the hand signals that will be used to communicate between operators and ground personnel.
- Personnel working around heavy equipment operations are to maintain eye contact with operators to the greatest extent possible (always face equipment). Never approach equipment from a blind spot or angle.
- All heavy equipment whose backup view can be obstructed shall be equipped with reverse warning devices (i.e., backup alarms) that can be significantly heard over equipment and other background noise. Reverse signaling lights shall be in working order.

- When feasible, two-way radios shall be used to verify the location of nearby ground personnel.
- When an operator cannot adequately survey the working or traveling zone, a guide shall use a standard set of hand signals to provide directions. Flags or other high visibility devices may be used to highlight these signals.

4.7 Ground Personnel

4.7.1 Ground clearance around heavy equipment may significantly reduce hazards posed during heavy equipment operations.

4.7.2 The following outline the clearance requirements during heavy equipment operations:

- Ground personnel shall always yield to heavy equipment.
- Ground personnel shall maintain a suitable "buffer" area of clearance from all active heavy equipment.
- A job-specific hazard analysis that identifies any special precautions shall be completed and communicated to all AECOM personnel.
- Site supervisors/managers shall designate areas of heavy equipment operation and confirm that all ground personnel are aware of designated areas. Designated areas shall include boundaries and travel routes for heavy equipment. Travel routes shall be set up to reduce crossing of heavy equipment paths and to keep heavy equipment away from ground personnel.
- When feasible, site supervisors/managers shall set up physical barriers (e.g., caution tape, orange cones, concrete jersey barriers) around designated areas and confirm that unauthorized ground personnel do not enter such areas.
- Operators shall stop work whenever unauthorized personnel or equipment enter the designated area and only resume when the area has been cleared.
- Operators shall only move equipment when aware of the location of all workers and when the travel path is clear.
- Ground personnel shall never stand between two pieces of heavy equipment or other objects (i.e., steel support beams, trees, buildings, etc.).
- Ground personnel shall never stand directly below heavy equipment located on higher ground.
- If working near heavy equipment, ground personnel shall stay out of the travel and swing areas (excavators, all-terrain forklifts, hoists, etc.) of all heavy equipment.
- Ground personnel shall never work near heavy equipment.
- Personnel shall keep all extremities, hair, tools, and loose clothing away from pinch points and other moving parts on heavy equipment.
- Personnel shall not talk on a cell phone while standing or walking on a roadway or other mobile equipment path.

4.7.3 At a minimum, all ground personnel and operators outside of heavy equipment shall wear the following:

- High visibility, reflective (Class 2) safety vest that is visible from all angles and made of fluorescent material and orange, white, or yellow reflective material (confirm that vest is not faded or covered with outer garments, dirt, etc.).
- Retro-reflective striping for arms and legs (night work)
- ANSI-CSA approved hard hat
- ANSI-CSA approved safety glasses with side shields
- ANSI-CSA approved work boots (unless project requirements are more stringent)
- ANSI-CSA approved hearing protection as needed
- Appropriate work clothes (i.e., full length jeans/trousers and a sleeved shirt; no tank, crew tops or other loose clothing permitted).

4.8 Prior to work commencing

4.8.1 All mobile equipment will be regularly inspected pre-shift and then regularly as required with the details of the inspection recorded in a log book.

4.8.2 The operator will report defects and conditions affecting the safe operation of the equipment to the supervisor or employer. Any repair or adjustment necessary for the safe operation of the equipment will be made before the equipment is used.

4.8.3 Exposed moving parts on mobile equipment which are a hazard to the operator or to other workers will be guarded and if a part will be exposed for proper function it will be guarded as much as is practicable consistent with the intended function of the component.

4.8.4 An approved Underwriter's Laboratories (UL) 4A40BC fire extinguisher should be present on all mobile equipment.

4.8.5 Inform the operators of the equipment that AECOM employees are in the area and inquire if there are any restricted areas or specific rules or requirements. In some industrial facilities, mobile equipment has the 'right of way'.

4.8.6 Where the operator will not have a full view of the path of travel, a signal person will be used on the ground that has a full view of the load, the operator, and the path.

4.8.7 Mobile equipment in which the operator cannot directly or by mirror or other effective device see immediately behind the machine will have an automatic audible warning device which activates whenever the equipment controls are positioned to move the equipment in reverse, and if practicable, is audible above the ambient noise level.

4.9 Operation

4.9.1 The operator of mobile equipment will operate the equipment safely, maintain full control of the equipment, and comply with the laws governing the operation of the equipment.

4.9.2 A supervisor will not knowingly operate or permit a worker to operate mobile equipment which is, or could create, an undue hazard to the health or safety of any person.

4.9.3 The operator of mobile equipment will not leave the controls unattended unless the equipment has been secured against inadvertent movement such as by setting the parking brake, placing the transmission in the manufacturer's specified park position, and by chocking wheels where necessary.

4.9.4 The operator will maintain the cab, floor and deck of mobile equipment free of material, tools or other objects which could create a tripping hazard, interfere with the operation of controls, or be a hazard to the operator or other occupants in the event of an accident.

4.9.5 If mobile equipment has seat belts required by law or manufacturer's specifications, the operator and passengers will use the belts whenever the equipment is in motion, or engaged in an operation which could cause the equipment to become unstable.

4.9.6 When approaching or crossing the intended path of travel of mobile equipment, establish eye contact with the operator of the mobile equipment and confirm that it is safe to proceed.

4.9.7 Have vehicle headlights on at all times when driving in the area.

4.9.8 Park motor vehicles off the haul roads, or away from the work areas.

4.9.9 Do not wear loose clothing where there is a danger of entanglement in rotating equipment.

4.9.10 Do not enter the swing area of machines such as cranes, mobile drill rigs, or excavators, without first making eye contact with the operator, and receiving permission to do so.

4.9.11 Stay out of the blind areas around mobile equipment and never assume that the equipment operators have seen them or are aware of their presence.

4.9.12 Maintain a distance of 60 cm (2 ft.) between the counterweight of swing machines and the nearest obstacle. If this distance cannot be maintained, the area will be barricaded or guarded to prevent access.

4.9.13 Vibration from moving traffic or mobile equipment can cause excavations or spoil piles to become unstable. Be aware of the risk and keep clear.

4.9.14 All heavy equipment shall be operated in a safe manner that will not endanger persons or property.

4.9.15 All heavy equipment shall be operated at safe speeds.

4.9.16 Always move heavy equipment up and down the face of a slope. Never move equipment across the face of a slope.

4.9.17 Slow down and stay as far away as possible while operating near steep slopes, shoulders, ditches, cuts, or excavations.

4.9.18 When feasible, operators shall travel with the "load trailing", if the load obstructs the forward view of the operator.

4.9.19 Slow down and sound horn when approaching a blind curve or intersection. Flagmen equipped with 2-way radio communications may be required to adequately control traffic.

4.9.20 Operators shall remain in cab while heavy equipment is being loaded.

4.9.21 Equipment shall be shut down prior to and during fueling. Do not smoke or use electrical devices while fueling. Fuel shall not be carried in or on heavy equipment, except in permanent fuel tanks or approved safety cans.

4.9.22 Turn off heavy equipment, place gear in neutral and set parking brake prior to leaving vehicle unattended. Buckets and blades are to be placed on the ground and with hydraulic gears in neutral. Heavy equipment parked on slopes shall have the wheels chocked.

4.9.23 Never jump on to or off of a piece of heavy equipment, always maintain 3-points of contact at a minimum.

4.9.24 Never exit heavy equipment while it is in motion.

4.9.25 Passengers shall only ride in heavy equipment designed for occupancy of passengers.

4.9.26 Never ride on the outside of a piece of heavy equipment (e.g., tailgates, buckets, steps, etc.).

4.9.27 Site vehicles will be parked in a designated parking location away from heavy equipment.

4.9.28 Operators shall never push/pull "stuck" or "broken-down" equipment unless a spotter determines that the area is cleared of all personnel around and underneath the equipment.

4.9.29 If designated for work in contaminated areas/zones, equipment shall be kept in the exclusion zone until work or the shift has been completed. Equipment will be decontaminated within designated decontamination areas.

4.9.30 Equipment left unattended at night adjacent to traveled roadways shall have appropriate lights or reflectors, or barricades equipped with appropriate lights or reflectors, to identify the location of that equipment, and shall not be closer than 6 feet (or the regulatory requirement for the work location) to the active roadway.

4.9.31 Pneumatic-tired earthmoving haulage equipment, with a maximum speed exceeding 15 miles per hour, shall be equipped with fenders on all wheels.

4.9.32 Lift trucks shall have the rated capacity clearly posted on the vehicle, and the ratings are not exceeded.

4.9.33 Steering or spinner knobs shall not be attached to steering wheels.

4.9.34 High lift rider industrial trucks shall be equipped with overhead guards.

4.9.35 When ascending or descending grades in excess of 5%, loaded trucks shall be driven with the load upgrade.

4.9.36 All belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating or moving parts of equipment shall be guarded when exposed to contact by persons or when they otherwise create a hazard.

4.9.37 All hot surfaces of equipment, including exhaust pipes or other lines, shall be guarded or insulated to prevent injury and fire.

4.9.38 All equipment having a charging skip shall be provided with guards on both sides and open end of the skip area to prevent persons from walking under the skip while it is elevated.

4.9.39 Platforms, foot walks, steps, handholds, guardrails, and toeboards shall be designed, constructed, and installed on machinery and equipment to provide safe footing and access ways.

4.9.40 Substantial overhead protection shall be provided for the operators of fork lifts and similar equipment.

4.10 Utilities

4.10.1 When contacted by heavy equipment, aboveground and underground utilities may cause severe injuries or death as a result of electrocution, explosion, etc.

4.10.2 The following outline the requirements while performing heavy equipment operations that may lead to contact with aboveground or underground utilities:

- Always be aware of surrounding utilities.
- Confirm all equipment (i.e., dump trailers, loaders, excavators, etc.) is lowered prior to moving underneath of aboveground utilities.
- Confirm utilities are cleared and identified prior to beginning any earthmoving operation. Contact the local utility service providers for clearance prior to performing work. Confirm documentation of the contact is made; date, number; contact name, organization, etc.

4.11 Training

4.11.1 The operator or other qualified supervisor will provide all on-site personnel with an orientation to the mobile equipment and its associated hazards and controls.

4.11.2 Only designated, qualified personnel shall operate heavy equipment.

4.11.3 Operators shall have all appropriate local, state, or federal licenses or training to operate a designated piece of heavy equipment.

4.11.4 Operators shall be evaluated through documented experience and routine monitoring of activities unless the equipment is operated by an AECOM operator in which case a practical evaluation is needed. Operators shall be knowledgeable and competent in the operation of a designated piece of heavy equipment.

4.12 Inspection and Maintenance

4.12.1 Maintenance records for any service, repair or modification which affects the safe performance of the equipment will be maintained and be reasonably available to the operator and maintenance personnel during work hours.

4.12.2 Maintenance records will be maintained on the site or project for mobile equipment.

4.12.3 Servicing, maintenance and repair of mobile equipment will not be done when the equipment is operating, unless continued operation is essential to the process and a safe means is provided.

4.12.4 All heavy equipment shall have a documented inspection and if necessary, repaired prior to use. Operators shall not operate heavy equipment that has not been cleared for use. All machinery and mechanized equipment will be certified to be in safe operating condition (certification form attached) by a competent individual seven days prior to on-site operation, and is valid for one year.

4.12.5 All heavy equipment shall be inspected at a minimum to the manufacturer's recommendations prior to each work shift. All defects shall be reported to the site supervisor/manager immediately. Inspection records shall be maintained at the site. If a manufacturer's or company-specific inspection checklist is not provided, use the Heavy Equipment Pre-Operation Inspection Checklist (attached).

4.12.6 Defective heavy equipment shall be immediately taken out of service until repaired.

4.13 Fueling and batteries

4.13.1 A well-ventilated area shall be used for refueling.

4.13.2 Only the type and quality of fuel recommended by the engine manufacturer shall be used.

4.13.3 Fuel tanks shall not be filled while the engine is running. All electrical switches shall be turned off.

4.13.4 No one shall spill fuel on hot surfaces. Any spillage should be cleaned before starting an engine.

4.13.5 Spilled fuel shall be cleaned with cotton rags or cloths; do not use wool or metallic cloth.

4.13.6 Open flames, lighted smoking materials, or sparking equipment shall remain well away from the fueling area.

4.13.7 Heaters in carrier cabs shall be turned off when refueling the carrier or the drill rig.

4.13.8 Portable fuel containers shall not be filled completely to allow expansion of the fuel during temperature changes.

4.13.9 The fuel nozzle shall be kept in contact with the tank being filled to prevent static sparks from igniting the fuel.

4.13.10 Portable fuel containers shall not travel in the vehicle or carrier cab with personnel.

4.13.11 Fuel containers and transfer hoses shall be kept in contact with a metal surface during travel to prevent buildup of a static charge.

4.13.12 Batteries shall be serviced in a ventilated area while wearing appropriate PPE.

4.13.13 When a battery is removed from a vehicle or service unit, the battery shall be disconnected ground post first.

4.13.14 When installing a battery, the battery shall be connected ground post last.

4.13.15 When charging a battery, cell caps shall be loosened prior to charging to permit gas to escape.

4.13.16 When charging a battery, the power source shall be turned off to the battery before either connecting or disconnecting charger loads to the battery posts.

4.13.17 Spilled battery acid shall be immediately flushed off the skin with a continuous supply of water.

4.13.18 Should battery acid get into the eyes, the eyes shall be flushed immediately with copious amounts of water and medical attention sought immediately.

4.13.19 To avoid battery explosions, the cells shall be filled with electrolytes. A flashlight (not an open flame) shall be used to check water electrolyte levels. Avoid creating sparks around battery by shorting across a battery terminal. Lighted smoking materials and flames shall be kept at least 25 feet away from battery-charging stations.

5.0 Records

5.1 Inspection records shall be maintained with the equipment.

6.0 Attachments

6.1 S3NA-309-FM1 Certification of Machinery and Mechanized Equipment

6.2 S3NA-309-FM2 Heavy Machinery Pre-Operation Checklist

6.3 S3NA-309-WI Brokk180 Safety Card

S3NA-405-PR Drilling, Boring, and Direct Push Probing

1.0 Purpose and Scope

1.1 Provides the minimum requirements to be followed when drilling and boring work are performed.

1.2 This procedure applies to all AECOM North America-based employees and operations.

2.0 Terms and Definitions

None.

3.0 References

None.

4.0 Procedure

4.1 All client on-site safety procedures shall be understood and adhered to.

4.2 Be aware of the provincial/territorial regulations that govern drill rig operations and exposed moving parts.

4.3 **Roles and Responsibilities**

4.3.1 **Project Manager or Resident Engineer** is responsible for ensuring that sound principles of safety, training, inspection, maintenance, and operation consistent with all resource data available from the manufacturer, OSHA, and ANSI is provided to the operator and users by the Contractor or operating entity.

4.3.2 **Site Safety Coordinator (SSC)** shall assist the **Project Manager** in compliance with the requirements of this procedure.

4.3.3 The **SH&E Department** shall assist site management with guidance about this procedure.

4.3.4 **AECOM employees** engaged in project field activities shall be cognizant of contractor activities that may affect their safety and shall follow these procedures.

4.3.5 **AECOM Equipment Operator**

- In cases where AECOM owns and operates drilling, boring, or probing equipment, the lead equipment operator is responsible for the maintenance and safe operation of equipment under their control consistent with those responsibilities of a Contractor.
- Operations will be terminated during an electrical storm, and all crew members will move away from the rig. If lightning is observed, shut down all rig operations immediately.

4.3.6 **Contractors**

- **Contractors** have direct control over the application and operation of all drilling, boring, and probing equipment owned by their organization.
- It is the **Equipment Contractor** operator's responsibility to implement safe work practices provided by the **Contractor's** project management or supervisory staff supplemented by good judgment, safe control, and caution whenever operating drilling, boring, and probing equipment.

4.3.7 **Safety Representative**: Unless the **Contractor** has a designated **Safety Representative**, the **Contractor**'s responsible person for safety for the drill crew will be the drill rig operator. The safety person's responsibilities are to

- Consider the "responsibility" for safety and the "authority" to enforce safety to be a matter of first importance.
- Be the leader in using proper personal protective equipment (PPE) and set an example in following the rules that are being enforced on others. See section 4.5 for PPE required by this SOP.
- Enforce the use of proper safety equipment and take appropriate corrective action when proper PPE is not being used.

- Understand that the proper maintenance of tools and equipment and general housekeeping on the drill rig will provide an environment that promotes and enforces safety. See Sections 4.7 and 4.9 for housekeeping and maintenance requirements of this SOP.
- Ensure that the operator has had adequate training and is thoroughly familiar with the rig, its controls, and its capabilities prior to commencement of drilling activities.
- Inspect the rig at least daily for structural damage, loose bolts and nuts, proper tension in chain drives, loose or missing guards or protective covers, fluid leaks, damaged hoses, and/or damaged pressure gauges and pressure relief valves. A Rig Inspection Form has been provided in S3NA-405-FM1 Drill Rig Inspection for use in performing inspections when the Contractor does not have their own.
- Check and test all safety devices such as emergency shutdown switches at least daily and preferably at the start of a work shift. Rig operation should not be permitted until all emergency shutdown and warning systems are working correctly. Wiring around, bypassing, or removing an emergency device is not permitted.
- Check that all gauges, warning lights, and control levers are functioning properly, and listen for unusual sounds on each starting of an engine.
- Ensure that all new rig workers are informed of safe operating practices on and around the rig. Provide each new rig worker with a copy of the organization's drilling operations safety procedures and, when appropriate, the rig manufacturer's operations and maintenance manual. The safety person should ensure that each new employee reads and understands the safety procedures.
- Ensure that a first aid kit and fire extinguishers are available and properly maintained on each rig and on each additional vehicle.
- Be well trained and capable of using a first aid kit, a fire extinguisher, and all other safety devices and equipment.
- Maintain a list of addresses and telephone numbers of emergency assistance units (ambulance services, police, hospitals, etc.), and inform other members of the drill crew of its location.
- See that new workers are instructed in rig safety, and observe the new worker's progress toward understanding safe operating practices.
- Observe the mental, emotional, and physical capability of workers to perform the assigned work in a proper and safe manner. Dismiss from the job site any worker whose mental and physical capabilities might cause injury to the worker or coworkers.
- Rig Crew and Other Field Personnel (Those employees involved in fieldwork): All personnel engaged in site activities are required to become thoroughly familiar with, and to conform to, the provisions of AECOM's safety plan, procedures, and such other safety directives as may be considered appropriate by **Project Managers**, **Safety Officers,** and **Supervisors**.
- Rig Workers: Personnel are encouraged to offer ideas, suggestions, or recommendations regarding any operational condition, procedure, or practice that may enhance the safety of site personnel or the public. Their primary responsibilities will be:
    - Perform all required work safely.
    - Familiarize themselves with and understand the plan, including proper use of personal protective equipment.
    - Report any unsafe conditions to supervisory personnel.
    - Be aware of signs and symptoms of thermal stress.

4.4 Training

4.4.1 All staff shall be provided with on-site orientation to the rig and its operator.

4.4.2 All operators and assistants shall have industry-standard safety training and be versed in the equipment to be utilized. This may include, but is not limited to, HAZWOPER, Petroleum Safety Training (or Construction Safety Training), and H2S Alive as appropriate.

4.5 Personal Protective Equipment

4.6 For most geotechnical, mineral, and/or groundwater drilling projects, PPE should include

- Hard hat: Hard hats shall be worn by everyone working at a drilling/boring site. Hats should meet the requirements of ANSI Z89 and be kept clean and in good repair with the headband and crown straps properly adjusted for the employee.

- Safety shoes: Safety shoes or boots shall be worn by all drilling personnel and all visitors to the site who observe operations within close proximity of the rig. Safety shoes or boots should meet the requirements of ANSI Z4 1.1.
- Safety glasses: All rig personnel shall wear safety glasses meeting the requirements of ANSI Z87.1.
- High Visibility Class II Safety Vest shall be worn by all **AECOM employees**. All rig personnel should attempt to wear high-visibility clothing that should be close fitting and not have large cuffs or loose material that can catch on rotating or translating components of the rig.
- Close fitting gloves and clothing: All rig personnel should wear gloves for hand protection against cuts and abrasions that could occur while handling wire rope or cable and from contact with sharp edges and burrs on drill rods and other drilling or sampling tools. Gloves should be close fitting and not have large cuffs or loose ties which can catch on rotating or translating components of the rig.
- Other protective equipment: For some operations, the project may dictate use of other protective equipment. The management of the contractor and its safety person shall determine the requirements. Such equipment might include face or ear protection or reflective clothing. The design and composition of the protective equipment and clothing should be determined as a joint effort of management and the client.
- Each worker should wear noise reducing ear protectors around operating equipment or during elevated noise levels.
- When drilling, boring, or probing is performed in chemically or radiological contaminated ground, special protective equipment and clothing will probably be required.
- The clothing of the individual rig worker is not generally considered protective equipment; however, clothing should be close fitting and comfortable without loose ends, straps, draw strings or belts or otherwise unfastened parts that might catch on some rotating or translating component of the rig. Rings and jewelry should not be worn during a work shift.

4.7 Housekeeping

4.7.1 A key requirement for safe field operations is that the Contractor safety person understands and fulfills the responsibility for maintenance and "housekeeping" on and around the drill rig, including the following:

- Suitable storage locations should be provided for all tools, materials, and supplies so that tools, materials, and supplies can be conveniently and safely handled without hitting or falling on a member of the crew or a visitor.
- Storage or transporting tools, materials, or supplies within or on the mast (derrick) of the rig should be avoided.
- Pipe, drill rods, probe rods, casing augers, and similar tooling should be orderly stacked on racks or sills to prevent spreading, rolling, or sliding.
- Penetration or other driving hammers should be placed at a safe location on the ground or be secured to prevent movement when not in use.
- Work areas, platforms, walkways, scaffolding and other accesses should be kept free of materials, debris and obstructions and substances such as ice, grease, or oil that could cause a surface to become slick or otherwise hazardous.
- All controls, control linkages, warning and operation lights, and lenses should be kept free of oil, grease, and/or ice.
- Do not store gasoline in any portable container other than a non-sparking, red safety container with a flame arrester in the fill spout and having the word "gasoline" easily visible.

4.8 Traffic Control

4.8.1 When operating near public vehicular and pedestrian traffic, the on-site personnel shall take every precaution necessary to see that the work zone is properly established, identified, and isolated from both moving traffic and passerby pedestrians.

4.8.2 All traffic control devices shall be installed, placed, and maintained in accordance with the Traffic Control Plan, client specifications, and/or the Manual of Uniform Traffic Control Devices (MUTCD). Traffic control devices shall consist of and not be limited to:

- Directional and informational signage;
- High visibility barricades, cones, or barrels;

- Lighting; and
- Other equipment and devices as required.

4.9 Maintenance & Inspection

4.9.1 Good maintenance and thorough inspection will make operations safer. Maintenance tasks should be done safely by a qualified maintenance person. Inspection and maintenance tasks include but are not limited to the following requirements:

- Inspections shall be completed at the beginning of each day by the equipment operator and in the presence of an AECOM employee when the equipment is not owned and operated by AECOM. A Rig Inspection Form is provided in S3NA-405-FM1 Drill Rig Inspection for use in performing inspections.
- Safety glasses should be worn when performing maintenance on a rig or on drilling or probing tools.
- The drill rig engine should be shut down to make repairs or adjustments to a drill rig or to lubricate fittings (except repairs or adjustments that can only be made with the engine running).
- Precautions should be taken to prevent accidental starting of an engine during maintenance by removing or tagging the ignition key.
- Wheels or the lowering of leveling jacks or both should be blocked ("zero energy state") and hand brakes set before working under a drill rig.
- When possible and appropriate, all pressure on the hydraulic systems should be released as well as the drilling fluid system and the air pressure systems of the drill rig prior to performing maintenance. In other words, reduce the drill rig and operating systems to a "zero energy state" before performing maintenance. Use extreme caution when opening drain plugs and radiator caps and other pressurized plugs and caps.
- Personnel shall not touch an engine or the exhaust system of an engine following its operation until the engine and exhaust system have adequate time to cool.
- Welding and cutting shall not occur on or near a fuel tank.
- Wire rope safety factors shall be in accordance with American National Standards Institute B 30.5-1968 or SAE J959-1966.
- Gasoline or other volatile or flammable liquids shall not be used as a cleaning agent on or around an l rig.
- The manufacturer's recommendations should be followed for applying the proper quantity and quality of lubricants, hydraulic oils, and/or coolants.
- All caps, filler plugs, protective guards, panels, high-pressure hose clamps, chains, or cables that have been removed for maintenance should be replaced.

4.10 Hand Tools

4.10.1 A large number of hand tools can be used on or around a drill or probe rig and in repair shops and more than an equal number of instructions for proper use exist. "Use the tool for its intended purpose" is the most important rule. Additionally, equipment operators and assistants should not use their hand in place of the proper tool; work shall be stopped until the correct tool can be found. The following are a few specific and some general suggestions that apply to the safe use of several hand tools that are often used on and around rigs:

- When a tool becomes damaged, either repair it before using it again or get rid of it.
- When using a hammer, any kind of hammer for any purpose, wear safety glasses and require all others around you to wear safety glasses.
- When using a chisel, any kind of chisel, for any purpose, wear safety glasses and require all others around you to wear safety glasses.
- Keep all tools cleaned and orderly stored when not in use.
- Use wrenches on nuts; don't use pliers on nuts.
- Use screwdrivers with blades that fit the screw slot.
- When using a wrench on a tight nut, first use some penetrating oil, use the largest wrench available that fits the nut, when possible pull on the wrench handle rather than pushing, and apply force to the wrench with both hands when possible and with both feet firmly placed. Don't push or pull with one or both feet on the drill rig or the side of a mud pit or some other blocking-off device. Always assume that you may lose your footing – check the place where you may fall for sharp objects.

- Keep all pipe wrenches clean and in good repair. The jaws of pipe wrenches should be wire brushed frequently to prevent an accumulation of dirt and grease which would otherwise build up and cause wrenches to slip. Replace hook and heel jaws when they become visibly worn.
- Avoid the use pipe wrenches in place of a rod-holding device whenever possible.
- When breaking tool joints on the ground or on a drilling platform, position your hands so that your fingers will not be smashed between the wrench handle and the ground or the platform, should the wrench slip or the joint suddenly let go.

4.11 Clearing Work Areas

4.11.1 Prior to set up, adequate site clearing and leveling should be performed to accommodate the rig and supplies and provide a safe working area. Clearing the site includes clearing the intended drilling area of underground utilities in accordance with S3NA-417-PR Utilities, Underground. Drilling or probing should not be commenced when tree limbs, unstable ground or site obstructions cause unsafe tool handling conditions.

4.11.2 Start-Up

- All rig personnel and visitors should be instructed to "stand clear" of the rig immediately prior to and during starting of an engine.
- Make sure all gear boxes are in neutral, all hoist levers are disengaged, all hydraulic levers are in the neutral-actuating positions, and the cathead rope is not on the cathead before starting a drill rig engine.
- Start all engines according to the manufacturer's manual.

4.12 Drilling and Probing Operations

4.12.1 The following safety measures shall be taken during drilling and probing operations on-site:

- The operator and helper shall be present during all active rig operations.
- Site personnel shall remain within visual contact of the rig operator.
- Hard hats approved safety boots and hearing protection shall be worn in the presence of a rig.
- Services shall be cleared prior to drilling or probing.
- Hands shall be kept away from moving parts (augers).
- The emergency shut-off switch on the rig should be identified to site personnel and tested on a regular basis by the operator.
- Unauthorized personnel shall be kept clear of the rig.

4.12.2 Safety requires the attention and cooperation of every worker and site visitor.

- Do not drive the rig from hole to hole with the mast (derrick) in the raised position.
- Before raising the mast (derrick) look up to check for overhead obstructions. Refer to *S3NA-417-PR Utilities, Underground* and *S3NA-406-PR Electrical Lines, Overhead.*
- Before raising the mast (derrick), all rig personnel (with the exception of the operator) and visitors should be cleared from the areas immediately to the rear and the sides of the mast. All rig personnel and visitors should be informed that the mast is being raised prior to raising it.
- Before the mast (derrick) of a drill rig is raised and drilling is commenced, the drill rig shall be first leveled and stabilized with leveling jacks and/or solid cribbing. The drill rig should be releveled if it settles after initial set up. Lower the mast (derrick) only when the leveling jacks are down, and do not raise the leveling jack pads until the mast (derrick) is lowered completely.
- Before starting drilling operations, secure and/or lock the mast (derrick) if required according to the drill manufacturer's recommendations.
- The operator of a rig should only operate a drill rig from the position of the controls. If the operator of the rig shall leave the area of the controls, the operator should shift the transmission controlling the rotary drive into neutral and place the feed control lever in neutral. The operator should shut down the drill engine before leaving the vicinity of the drill.
- Throwing or dropping tools will not be permitted. All tools should be carefully passed by hand between personnel or a hoist line should be used.
- Do not consume alcoholic beverages or other depressants or chemical stimulants prior to starting work on a rig or while on the job.
- If it is necessary to operate the rig within an enclosed area, make certain that exhaust fumes are conducted out of the area. Exhaust fumes can be toxic and some cannot be detected by smell.

- Clean mud and grease from your boots before mounting a rig platform and use hand holds and railings. Watch for slippery ground when dismounting from the platform.
- During freezing weather, do not touch any metal parts of the rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
- All air and water lines and pumps should be drained when not in use if freezing weather is expected.
- All unattended bore holes shall be adequately covered or otherwise protected to prevent rig personnel, site visitors, or animals from stepping or falling into the hole. All open bore holes should be covered, protected, or backfilled adequately and according to local or state regulations on completion of the drilling project.
- "Horsing around" within the vicinity of the drill rig and tool and supply storage areas should never be allowed, even when the rig is shut down.
- When using a ladder on a rig, face the ladder and grasp either the side rails or the rungs with both hands while ascending or descending. Always use adequate fall protection and a full body harness when climbing above six feet of the ground. Do not attempt to use one or both hands to carry a tool while on a ladder. Use a hoist line and a tool "bucket" or a safety hook to raise or lower hand tools.

4.13 Elevated Derrick Platforms

4.13.1 The following precautions should be used:

- When a rig worker first arrives at a derrick platform, the platform should immediately be inspected for broken members, loose connections, and loose tools or other loose materials.
- A derrick platform over 4 feet (1.2 m) above ground surface should have toe boards and safety railings that are in good condition.
- When climbing to a derrick platform that is higher than 6 feet (am), a fall arresting device shall be used. The fall arresting device should consist of a full body harness and fall protection. The harness should fit snugly but comfortably. The lifeline when attached to the derrick should be less than 6 feet (2 m) long and attached to a fall arrester. The harness and lifeline should be strong enough to withstand the dynamic force of a 250-pound (115 kg) weight (contained within the belt) falling 6 feet (2 m).
- When a rig worker is on a derrick platform, the lifeline should be fastened to the derrick just above the derrick platform and to a structural member that is not attached to the platform or to other lines or cables supporting the platform.
- Tools should be securely attached to the platform with safety lines. Do not attach a tool to a line attached to your wrist or any other part of your body.
- When you are working on a derrick platform, do not guide drill rods or pipe into racks or other supports by taking hold of a moving hoist line or a traveling block.
- Loose tools and similar items should not be left on the derrick platform or on structural members of the derrick.
- Workers on the ground or the drilling floor should avoid being under rig workers on elevated platforms whenever possible.

4.14 Lifting Heavy Objects

4.14.1 Before lifting any object without using a hoist, make sure that the load is within your personal lifting capacity. If it is too heavy ask for assistance.

4.14.2 Before lifting a relatively heavy object, approach the object by bending at the knees, keeping your back vertical and unarched while obtaining a firm footing. Grasp the object firmly with both hands and stand slowly and squarely while keeping your back vertical and unarched. In other words, perform the lifting with the muscles in your legs, not with the muscles in your lower back.

4.14.3 If a heavy object shall be moved some distance without the aid of machinery, keep your back straight and unarched. Change directions by moving your feet, not by twisting your body.

4.14.4 Move heavy objects with the aid of handcarts or lifting devices whenever possible.

4.15 Use of Wire Line Hoists, Wire Rope, and Hoisting Hardware

4.15.1 The use of wire line hoists, wire rope, and hoisting hardware should be as stipulated by the American Iron Steel Institute, Wire Rope Users Manual.

- All wire ropes and fittings should be visually inspected during use and thoroughly inspected at least once a week for abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper revving, jamming, crushing, bird caging, kinking, care protrusion, and damage to lifting hardware. Wire ropes should be replaced when inspection indicates excessive damage according to the Wire Rope Users Manual. All wire ropes that have not been used for a period of a month or more should be thoroughly inspected before being returned to service.
- End fittings and connections consist of spliced eyes and various manufactured devices. All manufactured end fittings and connections should be installed according to the manufacturer's instructions and loaded according to the manufacturer's specifications.
- If a ball-bearing type hoisting swivel is used to hoist drill rods, swivel bearings should be inspected and lubricated daily to ensure that the swivel freely rotates under load.
- If a rod-slipping device is used to hoist drill or probe rods, do not drill through or rotate drill rods through the slipping device; do not hoist more than 1 foot (.3 m) of the rod column above the top of the mast (derrick); and do not hoist a rod column with loose tool joints while the rod column is being supported by a rod slipping device. If rods should slip back into the hole, do not attempt to break the fall of the rods with your hands or by applying tension to the slipping device.
- Most sheaves on exploration drill rigs are stationary with a single part line. The number of parts of line should never be increased without first consulting with the manufacturer of the drill rig.
- Wire ropes shall be properly matched with each sheave. If the rope is too large, the sheave will pinch the wire rope; if the rope is too small, it will groove the sheave. Once the sheave is grooved, it will severely pinch and damage larger-sized wire ropes and therefore shall be replaced.

4.15.2 The following procedures and precautions shall be understood and implemented for safe use of wire ropes and rigging hardware.

- Use tool-handling hoists only for vertical lifting of tools (except when angle hole drilling). Do not use tool-handling hoists to pull on objects always from the rig; however, drills may be moved using the main hoist if the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.
- When struck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull to the hoist line or the feed mechanism of the drill.
- When attempting to pull out a mired down vehicle or drill rig carrier, only use a winch on the front or rear of the vehicle and stay as far as possible away from the wire rope. Do not attempt to use tool hoists to pull out a mired down vehicle or drill rig carrier.
- Minimize shock loading of a wire rope. Apply loads smoothly and steadily. Avoid sudden loading in cold weather.
- Never use frozen ropes.
- Protect wire rope from sharp corners or edges.
- Replace faulty guides and rollers.
- Replace damaged safety latches on safety hooks before using.
- Know the safe working load of the equipment and tackle being used. Never exceed this limit.
- Clutches and brakes of hoists should be periodically inspected and tested.
- Know and do not exceed the rated capacity of hooks, rings, links, swivels, shackles, and other lifting aids.
- Always wear gloves when handling wire ropes.
- Do not guide wire rope on hoist drums with your hands.
- Following the installation of a new wire rope, first lift a light load to allow the wire rope to adjust.
- Never carry out any hoisting operations when the weather conditions are such that hazards to personnel, the public, or property are created.
- Never leave a load suspended in the air when the hoist is unattended.

- Keep your hands away from hoists wire rope, hoisting hooks, sheaves, and pinch points while slack is being taken up and when the load is being hoisted.
- Never hoist the load over the head body, or feet of any personnel. Never use a hoist line to "ride" up the mast (derrick) of a drill rig.
- Replacement wire ropes should conform to the drill rig manufacturer's specifications.

4.16 Use of Cathead and Rope Hoists

4.16.1 The following safety procedures should be employed when using a cathead hoist:

- Keep the cathead clean and free of rust and oil and/or grease. The cathead should be cleaned with a wire brush if it becomes rusty.
- Check the cathead periodically, when the engine is not running, for rope wear grooves. If a rope groove forms to a depth greater than 1/8 inches (3 mm), the cathead should be replaced.
- Always use a clean, dry, sound rope. A wet or oily rope may "grab" the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast.
- Should the rope "grab" the cathead or otherwise become tangled in the drum, release the rope and sound an appropriate alarm for all personnel to rapidly back away and stay clear. The operator should also back away and stay clear. If the rope "grabs" the cathead, and tools are hoisted to the sheaves at the top of the mast, the rope will often break, releasing the tools. If the rope does not break, stay clear of the drill rig until the operator cautiously returns to turn off the drill rig engine and appropriate action is taken to release the tools. The operator should keep careful watch on the suspended tools and should quickly back away after turning off the engine.
- The rope should always be protected from contact with all chemicals. Chemicals can cause deterioration of the rope that may not be visibly detectable.
- Never wrap the rope from the cathead (or any other rope, wire rope or cable on the drill rig) around a hand, wrist, arm, foot, ankle, leg or any other part of your body.
- Always maintain a minimum of 18 inches of clearance between the operating hand and the cathead drum when driving samplers, casing or other tools with the cathead and rope method. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground.
- Never operate a cathead (or perform any other task around a drill rig) with loose unbuttoned or otherwise unfastened clothing or when wearing gloves with large cuffs or loose straps or lacings.
- Do not use a rope that is any longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.
- Do not use more rope wraps than are required to hoist a load.
- Do not leave a cathead unattended with the rope wrapped on the drum. Position all other hoist lines to prevent contact with the operating cathead rope.
- When using the cathead and rope for driving or back driving, make sure that all threaded connections are tight and stay as far away as possible from the hammer impact point.
- The cathead operator shall be able to operate the cathead standing on a level surface with good, firm footing conditions without distraction or disturbance.

4.17 Use of Augers

4.17.1 The following general procedures should be used when starting a boring with continuous flight of hollow-stem augers:

- Prepare to start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low RPM.
- Apply an adequate amount of down pressure prior to rotation to seat the auger head below the ground surface.
- Look at the auger head while slowly engaging the clutch or rotation control and starting rotation. Stay clear of the auger.
- Slowly rotate the auger and auger head while continuing to apply down pressure. Keep one hand on the clutch or the rotation control at all times until the auger has penetrated about one foot or more below ground surface.
- If the auger head slides out of alignment, disengage the clutch or hydraulic rotation control and repeat the hole starting process.
- An auger guide can facilitate the starting of a straight hole through hard ground or a pavement.

- The operator and tool handler should establish a system of responsibility for the series of various activities required for auger drilling, such as connecting and disconnection auger sections, and inserting and removing the auger fork. The operator shall ensure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation.
- Only use the manufacturer's recommended method of securing the auger to the power coupling. Do not touch the coupling or the auger with your hands, a wrench, or any other tools during rotation.
- Whenever possible, use tool hoists to handle auger sections.
- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.
- Never allow feet to get under the auger section that is being hoisted.
- When rotating augers, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason.
- Use a long-handled shovel to move auger cuttings away from the auger. Never use your hands or feet to move cuttings away from the auger.
- Do not attempt to remove earth from rotating augers. Augers should be cleaned only when the drill rig is in neutral and the augers are stopped from rotating.

4.18 Rotary and Core Drilling

4.18.1 Rotary drilling tools should be safety checked prior to drilling:

- Water swivels and hoisting plugs should be lubricated and checked for "frozen" bearings before use.
- Drill rod chuck jaws should be checked periodically and replaced when necessary.
- The capacities of hoists and sheaves should be checked against the anticipated weight to the drill rod string plus other expected hoisting loads.

4.18.2 Special precautions that should be taken for safe rotary or core drilling involve chucking, joint break, hoisting, and lowering of drill rods:

- Only the operator of the drill rig should brake or set a manual chuck so that rotation of the chuck will not occur prior to removing the wrench from the chuck.
- Drill rods should not be braked during lowering into the hole with drill rod chuck jaws. Drill rods should not be held or lowered into the hole with pipe wrenches.
- If a string of drill rods are accidentally or inadvertently released into the hole, do not attempt to grab the falling rods with your hands or a wrench.
- In the event of a plugged bit or other circulation blockage, the high pressure in the piping and hose between the pump and the obstruction should be relieved or bled down before breaking the first tool joint.
- When drill rods are hoisted from the hole, they should be cleaned for safe handling with a rubber or other suitable rod wiper. Do not use your hands to clean drilling fluids from drill rods.
- If work shall progress over a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross members. The mud pit should be equipped with rough-surfaced, fitted cover panels of adequate strength to hold drill rig personnel.
- Drill rods should not be lifted and leaned unsecured against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage or lay the rods down.

4.19 Site Movement of Equipment

4.19.1 The individual who transports a rig on and off a drilling site should:

- Be properly licensed and should only operate the vehicle according to federal, state, and local regulations.
- Know the traveling height (overhead clearance), width, length and weight of the rig with carrier and know highway and bridge load, width and overhead limits, making sure these limits are not exceeded with and adequate margin.
- Never move an I rig unless the vehicle brakes are in sound working order.
- Allow for mast overhand when cornering or approaching other vehicles or structures.

- Be aware that the canopies of service stations and motels are often too low for a drill rig mast to clear with the mast in the travel position.
- Watch for low hanging electrical lines, particularly at the entrances to drilling sites or restaurants, motels, other commercial sites.
- Never travel on a street, road, or highway with the mast (derrick) of the rig in the raised or partially raised position.
- Remove all ignition keys if rig is left unattended.

4.19.2 Loading and Unloading

- Use ramps of adequate design that are solid and substantial enough to bear the weight of the rig with carrier, including tools.
- Load and unload on level ground.
- Use the assistance of someone on the ground as a guide.
- Check the brakes on the rig carrier before approaching loading ramps.
- Distribute the weight of the rig, carrier, and tools on the trailer so that the center of eight is approximately on the centerline of the trailer and so that some of the trailer load is transferred to the high of the pulling vehicle. Refer to the trailer manufacturer's weight distribution recommendations.
- The rig and tools should be secured to the hauling vehicle with ties, chains, and/or load binders of adequate capacity.

4.19.3 Off-Road Movement

The following safety suggestions relate to off-road movement:

- Before moving a drill rig, first walk the route of travel, inspecting for depressions, stumps, gullies, ruts, and similar obstacles.
- Always check the brakes of a drill rig carrier before traveling, particularly on rough, uneven, or hilly ground.
- Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts, and mountings.
- Discharge all passengers before moving a drill rig on rough or hilly terrain.
- Engage the front axle (for 4 x 4, 6 x 6, etc. vehicles or carriers) when traveling off highway on hilly terrain.
- Use caution when traveling side-hill. Conservatively evaluate side-hill capability of drill rigs, because the arbitrary addition of drilling tools may raise the center of mass. When possible, travel directly uphill or downhill. Increase tire pressures before traveling in hilly terrain (do not exceed rated tire pressure).
- Attempt to cross obstacles such as small logs and small erosion channels or ditches squarely, not at an angle.
- Use the assistance of someone on the ground as a guide when lateral or overhead clearance is close.
- After the drill has been moved to a new drilling site, set all brakes and/or locks. Always block/chock the wheels.

4.20 Tires, Batteries, and Fuel

4.20.1 Tires on the rig shall be checked daily for safety and during extended travel for loss of air and they shall be maintained and/or repaired in a safe manner. If tires are deflated to reduce ground pressure for movement on soft ground, the tires should be inflated to normal pressures before movement on firm or hilly ground or on streets, roads and highways. Under-inflated tires are not as stable on firm ground as properly inflated tires. Air pressures should be maintained for travel on streets, roads, and highways according to the manufacturer's recommendations. During air pressure checks, inspect for:

- Missing or loose wheel lugs.
- Objects wedged between dual or embedded in the tire casing. Damaged or poorly fitting rims or rim flanges.
- Abnormal wear, cuts, breaks, or tears in the casing.
- The repair of truck and off-highway tires should only be made with required special tools and following the recommendations of a tire manufacturer's repair manual.

4.20.2 Batteries contain strong acid. Use extreme caution when servicing batteries.

- Batteries should only be serviced in a ventilated area while wearing safety glasses.
- When a battery is removed from a vehicle or service unit, disconnect the battery ground clamp first.
- When installing a battery, connect the battery ground clamp last.
- When charging a battery with a battery charger, turn off the power source to the battery before either connecting or disconnecting charger leads to the battery posts. Cell caps should be loosened prior to charging to permit the escape of gas.
- Spilled battery acid can burn your skin and damage your eyes. Spilled battery acid should be immediately flushed off of your skin with lots of water. Should battery acid get into someone's eyes, flush immediately with large amounts of water and see a physician at once.
- To avoid battery explosions, keep the cells filled with electrolyte; use a flashlight (not an open flame) to check electrolyte levels and avoid creating sparks around the battery by shorting across a battery terminal. Keep lighted smoking materials and flames away from batteries.

4.20.3 Special precautions shall be taken for handling fuel and refueling the rig or carrier. Only use the type and quality of fuel recommended by the engine manufacturer.

- Refuel in a well-ventilated area.
- Do not fill fuel tanks while the engine is running. Turn off all electrical switches. Do not spill fuel on hot surfaces. Clean any spillage before starting an engine. Wipe up spilled fuel with cotton rags or cloths. Do not use wool or metallic cloth.
- Keep open lights, lighted smoking materials, and flames or sparking equipment well away from the fueling area.
- Turn off heaters in carrier cabs when refueling the carrier or the drill rig.
- Do not fill portable fuel containers completely full to allow expansion of the fuel during temperature changes.
- Keep the fuel nozzle in contact with the tank being filled to prevent static sparks from igniting the fuel.
- Do not transport portable fuel containers in the vehicle or carrier cab with personnel.
- Fuel containers and hoses should remain in contact with a metal surface during travel to prevent the buildup of static charge.

4.21 First Aid (see S3NA-207-PR Medical Services and First Aid)

4.21.1 At least one member of the crew (and if only one, preferably the drilling and safety supervisor) should be trained to perform first aid. First aid is taught on a person-to-person basis, not by providing or reading a manual. Manuals should only provide continuing reminders and be used for reference. It is suggested that courses provided or sponsored by the American Red Cross or a similar organization would best satisfy the requirements of first aid training for drill crews.

4.21.2 For drilling and probing operations it is particularly important that the individual responsible for first aid should be able to recognize the symptoms and be able to provide first aid for electrical shock, heart attack, stroke, broken bones, eye injury, snake bite, and cuts or abrasions to the skin. Again, first aid for these situations is best taught to drill crewmembers by instructors qualified by an agency such as the American Red Cross.

4.21.3 A first aid kit should be available and well maintained on each drill site. The contents of the first aid kit shall be placed in a weatherproof container with individual sealed packages for each type of item.

4.22 Rig Utilization

4.22.1 Do not attempt to exceed manufacturers' ratings of speed, force, torque, pressure, flow, etc.

4.22.2 Only use the drill rig and tools for the purposes that they are intended and designed.

4.23 Rig Alterations

4.23.1 Alterations to a rig or drilling or probing tools should only be made by qualified personnel and only after consultation with the manufacturer.

5.0 Records

None.

6.0 Attachments

6.1 S3NA-405-FM1 Drill Rig Inspection

6.2 S3NA-405-FM2 Subsurface Investigation Checklist

6.3 S3NA-405-ST Drilling and Boring

6.4 S3NA-405-WI Core Drilling Machine Safety Card

S3NA-406-PR Electrical Lines, Overhead

1.0 Purpose and Scope

1.1 Provides the safe work requirements to be observed where overhead power lines are present on a job site.

1.2 This procedure applies to all AECOM North America-based employees and operations.

2.0 Terms and Definitions

2.1 Types of overhead lines:

2.1.1 Overhead power lines

2.1.2 Structural cable supports

2.1.3 Guy wires

2.1.4 Cable television / communication lines

3.0 References

None.

4.0 Procedure

4.1 An appropriate distance must be kept between equipment and overhead utility lines.

4.2 Employees must contact the power line operator before work is done or before equipment is operated within 15.25 metres (50 feet) of an energized overhead power line, in order to:

- determine the voltage of the power line, and
- establish the appropriate safe limit of approach distance as identified by provincial/territorial regulations.

4.3 The safe limit of approach distances do not apply to a load, equipment, or building that is transported under energized overhead power lines if the total height, including equipment transporting it, is less than 4.15 metres (13.5 feet).

4.4 **Employers** or **Project Managers** must formally notify (using the Overhead Electrical Lines Acknowledgement form) all subcontractors or equipment operators of an energized overhead power line before work is done or equipment is operated in the vicinity of the power line at distances less than the safe limit of approach distances and obtain the operator's assistance in protecting workers involved.

4.5 Employees must not place earth or other material under or beside an overhead power line if doing so reduces the safe clearance to less than the safe limit of approach distances.

4.6 To maintain minimum safe clearances:

4.6.1 Install warning devices and signs (hang a sign from and mark all guy wires to warn traffic of low clearance; provide warning signage for all overhead services).

4.6.2 Install telescopic, nonconductive posts and flagging across right-of-way at the minimum allowable clearance as allowed by regulations for the line voltage.

4.6.3 Position signs or other devices to determine the "Danger Zone."

4.6.4 Inform all on-site staff with the on-site clearances required.

4.6.5 Beware of atmospheric conditions, such as temperature, humidity, and wind, that may dictate more stringent safety procedures.

4.7 Operation of heavy equipment and cranes in areas with overhead power lines represents a significant hazard to all personnel on the job site. Accidental contact with an energized line or arcing between a high power line and grounded equipment can cause electrocution of equipment operators or nearby ground personnel, and damage to power transmission and operating equipment. Although

maintaining a safe distance from all energized lines is the preferred means for control of this hazard, site conditions may not always accommodate this. If work will (or may) occur within 50 feet of any energized line, the procedures outlined below will be observed.

4.8 Overhead power lines will be identified on each job site before the work commences. For each identified line, the Project Manager must determine whether it is energized (and the operating voltage for energized lines), and whether work operations will require that activities with heavy equipment (excavators, loaders, cranes, etc.) will occur within 50 feet (15.25 metres) of the line. Unless verified, it will be assumed that all lines are energized.

4.9 Safe working distance is the minimum distance that must be maintained between any energized electrical line and any part of the operating equipment to maintain adequate safety margins and is based on the line voltage of the power line. Figure 4-1 lists the line voltages in kilovolts and the Minimum Safe Work Distance in the United States and Figure 4-2 indicates the Nominal Phase to Phase voltage rating in kilovolts for Canada. The following safe working distance criteria will be applied for all AECOM operations:

Figure 4-1: United States Overhead Line Criteria

Line Voltage (Kilovolts)	Minimum Safe Working Distance
0 – 50	10 feet
>50 – 200	15 feet
>200 – 350	20 feet
>350 – 500	25 feet
>500 – 750	35 feet
>750 – 1,000	45 feet

Source: American National Standards Institute, Publication B30.5.

Figure 4-2: Canadian Overhead Line Criteria

Column 1	Column 2
Nominal phase-to-phase voltage rating	Minimum Distance
Over 425 to 12,000	3.0 metres
Over 12,000 to 22,000	3.0 metres
Over 22,000 to 50,000	3.0 metres
Over 50,000 to 90,000	4.5 metres
Over 90,000 to 120,000	4.5 metres
Over 120,000 to 150,000	6.0 metres
Over 150,000 to 250,000	6.0 metres
Over 250,000 to 300,000	7.5 metres
Over 300,000 to 350,000	7.5 metres
Over 350,000 to 400,000	9.0 metres

Source: Canada Occupational Health and Safety Regulations Electrical Safety- Subsection 8.5(6).

4.10 Under no circumstances will any object pass closer than 3 metres to any energised, uninsulated electrical line.

4.11 Formally notify all subcontractors of Overhead Power lines with the attached *S3NA-406-FM Overhead Electrical Lines Acknowledgement* form.

4.12 **Acceptable Safety Procedures**

4.12.1 Where any work task will not allow the minimum safe working distance to be maintained at all times, an alternate means of protection must be identified and approved by the SH&E Department. In order of preference, acceptable procedures are

- De-energize the power line(s)/lockout by local utility authorities
- Install insulated sleeves on power lines
- Assign line spotters to assist the equipment operator

4.12.2 De-energize Power Lines

Elimination of electrical power provides the most acceptable means of ensuring safety of personnel. While temporary site power lines are under the control of the site manager (and can be de-energized locally), electrical distribution and transmission lines can be de-energized only by the owner of the line (generally the local electrical utility). Therefore, de-energizing of a line requires advance coordination with the line owner; generally, at least one week advance notice should be provided.

4.12.3 Install Insulating Sleeves

Insulating sleeves can be placed over power lines to provide a contact and arcing barrier if work must occur closer to the power lines than the accepted safe work distance. Although not as desirable as line de-energizing, the use of these sleeves can provide an acceptable alternative where electrical lines are required to remain in service.

As with de-energizing of distribution and transmission lines, placement of insulating sleeves can be performed only by the line owner. This requires advance coordination with the line owner; generally, at least one week advance notice should be provided. To install the sleeves, representatives of the line owner will require access to the job site.

4.12.4 Assign Line Spotters

A line spotter is a person located at ground level who is assigned to observe equipment operations, with the specific duty of assisting the equipment operator to ensure that no part of the equipment gets too close to an energized, unprotected electrical line.

Persons assigned to act as line spotters must meet the following requirements:

- While acting as a line spotter, no other duties may be performed (e.g., the line spotter cannot also act as the load spotter during a lifting operations).
- The spotter will have a radio or other direct means of communicating with the equipment operator at all times.
- The spotter will be positioned at a right angle to the equipment operator's line of sight to maximize the sight angles between the personnel.

Under no circumstances will any portion of a piece of equipment pass closer than 10 feet to any energized, uninsulated electrical line.

4.13 **Additional Safety Measures**

4.13.1 The following additional safety measures can be implemented as needed when working around energized power lines:

- Provide equipment with proximity warning devices. These provide an audible alarm if any part of the equipment gets too close to a line.
- Install ground safety stops. These prevent vehicles from accidentally entering hazardous areas.
- Equip cranes with a boom-cage guard. This prevents the boom from becoming energized if an electrical line is contacted.
- Utilize insulated links and polypropylene tag lines. These prevent the transmission of electricity to loads or tag line handlers if an electrical line is contacted.

NOTE: These additional safeguards are intended as supplemental protection. Use of these measures is not permissible as a substitute for maintaining the safe working distance or implementation of the procedures in Section 4.1.

4.13.2 If an electrical power line is hit or an electrical arc occurs:

- All ground personnel must evacuate IMMEDIATELY to a distance of at least 50 feet (15.25 metres). DO NOT attempt to rescue any injured person until the line can be de-energized.
- The operator should remain in the cab until the line can be de-energized and should carefully try to extricate the equipment from the power line. This may not be possible where melting of insulator material or metal has occurred.
- Contact the line owner to report the line contact and request that the line be de-energized immediately.
- Once the line has been confirmed to be de-energized, the operator can safely evacuate the cab and rescue can commence for any injured personnel.
- Contact the SH&E Department to report the incident and implement any instructions provided.

If the operator must evacuate while the line is still energized (because of fire or other life-threatening condition) he/she should jump clear of the equipment (making sure to avoid touching the equipment and the ground simultaneously), and land upright and with feet together. Once on the ground, proceed in a direct line away from the equipment using a short, shuffling gait (feet touching, sliding each foot no more than 1 foot forward at a time) to minimize shock hazard from electrical energy being transmitted through the ground.

5.0 Records

None

6.0 Attachments

6.1 S3NA-406-FM Overhead Electrical Lines Acknowledgement

S3NA-410-PR Hazardous Energy Control

1.0 Purpose and Scope

1.1 Establishes the requirements for AECOM employees to perform hazardous energy control (equipment lockout and tagout (LOTO)) operations.

1.2 This procedure applies to all AECOM North America based employees and operations.

1.3 All AECOM work is regulated by this procedure when:

1.3.1 An unexpected energization or start-up of machines and/or equipment would result in the release of stored energy which could cause injury to an employee.

1.3.2 Any employee (or contractor) is required to remove or bypass a guard or other safety device.

1.3.3 Any employee (or contractor) is required to place any part of his body into the mechanism of a piece of equipment or path of hazardous energy.

2.0 Terms and Definitions

2.1 **Affected Employee:** A trained person whose job requires him/her to operate or use a machine or piece of equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed

2.2 **Authorized Employee:** A person who locks out or tags out a machine or piece of equipment in order to perform servicing or maintenance on that machine or equipment.

2.3 **Cord and Plug-connected Equipment:** Equipment where the only energy source is electrical power provided by a plug-in connection

2.4 **Energy Source:** Any electrical, mechanical, hydraulic, pneumatic, chemical, radiation, thermal, or compressed gas energy source; energy stored in springs; and potential energy from suspended objects (gravity) that may injure personnel, cause property damage, and/or cause a release of hazardous substance to the environment.

2.5 **Energized:** Connected to an energy source or containing residual or stored energy

2.6 **Energy-isolating Device:** A mechanical device that physically prevents the transmission or release of energy. This includes locks, hairpins, tongs, lockable valves, clamshell devices for valves, blank flanges for piping systems, and restraining devices to prevent movement of parts.

2.7 **Energy Source:** Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other energy.

2.8 **Isolation:** A physical activity using a device which prevents the transmission or release of energy. Examples of devices used to isolate equipment/systems include, but are not limited to restraint blocks, electrical circuit breakers, disconnect switches, fuses, slip gates, slip blinds, or double valves. Control circuit devices, motor controllers, etc., are not acceptable isolation devices.

2.9 **Locking Device:** A device that utilizes a lock, key, and identification number to hold an energy isolation device in the safe position for the purpose of protecting personnel.

2.10 **Lockout:** The use of a locking device to ensure that an energy-isolating device and the equipment it controls cannot be operated until the lockout device is removed.

2.11 **Lockout/Tagout (LOTO) Specific Procedure:** A written procedure developed specifically for each piece of machinery or equipment capable of unexpectedly releasing energy. This procedure outlines in detail how lockout/tagout will be performed.

2.12 **Normal Production Operations:** The utilization of a machine or piece of equipment to perform its intended production function.

2.13 **Servicing and/or Maintenance:** Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming of machines or equipment, and making adjustments or tool changes where employees could be exposed to the unexpected energization or start-up of the equipment or a release of hazardous energy.

2.14 **Tagout:** The use of a warning device to establish that an energy-isolating device and the equipment it controls may not be operated until the tagout device is removed.

3.0 References

None.

4.0 Procedure

4.1 Regional and District operations managers

4.1.1 Provide LOTO training to employees engaged in projects covered by this procedure

4.1.2 Assure that Project Managers are preparing and implementing LOTO procedures on their projects

4.2 **Project Manager** or **Resident Engineer** on the project is responsible for administering the procedure including:

4.2.1 Determining whether client employees or AECOM employees will be responsible for implementing any required lockout/tagout of energy sources at client facilities

4.2.2 Consulting with the SH&E Department regarding project specific requirements for lockout/tagout

4.2.3 Informing the field team about the client or facility's requirements for lockout

4.2.4 Ensuring that if AECOM is responsible for lockout/tagout, that only authorized employees work on or near equipment requiring hazardous energy control

4.2.5 Assuring that the written LOTO procedure in effect on a project is audited at least annually including the observation of workers performing the procedure

4.3 Supervisors

4.3.1 Assure that all employees under their direction are fully aware of, understand, and adhere to the Lockout/Tagout procedures

4.4 Authorized Employees

4.4.1 Verifying with the Project Manager who is responsible for LOTO at client facilities.

4.4.2 Obtaining a lock, key and tags.

4.4.3 Meeting with the facility representative and affected employees to review the LOTO activities.

4.4.4 Implementing project specific LOTO procedures.

4.5 Affected Employees

4.5.1 Assist Authorized Employees with the safe shutdown and restart of equipment.

4.5.2 Assure that no attempt is made to restart equipment without the knowledge of all employees performing work on the equipment.

4.6 All Employees

4.6.1 Refrain from making any attempt to restart equipment that is locked or tagged out.

4.6.2 Avoid areas where other employees are working on equipment.

4.7 Training

4.7.1 The supervisor must orientate all personnel to the project, the hazards associated with the work to be performed and the Lockout/ Energy Control Procedures to be followed.

4.7.2 Proof of training must be documented on the Project Safety Plan and readily available for review.

4.8 **General Procedures**

4.8.1 Energy control means to neutralize and make inoperable all potential sources of energy or power in the equipment or machinery to be worked on. No part of the equipment should be capable of inadvertent activation or movement, which may lead to personal injury. Removing a fuse, closing a valve or turning a switch is not an acceptable isolation from the energy source.

4.8.2 Only staff orientated to the lockout/energy control procedure will be involved with the locking out, de-energizing and control of all potential sources of energy on energized systems.

4.8.3 Written procedures for lockout and energy control shall be developed and approved by the Site Supervisor or Client and must be implemented prior to performing work.

4.8.4 The site, project or Client specific procedures must be understood and followed for the health and safety of all workers affected by or involved with the locking out, de-energizing and control of all potential sources of energy prior to the performance of work on energized systems.

4.8.5 Be aware of all potential energy sources, such as:

- Chemical
- Hydraulic
- Radiological
- Electrical
- Mechanical
- Residual
- Gravitational
- Pneumatic
- Thermal
- X-ray testing of pipes

4.8.6 It is the responsibility of on-site supervisors to identify through meetings with Client representatives when and where their work requires the isolation and control of an energy source.

4.8.7 The supervisor must also identify and communicate to all on-site personnel how the sources of energy will be isolated, brought to a zero energy state, locked out of service and tested to verify the effectiveness of the controls.

4.8.8 Where the procedures are affected by the facilities or workers of the Client, procedures will follow the requirements of and be approved by the Client.

4.8.9 Padlocks and Danger Tags

- Where there is a danger of equipment being energized, the motor switch on all individual motor drives shall be locked in the open position.
- It shall be the responsibility of each employer to maintain an adequate supply of safety locks.
- Each worker affected shall affix their own individual lock.
- In addition, a danger tag shall also be applied to the lockout bearing: a brief description of the work being done; the company name, the worker's name, the supervisor's name, the date and emergency phone numbers.
- The tag and locks shall remain in place until the work has been completed.
- Where a lock has been abandoned or must be removed due to an emergency, the Site Supervisor or Client contact must be notified and the removal must follow the approved lock abandonment procedure.

4.8.10 LOTO of energy sources must be performed only by an Authorized Employee. If more than one employee is involved, either each individual Authorized Employee must use his/her own lock (multiple lockout), or a group lockout may be performed by the employees' supervisor/foreman.

4.8.11 The locks, tags, and equipment shall not be tampered with by any employee.

4.8.12 Only the person placing the lock and tag the equipment may remove the lock and tag.

4.8.13 If the employee who placed the lockout/tagout device/sign subsequently no longer works for the company, or cannot be located, only the authorized supervisor/foreman can remove the locks and

tags in accordance with the procedure outlined below for Removal of Unattended Lockout/Tagout Devices.

4.9 Authorized Employees

4.9.1 Only employees that have completed training for Lockout/Tagout Authorized Employees will be permitted to perform work under Lockout/Tagout procedures.

4.9.2 Each Authorized Employee will also be responsible for reviewing any applicable equipment-specific Lockout/Tagout procedure prior to initiating work.

4.9.3 Any problems identified with the equipment-specific procedure are to be immediately reported as an incident or near miss and should be brought to the attention of the SH&E Department and all work on affected equipment halted.

4.10 Shift Change Procedures

4.10.1 If ongoing work requires carryover from shift to shift, or transfer of responsibility between employees, the following procedure will be implemented:

- The employee(s) who originally performed the lockout shall walk through the lockout/isolation steps with the new worker.
- At each isolation point the original worker shall remove his/her lockout/tagout device(s), to be immediately replaced by the new worker's device(s).
- Upon transfer of the lockout/tagout equipment, the new employee shall verify that the equipment is still isolated prior to continuation of work.

4.10.2 Under no circumstances shall the original devices remain in place and just the keys transferred.

4.10.3 For supervisor/foreman and/or group lockouts, the same procedure shall be used with the oncoming supervisor/foreman.

4.11 Removal of Unattended Lockout/Tagout devices

4.11.1 Only the person(s) who placed the lockout/tagout devices on the system can remove the devices, unless:

- The Project Manager has verified that the employee is not on site and is not available to return to the site to remove the lock.
- All reasonable efforts have been made to contact the employee to verify that the work is complete and the devices are about to be removed.
- The Project Manager inspects the locked-out/tagged-out device and ensures that the equipment is capable of being safely re-energized.

4.11.2 If all of the above apply, the locks and tags can be removed at the direction of the Project Manager. The Project Manager shall complete an *S3NA-410-FM1 Lock and Tag Removal Form* to document the event prior to removing the lock and file the form with the project records. A copy of the form shall be sent to the SH&E department member with oversight responsibility for the project.

4.11.3 **UNAUTHORIZED REMOVAL OF A LOCKOUT/TAGOUT DEVICE WILL RESULT IN IMMEDIATE DISMISSAL FROM THE PROJECT SITE AND POTENTIAL TERMINATION!**

4.12 Emergency Lock Removing Procedures

4.12.1 This procedure will ONLY be used in an emergency situation defined as an event that may cause injury, fire, explosion, over exposure or other hazards to the general public, the environment or personnel.

4.12.2 In an emergency event that requires a lock or tag to be removed by a person other than the person who placed the lock or tag, the following lock-removing procedure will be implemented by another Authorized Employee:

- Investigate and verify that all equipment and material in relation to the work has been completed and/or put into a safe configuration.
- Ensure all personnel have been removed from the hazardous location and Affected Employees on site are notified.
- Remove lock.
- Attempt to contact the person that originally provided LOTO to advise him that the LOTO has being removed.

- Complete the *S3NA-410-FM3 Emergency Lock Removal Form*. The Emergency Lock Removal Forms will be placed in the project files and send a copy to the SH&E department member with oversight responsibility for the project.
- Whenever a LOTO is removed for emergency purposes by anyone other then the employee who placed the LOTO, that person and all affected personnel must be contacted prior to the start of their next shift to inform them that the equipment/system is no longer locked out/tagged out.

4.13 Specific LOTO Procedures

4.13.1 Written procedures will be developed for the lockout and tagout of each piece of equipment that has potentially hazardous energy sources (*S3NA-410-TP Equipment-Specific LOTO Procedure Template*).

4.13.2 Each procedure must be reviewed and approved by the SH&E Department prior to implementation.

4.13.3 Equipment-specific written lockout/tagout procedures are not required, if ALL of the following conditions are met:

- The equipment's only energy source is electrical; and
- The unexpected start up of the equipment is controlled by unplugging the equipment from the electrical source; and,
- The plug or switch is under the exclusive control of the person performing the work.

4.13.4 Additionally, equipment-specific Lockout/Tagout procedures are not required if ALL of the following apply:

- The machine has no potential for stored or residual energy, or re-accumulation of stored energy after shutdown (i.e. contains a capacitor to store electrical energy or pressurized tank to store air/gas); and,
- The machine has a single energy source that can be readily identified and isolated (if more than one energy source is present (e.g., gas and electric), then written procedures shall be developed); and,
- The isolation and locking out of the single energy source completely de-energizes and deactivates the equipment; and,
- Servicing of the machine requires that its energy source must previously have been locked out and tagged out in accordance with this section; and,
- A single lock-out device achieves a locked-out condition.

4.13.5 Procedure Outline. All equipment-specific Lockout/Tagout procedures will be prepared to meet the following steps:

- Identify type and magnitude of energy.
- Notify affected employees that the machine/equipment will be shut down and locked out for servicing.
- Shut down machine/equipment by normal stopping procedure.
- Identify all energy-isolating device(s) for the machine or equipment being serviced.
- Lock out each device with individual locks. Tag out only if a device is not capable of being locked out.
- Relieve or restrain stored and/or residual energy.
- Verify the isolation of equipment and its zero energy state (attempt to restart the equipment.)
- Establish that energy to the equipment being worked on was isolated.
- Complete *S3NA-410-FM2 LOTO Verification Checklist LOTO Verification Checklist.*
- Perform work.
- Check work area to remove non-essential items and ensure equipment components are intact.
- Check work area to ensure all personnel are removed from the area.
- Verify that the controls are in neutral (off).
- Remove lockout device(s).
- Notify affected employees that the machine/equipment is ready for use.
- Reenergize the machine or equipment.

4.14 Non-Specific LOTO Procedures

In the absence of an equipment-specific LOTO procedure, the following procedures, in combination with a completed Task Hazard Analysis (or Job Safety Analysis), can be used as an acceptable substitute.

4.14.1 Process Equipment

- Determine what energy sources are present, such as electrical, gas, pressurized systems (e.g., steam, water, and hydraulics), heated fluids or gas (e.g., steam, hot water), and gravity (e.g., presses, elevated vehicles).
- Determine which of these sources requires isolation to perform the work.
- Determine the locations where each energy source for that piece of equipment can be turned off/isolated AND be locked out. For example, if a machine has an on/off button, pushing the button to the off position is not sufficient isolation, since the button cannot be locked out. You must then either unplug the equipment or find, close, and lock out the circuit breaker or electrical switch supplying the machine.
- Make sure anyone in the area knows you are about to turn off and lock out the equipment, and then close the isolation devices. Once closed, lock out the isolation devices so they cannot be inadvertently opened.
- Place an appropriate tag on each lock out device, with the appropriate warning (e.g., Do Not Open, Do Not Start) with date and time of isolation and a means of identifying who has performed the lockout.
- Once everything is locked out, verify that the isolation was successful by following manufacturers' directions or standard trade practice. Means of determining whether isolation was successful include:
  - Try to turn the equipment on.
  - Use pressure relief valves.
  - Try to ignite the pilot light.
- Complete the *S3NA-410-FM2 LOTO Verification Checklist LOTO Verification Checklist*
- Perform the necessary work.
- Ensure all tools and parts are removed from the work area.
- Remove the tags and locks used to isolate the various energy sources.
- Open up each isolation source. For fluid or gas systems, check for leaks at the area the work was performed as necessary.
- Inform personnel in the area that the lockout/tagout systems have been removed.
- If additional work is required (e.g., repair of leak, fine tuning of work), the lockout/tagout procedure must be re-established. Under no circumstances shall work be performed on the equipment without prior isolation of the energy sources.

4.14.2 High Voltage Electrical Systems

In general, AECOM personnel will provide lockout/tagout services in low voltage situations only (voltage is below 600 volts) For high voltage situations (above 600 volts), AECOM will either subcontract operations to an electrical subcontractor or obtain approval of the equipment-specific Lockout/Tagout procedure from the Group SH&E Manager and the Regional Manager. If an electrical subcontractor is utilized, they will be required to provide documentation of their high voltage certification.

4.14.3 Low Voltage Procedure

- Make sure the equipment to be worked on is turned off.
- Locate the source of the electrical supply and isolate the equipment. This can be accomplished by:
  - Turning the appropriate circuit breaker off.
  - Unplugging the equipment.
  - Disconnecting the source from the battery (e.g., pulling cables from automotive batteries).
- Lock the isolation circuit in the closed position using an appropriate locking device and a unique lock and key system.

- Tag the locked-out circuit. The tag used shall warn against the hazard (e.g., Do Not Start), and include a means of identifying the employee who installed the tag and lock.
- Go back to the equipment and try to turn it on to ensure that the proper source has been isolated. If the machine turns on, reverse the above steps (b-d), and start again until the proper circuit is isolated. Report the incident to site safety coordinator as a serious near miss and do not perform the task until proper isolation is performed and verified. The site (project) manager is responsible for developing the written procedure for LOTO of this equipment prior to authorizing re-work on it.
- Complete the LOTO Verification Checklist.
- Perform the required work.
- Upon completion of the work, inspect the area to ensure all tools and parts are removed. If tools or parts are noticed after the energy source is no longer locked out, steps (a-e) MUST be performed again prior to retrieval of the tools/parts. Under no circumstances shall the items be retrieved without the equipment being locked out.
- Inform anyone in the area that work has been completed and equipment is being energized.
- Remove the tag and lock.
- Turn on the closed circuit following the appropriate procedures (or reconnect the battery cables).
- Turn the equipment on to verify operation.

4.14.4 Pressurized Water or Air/Gas

- Turn the appropriate valve upstream from the area of work to the off position (closed). Note: if steam or water can enter the pipe from the normal downstream side, either verify that the check valve is operating properly, or ensure that all necessary valves have been closed to stop all fluid or steam flow into the section to be worked. If this procedure is being used in preparation of Confined Space Entry, positive isolation (i.e. line break, blind plate, or double-block and bleed) must be established on both sides prior to authorizing confined space entry.
- Using the appropriate device, lock the valve(s) in the closed position using a unique lock and key.
- Tag the locked-out valve(s). The tag shall warn against the hazard (Do Not Open) and include date and time of isolation and a means of identifying the employee who installed the lock and tag.
- Allow the system to be worked to cool down (in the case of steam or hot water).
- Relieve the pressure in the system and then drain any fluid from the system. If the system is not equipped with a pressure relief or drain system, make sure the pipes are cool to the touch and slowly open and drain in accordance with standard trade practice.
- Once the system has been bled to atmospheric pressure, the pipes or lines shall be disconnected, blinded, or closed by a valve and locked out and/or tagged accordingly. Observe line entry procedures when first opening the line.
- Complete the *S3NA-410-FM2 LOTO Verification Checklist.*
- Perform the necessary work.
- Ensure all sections are secure and closed.
- Remove the tag and lock.
- Slowly open the valve, stopping when water or steam flow has started. Observe the work performed to make sure no leaks are evident. If there are no leaks, then the valve can be completely opened. If leaks are observed, then re-close the valve, and follow steps 2-5 above to reapply the LOTO to the system.

4.14.5 Natural Gas Lines

- Turn off the valve upstream from the area to be worked.
- Using the appropriate device, lock the valve in the closed position using a unique lock and key.
- Ensure all spark sources in the area have been isolated or removed.
- Using non-sparking tools, remove the remaining gas in the line using standard trade practice. If in an enclosed area, make sure appropriate ventilation is present. If the flow of gas does not stop, then shut down the next upstream valve, or the gas main valve. Each additional valve closed must be locked out and tagged out.
- Complete the *S3NA-410-FM2 LOTO Verification Checklist.*

- Perform the required work. If hot work is necessary (i.e. soldering, grinding, welding), make sure the line has been purged of gas and that the hot work requirements of this manual are followed, including explosivity check prior to authorizing work.
- Make sure that all connections are secure. Also, have a solution of soap and water for leak testing.
- Remove all tools and parts from the area.
- Remove the lock(s) and tag(s) from the valve(s).
- Slowly crack open the valve(s).
- Test the work area for leaks using the soap solution. If leaks are detected, the system must be locked out and tagged out following steps 1-4 above before additional repairs can be made.
- If no leaks are detected, gradually open the isolation values to their normal position.

4.15 Annual Program Review

4.15.1 At least annually (or whenever any incident or serious near miss occurs due to inadequate lockout/tagout) , an independent Authorized Employee who is not involved in the procedure being inspected must conduct and document a review and inspection of the Energy Control Program specific to the identified facility. The inspection should include a meeting with authorized employees and any other affected employees.

4.15.2 The inspection procedure must include the following elements.

- Where lockout is used, discuss the authorized employee's responsibilities under the lockout/tagout program with the inspector.
- Hold group meetings with the authorized employees who are performing the inspection and all authorized employees who implement the procedure.
- Where tagout is used, discuss the authorized employee's responsibilities under the lockout/tagout program and the limitations of the tagout system.
- Review of lockout/tagout verification checklists and other documentation to ensure procedure is being correctly followed and documented.
- If deficiencies are noted during the inspection, corrective actions and retraining of employees, as necessary, must be performed immediately.
- The inspector shall provide a copy of all inspection documentation to the applicable AECOM Manager for review and filing.

These inspections shall at least provide for a demonstration of the procedures and may be implemented through random audits and planned visual observations. These inspections are intended to ensure that the energy control procedures are being properly and consistently implemented.

4.16 Training

4.16.1 Authorized Employees

Authorized Employees involved in or affected by lock out and their Supervisors and Project Managers will be trained in the following areas before being allowed to work on equipment requiring LOTO:

- Recognition of hazardous energy sources;
- Types and magnitudes of energy sources located in the workplace;
- Procedures for energy isolation and control, including specific procedures developed for specific equipment and systems;
- Purpose and use of the energy-control (lock out/tag out) procedure, equipment, and devices;
- Prohibitions and penalties for attempting to restart or re-energize equipment which has been locked out/tagged out, or to work on equipment without following the lock out/tag out procedures.

Authorized Employees are limited to those departmental supervisors and managers, and those selected employees who have successfully completed all of the required training listed above.

4.16.2 Affected Employees

Affected Employees will be trained in the purpose and use of the lock out/tag out procedure. All employees whose work operations may be in an area where lock out/tag out procedures may be utilized will be trained about the procedure and about the prohibition relating to attempts to restart or reenergize machines or equipment that are locked out/tagged out. These personnel are not required to be familiar with specific procedures for equipment and systems.

4.16.3 Retraining

Retraining or refresher training for Authorized and/or Affected employees will be conducted annually or whenever one of the following exists:

- The employee has a change in job assignment;
- There has been a change in the equipment or process;
- There has been a change in the energy-control procedure;
- An inspection reveals deviations from the standard procedures or inadequacies in the employee's knowledge or use of the lock out/tag out procedure;
- An incident occurs as a result of unexpected energy release.

4.16.4 Training Documentation

All employee training, including refresher training, will be documented in accordance with *S3NA-003-PR SH&E Training*. Employee training records will include type of training, date, and employee name. These records will be maintained for each employee for the duration of their employment.

Each office and project site shall maintain a current list of personnel trained in accordance with Authorized and Affected employees above.

5.0 Records

None.

6.0 Attachments

6.1 S3NA-410-FM1 Lock and Tag Removal Form

6.2 S3NA-410-FM2 LOTO Verification Checklist

6.3 S3NA-410-FM3 Emergency Lock Removal Form

6.4 S3NA-410-TP Equipment-Specific LOTO Procedure Template

6.5 S3NA-410-ST Hazardous Energy Control

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S3NA-417-PR Utilities, Underground

1.0 Purpose and Scope

1.1 Establishes requirements to ensure that underground installations are identified properly before excavation work commences.

1.2 This procedure applies to all AECOM North America-based employees and operations.

2.0 Terms and Definitions

2.1 **Underground Utilities:** All utility systems located beneath grade level, including, but not limited to, gas, electrical, water, compressed air, sewage, signaling and communications, etc.

2.2 **Ground Disturbance (GD):** Any indentation, interruption, intrusion, excavation, construction, or other activity in the earth's surface as a result of work that results in the penetration of the ground.

3.0 References

3.1 American Public Works Association, Excavator's Damage Prevention Guide and One-Call System Directory International 1990-1991, Utility Location and Coordination Committee.

4.0 Procedure

4.1 Ground disturbance may be a conducted for a variety of purposes, including, but not limited to, exposing existing buried lines, soil sampling, remedial excavations, or installing monitoring wells or test pits.

4.2 Improper ground disturbance may impact a buried pipeline or utility line and cause a major release of a hazardous substance, flood, or electrocution. Serious injuries and significant property damage have resulted from insufficient/inadequate identification of underground installations during the course of ground disturbance work.

4.3 To control hazards associated with coming in contact with such installations, the American Public Works Association's (APWA) guidelines for the uniform identification of underground installations has been adopted.

4.4 **Project Managers** are responsible for ensuring that all work, including the identification, location, and access to all underground utilities, is planned and performed in accordance with contract specifications and safety requirements.

4.4.1 The planning for associated work and avoidance of contacting underground utilities shall be part of the project safety planning in the HASP.

4.5 The **Lead Site Manager or Supervisor** is responsible for the execution of work in accordance with this and other associated AECOM SOPs, including:

- The review of the HASP.
- Verification that all steps have been taken to identify existing underground utilities in the area to be disturbed.

4.6 **Regional SH&E Manager** provides guidance as needed.

4.7 **Personal Protective Equipment**

- Long sleeved shirt and pants (coveralls/Nomex LILA for upstream oil and gas)
- Safety toe boots
- Hard hat
- High-visibility clothing
- Gloves
- Respirator with organic vapor/particulate filter cartridge (for use when the exposure exceeds the occupational exposure limit stated on the MSDS), as required
- Hydrogen Sulfide (H2S) Monitor (for areas with known or suspected H2S

4.8 Training

4.8.1 Staff shall successfully complete a Ground Disturbance training course.

4.8.2 Some clients may also have required client-based Ground Disturbance training.

4.9 Underground Utility Lines

4.9.1 To avoid injury from electrical and other utilities on site, utility lines shall be located and marked prior to conducting any drilling or digging on site. If available, refer to site drawings or client interviews for information pertaining to utilities on site.

4.9.2 Types of underground lines:

- Gas line
- Potable water line
- Raw water line
- Sewer line
- Power line
- Cable television/communication line
- Cathodic protection lines
- Grounding cable
- Process piping/flow line

4.9.3 Prior to conducting the ground disturbance, you shall locate all pipelines and utilities that pass within (30 m) of the work area. This is your search and control area. To do so, you need to do the following:

- Notify all pipeline and utility companies, and confirm that their notification requirements are fulfilled prior to conducting a ground disturbance.
- Identify pipelines, power lines, utilities, and irrigation canals in a 30-foot (9.1 m) zone of the work area with the owner of the utility.
- On private property, a properly trained and competent third party utility locator shall be used.
- Get approval for work within a right-of-way (ROW) or within 15 feet (4.6 m) of a line if there is no ROW.
- Prepare a site map identifying the search area, the ground disturbance area, and known underground utilities.
- Confirm that all pipelines, power lines, and utilities are marked.

4.9.4 Look for pipeline indicators:

- Look for warning signs where pipelines cross roads or water courses.
- Look for cut lines, wells, tanks, or valves that may indicate the presence of pipelines.
- Look for ground settling from previous work.
- Talk to nearby landowners and residents.
- Look for vegetation appearing "different" from the surrounding vegetation (e.g., greener, taller, shorter, or more brown than surrounding vegetation).

4.9.5 When you are working within a pipeline right-of-way, you shall get written approval from the pipeline owner prior to doing your work.

4.9.6 Call the pipeline owner at least two full working days before you dig so the pipeline can be located and marked.

4.9.7 Expose the pipeline by hand/hydrovac before digging within 15 feet (4.6 m) of the pipeline with machinery (no machinery comes may come within 2 feet [60 cm] of the pipeline) with the supervision of the owner or their representative, and call the owner at least one full day before you cover the exposed line.

4.9.8 During ground disturbance:

- All underground utilities shall be hand exposed or hydrovac'd within 3.3 feet (1 m) of a mark out or within the distance required by the owner of the utility before operating any mechanized equipment.
- Make arrangements for supervision ("a Signal Person") during hand exposure.

- If for any reason these hand excavations are temporarily filled in, mark them.
- Make arrangements for supervision ("a Signal Person") during any mechanical excavation within 5 m of the underground utility.
- Make arrangements for supervision ("a Signal Person") during backfilling of utilities.
- Cutting back and shoring of excavations shall be completed to ensure that there are no cave-ins (follow *SOP S3NA-303-PR Excavation and Trenching*).
- Do not damage utilities by shovels when hand exposing and picks should not be used.
- Remember that all workers have the right and responsibility to refuse to carry out any work or procedures that they feel are unsafe.
- If the ground disturbance is deeper than 3.3 feet (1 m), all crew members shall have appropriate training for excavations and trenches and shall be protected from cave-ins or sliding/rolling materials (follow *SOP S3NA-303-PR Excavation and Trenching*).
- Remember that incidents, injuries, and near misses shall be reported immediately.
- Review the site-specific emergency response plan.

4.9.9 If you hit an underground facility, stop the work immediately and notify the owner of the facility.

- The owner shall be informed of the location of the contact and the type of damage that resulted.
- If the facility is a pipeline, the company (client) shall immediately notify the required agencies and regulatory bodies of the location of the contact and the type of damage that resulted.
- The government agencies will require a written record and the company (client) should conduct an incident investigation into the causes and make recommendations for the future prevention of this incident.

4.10 Identification of Installations

4.10.1 Various forms of underground utility lines or pipes may be encountered during AECOM deployments to field sites. Damaged utilities, in particular, can present other hazards including asbestos, explosion, electric shock, scalding, etc., and they shall be avoided. The presence of damaged utilities at any work location shall be immediately brought to the attention of the field Lead Manager or other member of the AECOM site management team.

4.10.2 Guidance will be provided on the appropriate action to be taken, which could include suspension of work until the responsible utility agency is contacted and the hazard is either isolated or eliminated.

4.10.3 Extreme caution shall always be exercised when attempting to locate underground utilities. The location of utilities can be in some cases not consistent as shown on drawings, as indicated by the placement of surface signage, or as described by personnel. Coordination and planning of the job shall be required with the client or owner.

- Prior to digging and drilling operations, the client shall always be informed of the potential location(s) of underground utility systems.
- If a utility permit is required from the client or owner, it shall be secured.
- The client shall explain how the utility line may be identified—e.g., red concrete encasement.
- All underground installations shall be considered "live" and "operational" until the owner, client, or utility authority isolates any hazardous energy or deactivates the system and can demonstrate that condition.
- Where a line placement and depth is known or suspected and where there is potential for contact, hand digging, or hand auguring, instrumentation and other investigative techniques shall be used.

4.10.4 The One Call System Definition and Directory or its equivalent shall be used to prepare for excavation work in the event the identity of an underground installation(s) is unknown.

4.10.5 Line location documentation (or appropriate regional agency or company) provides a listing of companies that have registered buried facilities in the proposed work area. Some public utilities and private companies are not members of the One Call System. In order to give line operators sufficient time to respond to a request to locate, a minimum waiting period of 72 business hours is required prior to beginning work.

4.10.6 Once the underground installation has been identified, proper surface markings shall be made in accordance with the guidelines contained in this SOP or as contract-specified.

4.11 Surface Markings

4.11.1 Color-coded surface marks (paints or similar coatings) shall be used to indicate the type, location, and route of buried installations. Additionally, to increase visibility, color-coded vertical markers (temporary stakes or flags) shall supplement surface marks.

4.11.2 All marks and markers shall indicate the name, initials, or logo of the company that owns or operates the installation and the width of the installation if it is greater than two inches.

4.11.3 If the surface over the buried installation is to be removed, supplemental offset marking shall be used. Offset markings shall be on a uniform alignment and shall clearly indicate that the actual installation is a specific distance away.

4.12 Uniform Color-Coding

4.12.1 The colors and corresponding installation type are as follows unless otherwise contract-specified.

4.12.2 Red: Electric Power Lines, Cables Conduit, and Lighting Cables

4.12.3 Yellow : Gas, Oil, Stream, Petroleum, or Gaseous Materials

4.12.4 Orange :Communication, Alarm or Signal Lines, Cables, or Conduit

4.12.5 Green: Sewers and Drain Lines

4.12.6 White : Proposed Ground Disturbance area

4.12.7 Pink: Temporary Survey Markings

4.12.8 Purple: Nonpotable Water

5.0 Records

5.1 The following records on the identification of and response to underground utilities will be maintained in the project files:

5.1.1 All information regarding the identification of underground installations (this information can also be transferred to the appropriate drawings and/or prints and shall be available on site).

5.1.2 Drawings and/or prints shall be maintained for the life of this project.

5.1.3 Identifying Underground Installations Checklist.

6.0 Attachments

6.1 S3NA-417-FM Identifying Underground Installations Checklist

6.2 S3NA-417-WI One Call System Definition and Directory

6.3 S3NA-417-ST Undergrourc Utilities

S3NA-509-PR Hazardous Waste Operations and Emergency Response Activities

1.0 Purpose and Scope

1.1 Provides requirements for AECOM operations pertaining to hazardous waste and emergency response (HAZWOPER) services.

1.2 This procedure applies to all AECOM North America-based employees and operations.

1.3 In Canada there is no direct federal or provincial counterpart to HAZWOPER; however, as due diligence and in compliance with applicable provincial duty of care/general duty clauses, staff working in Canada will comply with this procedure.

2.0 Terms and Definitions

2.1 **Emergency Response**: A response effort by employees from outside the immediate release area or by other designated responders (i.e., mutual-aid groups, local fire departments, etc.) to an occurrence that results, or is likely to result, in an uncontrollable release of a hazardous substance. Responses to incidental release of hazardous substances where the substance can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area or by maintenance personnel are not considered to be emergency responses within the scope of the HAZWOPER standard. Responses to releases of hazardous substances where there is no potential safety or health hazard are not considered to be emergency responses.

2.2 **Health and Safety Plan**: A document prepared for each project that contains site-specific information including the Emergency Response Plan for the project.

2.3 **Incident Command System (ICS)**: ICS is a standardized on-scene incident management concept designed specifically to allow responders to adopt an integrated organizational structure equal to the complexity and demands of any single incident or multiple incidents without being hindered by jurisdictional boundaries. In the ICS the first person responding to an incident becomes the Incident Commander and turns that title and duties over to more qualified responders as they arrive on scene.

2.4 **First Responder**: First responders are individuals who are likely to witness or discover a hazardous substance release, injury, fire, or other incident and who have been trained to initiate an emergency response sequence by notifying the proper authorities of the release. They would take no further action beyond first aid, initial control of the incident, and notifying the authorities and others of the incident.

2.5 **Hazardous Materials Specialist**: Hazardous materials specialists are individuals who respond with and provide support to hazardous materials technicians. Their duties parallel those of the hazardous materials technician; however, those duties require a more directed or specific knowledge of the various substances they may be called upon to contain. The hazardous materials specialist would also act as the site liaison with federal, state, local, and other government authorities in regards to site activities.

2.6 **Hazardous Materials Technician**: Hazardous materials technicians are individuals who respond to releases or potential releases for the purpose of stopping the release. They assume a more aggressive role than a first responder in that they will approach the point of release in order to plug, patch, or otherwise stop the release of a hazardous substance.

2.7 **Incident Commander**: The Incident Commander (IC) is responsible for all aspects of the response, including developing incident objectives and managing all incident operations. The title and responsibilities are typically assumed by a qualified IC from the client or public sector.

2.8 **Hazardous Waste**: Hazardous waste is waste that is dangerous or potentially harmful to our health or the environment. Hazardous wastes can be liquids, solids, gases, or sludges. They can be discarded commercial products, like cleaning fluids or pesticides, or the byproducts of manufacturing processes. Hazardous waste are divided into Listed wastes, Characteristic wastes, Universal wastes,

and mixed wastes. Specific procedures determine how waste is identified, classified, listed, and delisted.

2.9 **Hazardous Materials:** A hazardous material is any item or agent (biological, chemical, physical) that has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors. Additionally a hazardous material may be defined as any substance or chemical which is a "health hazard" or "physical hazard," including chemicals that are carcinogens, toxic agents, irritants, corrosives, sensitizers; agents that act on the hematopoietic system; agents that damage the lungs, skin, eyes, or mucous membranes; chemicals that are combustible, explosive, flammable, oxidizers, pyrophorics, unstable-reactive, or water-reactive; and chemicals that in the course of normal handling, use, or storage may produce or release dusts, gases, fumes, vapors, mists, or smoke that may have any of the previously mentioned characteristics. This may be caused when released by spilling, leaking, pumping, pouring, emitting, emptying discharging, injecting, escaping, leaching, dumping disposing into the environment, by being transported or moved, and items or chemicals that are "special nuclear source" or byproduct materials or radioactive substances.

3.0 References

3.1 Federal Emergency Management Agency—FEMA: Incident Command System

3.2 29 CFCR 1910.120, Hazardous Waste Operations and Emergency Response

3.3 29 CFR 1910.38, Emergency Action Plans

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Regional Operations Managers** and **District Managers** shall be responsible for the following:

- Provide support to the implementation of Health and Safety Plans and Emergency Action Plans.

4.1.2 **Project managers** shall be responsible for the following:

- Prepare or request a HASP for every AECOM project.
- Verify that all personnel working on the project are qualified.
- Request client's emergency response procedures.
- Appoint a Site Safety Officer (SSO) for each project.
- Communicate the site-specific emergency response details to all employees assigned to a field project.
- Confirm that the necessary communications equipment for the project is available.
- Confirm that an accident/incident investigation is performed and a report is filed.

4.1.3 **Regional SH&E managers** shall be responsible for the following:

- Provide technical guidance for the development and implementation of Health and Safety Plans and Emergency Action Plans.
- Prepare emergency action plans as part of project HASPs and emergency reference sheets.
- Interface with the local emergency responders when necessary.
- Interface with clients regarding facility emergency response procedures.

4.1.4 **Site Safety Officer** is responsible for the following:

- Verify that a HASP is available for the project.
- Communicate the site-specific emergency response details to all employees assigned to a field project.
- Stop work and initiate emergency response procedures as required.
- Account for all AECOM and subcontractor employees after site evacuation.

- Conduct pre-entry briefing and daily tailgate meetings and review facility and site-specific emergency procedures.
- Brief on-site and off-site responders in the event of an emergency.

4.1.5 **Employees**

- Maintain HAZWOPER training.
- Follow the HASP and emergency procedures prepared for the project.
- Initiate emergency response via verbal communications or the alarm system if first to encounter the emergency.

4.1.6 All personnel (e.g., AECOM employees, general laborers, equipment operators, chemists, supervisors, etc.) performing activities at hazardous waste sites that expose or potentially expose them to hazardous wastes and health hazards are considered HAZWOPER site workers and must meet the training and medical surveillance requirements specified in 29 CFR 1910.120(e) and (f), respectively. Additional training may be required based on site activities including related exposures and risks (e.g., confined space entry, excavations, fall protection, other materials [lead], etc.). These additional training requirements are to be outlined in the project- or site-specific health and safety plan (HASP).

4.2 Personnel Qualifications—Medical Surveillance and Training

4.2.1 HAZWOPER-qualified employees will participate in the following medical surveillance and training requirements.

4.2.2 Medical Surveillance

- Specific HAZWOPER medical examination protocols have been developed by AECOM's Corporate Medical Provider (CMP) to meet the requirements of 29 CFR 1910.120(f). To be medically qualified to perform HAZWOPER work, employees receive the following medical examinations:
  - Initial (Baseline) Examination—The initial examination is part of pre-employment requirements and must be completed (with results received) prior to the employee's start of work date.
  - Annual Examination—HAZWOPER-qualified employees will complete a medical examination once each year. Medical qualification expires on the anniversary date of the last examination completed. There will be no "grace period" exemptions beyond this date without the express approval of the Regional SH&E Manager. At the recommendation of the SH&E Department, the CMP may approve an alternate examination frequency at periods of up to two years (biennial) in cases in which the worker's exposures to environmental contaminants are infrequent and typically well below any occupational exposure limits (e.g., senior management personnel).
  - Termination Examination—When reassigned to non-HAZWOPER duties, or at the conclusion of employment at AECOM, HAZWOPER-qualified personnel will be provided with the opportunity to receive a termination medical examination.
  - Special Examinations—The SH&E Department and the CMP will jointly determine the need for special examinations because of
    - Unusual exposure conditions.
    - In response to possible overexposures.
- The CMP will determine the medical protocol elements for each of these examinations based on exposure information provided by the SH&E Department. The CMP will evaluate the results of each employee's examination and will provide a written statement of medical clearance clearly stating medical compliance with the HAZWOPER regulatory standard (29 CFR 1910.120(f)) and approval of the employee to perform unrestricted HAZWOPER activities. for initial and annual examinations, the CMP will also evaluate the employee for the use of air purifying and supplied air respiratory protection. The written evaluation from these examinations will indicate the CMP's approval/limitations on the employee's use of respiratory protection.

4.2.3 AECOM Training

- All personnel assigned to work at a hazardous waste site must participate in training meeting the requirements of 29 CFR 1910.120(e).
- Initial 40-Hour Training—Before being assigned to a HAZWOPER site, AECOM employees must complete 40 hours of off-site training meeting the requirements of 29 CFR 1910.120(e)(3)(i). At the conclusion of training, personnel will receive a written certification of course completion, signed by the instructor, that indicates the course of instruction (40-hour HAZWOPER) and training dates. A copy of this certification must be provided to the employee's SH&E Coordinator. Employees are responsible for maintaining their own copy of this certificate and for presenting it to the site supervisor when working on any HAZWOPER site.
- In addition to the initial 40-hour training, the employee must receive three days of actual supervision by a trained experienced supervisor.
    - Available Training Sources:
        - On-site training provided by the SH&E Department.
        - Outsourced training providers approved by the SH&E Department.
- Refresher 8-Hour Training—To remain qualified to perform on-site HAZWOPER work activities, each AECOM employee will complete 8 hours of HAZWOPER refresher training meeting the requirements of 29 CFR 1910.120(e)(8) at yearly intervals following completion of Initial 40-hour training. At the conclusion of training, personnel will receive a written certification of course completion, signed by the instructor, that indicates the course of instruction (8-hour HAZWOPER Refresher) and the training date. A copy of this certification must be provided to the employee's SH&E Coordinator. Employees are responsible for maintaining their own copy of this certificate and for presenting it to the site supervisor when working on any HAZWOPER site.
    - Available Training Sources:
        - Internet-based training approved by SH&E Department
        - On-site training provided by the SH&E Department
        - Outsourced training providers approved by the SH&E Department
- Supervisor 8-Hour Training—Any AECOM employee acting in a management capacity for HAZWOPER activities (e.g., project management personnel, field managers/foremen, site safety officers, etc.) must complete an additional 8 hours of HAZWOPER Supervisor training meeting the requirements of 29 CFR 1910.120(e)(4). Although this training is required only once, supervisors must maintain their overall HAZWOPER qualification through annual completion of refresher training. At the conclusion of Supervisor 8-Hour Training personnel will receive a written certification of course completion, signed by the instructor, that indicates the course of instruction and the training date. A copy of this certification must be provided to the employee's SH&E coordinator. Employees are responsible for maintaining their own copy of this certificate and for presenting it to the senior site supervisor when working on any HAZWOPER site.
    - Available Training Sources:
        - On-site training provided by the SH&E Department
        - Outsourced training providers approved by the SH&E Department
- 24-Hour HAZWOPER Training—Site support contractors and site visitors may qualify to substitute 24-hour HAZWOPER training in place of 40-hour training, as specified in 29 CFR 1910.120(e)(3)(ii). Personnel potentially qualifying for this alternative training include:
    - Site support personnel who will not work in any Exclusion Zone areas.
- Subcontractors and site visitors whose duties will not entail significant exposure to site contaminants defined as not working in any areas where airborne contaminant concentrations exceed one-half of any applicable occupational exposure limit, and no contact or exposure to materials with site contaminant concentrations exceeding natural background levels.The Regional SH&E Manager or SH&E department designee must approve the substitution of 24-hour training for initial 40-hour training. Persons qualifying for

24-hour training must provide written certification of course completion prior to beginning work on site. Persons completing 24-hour training must complete 8 hours of annual refresher training at the required interval to maintain eligibility for on-site work and must provide proof of this training (as necessary to demonstrate retraining) prior to beginning work on site.

4.2.4 Subcontractor Personnel

Any subcontractor organization whose employees will support AECOM operations at a HAZWOPER site will:

- Provide the AECOM Project Manager with a copy of their written HAZWOPER medical surveillance and training program requirements. The elements of the program(s) must be similar to those for AECOM's own program, as detailed above.
- Provide the Project Manager with written certification of a physician's approved medical clearance for each employee who will work on the site. Certification can be demonstrated by:
  - A copy of the physician's signed medical clearance for each employee (preferred), or
  - A letter identifying the medical status and clearance expiration date of every employee, signed by the company's safety director or an officer of the company.
  - A copy of the each employee's training certifications, which will include:
    - The initial 40-hour training certificate (24-hour training may be substituted with SH&E department approval).
    - The most current Refresher training certificate (must be current within the previous one-year period).
    - A copy of the Supervisor training certificate for each person serving in a site supervisory capacity (e.g., field managers/foremen, site safety officers, etc.).

4.3 Project SH&E Documentation—Health and Safety Plans

4.3.1 The project SH&E documentation prepared for HAZWOPER activities is referred to as a site-specific Health and Safety Plan (HASP), and must meet the requirements presented in 29 CFR 1910.120(b)(4).

4.3.2 The required plan elements include:

- A description of the work location, the site history, and a summary of any information available concerning site hazards (including both physical hazards and contamination conditions).
- A summary of the work activities to be performed under AECOM's scope of activities.
- A safety and health risk or hazard analysis for each on-site task that will be performed. Identified risks must include both chemical and physical hazards to which personnel may be exposed during the conduct of the work task.
- Protective measures for each work task to prevent or mitigate the potential hazards identified in the hazard analyses.
- Personal protective equipment (PPE) requirements for each work task.
- Frequency and types of air monitoring, personal monitoring, and environmental sampling techniques and instrumentation to be used.
- Site control measures.
- Decontamination procedures.
- An emergency response plan, *S3NA-509-FM4 Emergency Information and Hazard Assessment*, addressing actions to be taken in the event of each type of credible incident that might result during the performance of planned work activities, including minor and major injuries, and chemical release and fire. Response plans must address the means for coordinating the evacuation of all on-site personnel in the event of a catastrophic incident.

4.3.3 Responsibility for development of each AECOM HASP will be coordinated between the **Project Manager** and the **Regional SH&E Manager** or SH&E Department designee as part of project

initiation. Regardless of where the HASP is developed, it will be reviewed and approved by the SH&E Department prior to submission to any agency outside of AECOM.

4.4 Contractors and Subcontractors

4.4.1 The health and safety of any contractor's or subcontractor's employees is solely the responsibility of that contractor or subcontractor, who shall evaluate the hazards and potential hazards to their own employees and shall adhere to their own Health and Safety Plan.

4.4.2 In addition, all AECOM subcontractors' Health and Safety Plans will, at a minimum conform to the requirements of the AECOM Health and Safety Plan. The AECOM Health and Safety Plan does not, nor is it intended to, address procedures of contractors or subcontractors during their site activities.

4.5 Field Emergency Response Plans

4.5.1 AECOM employees are not expected to take action or to participate in rescues or responses to chemical releases beyond the initial discovery of the release and immediate mitigation actions such as closing a valve, placing absorbents, and notifying the client and or public emergency response system (911.) If AECOM employees are to participate in the response to a chemical release beyond the initial reaction, there must be a contractual provision for this response and the employees must be specifically trained for this response. This document is designed to provide guidelines on how to prepare a written plan that will ensure prompt and proper response to an emergency situation that arises during field investigations and to outline the duties of AECOM employees during a field emergency and the associated training requirements.

4.5.2 Site specific health and safety plans that are prepared to comply with the HAZWOPER standard (29 CFR 1910.120) must address emergency response. This standard specifically outlines the elements that must be contained in an emergency response plan. However, the definition of emergency response, as written in 29 CFR 1910.120, focuses on emergencies involving the uncontrolled release of hazardous substances. Under 29 CFR 1910.120, an employer can opt to evacuate employees from the danger area when such an emergency occurs. AECOM does not expect its employees to actively assist in the handling of uncontrollable chemical releases that may occur during the implementation of field programs. As such, and as provided by the HAZWOPER standard, AECOM is exempt from the emergency response plan requirements of the standard as long as it provides an emergency action plan within the HASP that complies with 29 CFR 1910.38 (a). Therefore, all emergency response plans required under 29 CFR 1910.120 will be written to comply with 29 CFR 1910.38 (a).

4.5.3 The HAZWOPER standard does not prohibit AECOM employees from performing limited response activities. AECOM employees can provide response assistance by placing absorbent pillows or vermiculite around a small, contained spill that occurs during sampling efforts. AECOM's SH&E SOP 203—*Spill Containment Program*, describes the specific procedures that AECOM will follow when responding to an incidental chemical spill.

4.5.4 Field Project Preparation

- Every HASP that is prepared by AECOM will contain an emergency response section in which the required elements of an emergency action plan will be contained. For all projects that do not require a HASP an emergency reference sheet will be prepared; minimally, the sheet will list the telephone numbers of the local emergency responders and the local hospital and provides directions to the local hospital. When AECOM is working at an operating facility, the emergency response procedures of the facility will be appended to the HASP or the emergency reference sheet.
- There are two types of emergency situations that AECOM personnel must be prepared for and that must be addressed in the emergency action plan. These include:
  - Emergencies related to the operations of our clients at the facility where AECOM is working.
  - Emergencies related to our own on-site activities/investigations.
- AECOM employees are typically not expected to take action or participate in responses to chemical releases beyond the initial discovery of the release and immediate mitigation actions such as closing a valve, placing absorbents, and notifying the client and or public emergency response system (911.)
- AECOM employees are not to accept the role of Incident Commander without specific authority from the Regional SH&E Manager and the General Operations Manager

responsible for the project. Assuming the role of the Incident Commander requires training beyond the scope of this Procedure.

4.5.5 Client Facility Emergency Response Procedures

- AECOM implements field programs on active properties, including manufacturing facilities. These facilities have typically developed an emergency response plan that is specific to facility-related emergencies. If AECOM is working at an operating facility, emergency procedures established by the facility must be followed in the event of a facility catastrophe. AECOM personnel must be aware of and familiar with the alarm signals used at the facility to alert personnel to an emergency. AECOM personnel must also know where to assemble in the event of a facility evacuation as the facility must be able to account for all personnel, including subcontractors such as AECOM in the event of an evacuation.
- The first priority in AECOM's preparation of a project emergency action plan is to ensure that the responsibilities under the client's emergency response plan are fully understood. Because of the nature of their business, many of our clients have in-house fire brigades, medical staff, and hazardous materials teams that can assist AECOM in the event of an emergency related to our field activities. In many instances, our clients prefer or require that subcontractors seek emergency assistance through their facility first before calling outside responders to the site.
- A copy of the facility's procedures must be made available to AECOM so that the information can be incorporated into the HASP or attached to the emergency reference sheet. If this information is not available to AECOM prior to arriving on site, the SSO must meet with client representatives upon arrival to the facility to review procedures in the event of an emergency related to plant operations.

4.5.6 Emergency Action Plan

- As a minimum, each emergency action plan must contain the following topics as required by 29 CFR 1910.38 (a):
  - Procedures and contact information for reporting emergencies to public service responders and on-site (client or host employer) emergency control centers.
  - Emergency escape procedures and emergency escape route assignments.
  - Procedures to be followed by employees who remain to operate critical site operations before they evacuate.
  - Procedures to account for all employees after emergency evacuation is complete.
  - Rescue and medical duties for those employees who are to perform them.
  - Preferred means of reporting fires and other emergencies.
  - PPE to protect employees from expected exposures and potential exposures during an emergency.
  - Names of persons or departments who can be contacted for further information (i.e. emergency reference sheet).
  - Availability of medical surveillance for workers who might have been exposed to chemicals, bloodborne pathogens, or other biological agents as a result of project work or emergency response.
- In addition, each plan must establish the specific alarm system that will be used on site to warn employees of an AECOM emergency. The chosen alarm signals should not conflict with alarm signals already in place at the facility.

4.5.7 Escape Routes and Procedures

- Prior to the commencement of on-site activities, the SSO must determine how AECOM employees will evacuate each AECOM work area of the site. Two or more routes that are separate or remote from each other for each work area must be identified. Multiple routes are necessary in case one is blocked by fire or chemical spill. These routes must not overlap because, if a common point were obstructed, all intersecting routes would be blocked.
- Prominent wind direction should also be considered when designating escape routes and assembly areas. Escape routes and assembly areas should be upwind of the site whenever possible.

- Upon arrival to the site, the SSO must verify that the selected routes are appropriate for evacuation. During an emergency, the quickest and most direct route should be selected. However, when working at an operating facility, the established escape routes of the facility should be used whenever possible. In the event of a facility-related emergency, all AECOM employees must meet at the facility's assembly area so that the client can verify that AECOM has evacuated the property.

4.5.8 Accounting Method for All Employees after Evacuation

- The SSO is responsible for determining that all AECOM employees have been successfully evacuated from the work area(s). It is the responsibility of each AECOM subcontractor to verify that all of its employees evacuated the site and to report this information to the AECOM SSO. All employees must meet at the designated assembly area. A headcount is an acceptable way to determine complete evacuation when the field team is of a small size. The site log-in book should be referenced when attempting to account for more than 10 people. In the event of a facility-related emergency, the SSO must notify facility representatives that all AECOM employees and AECOM subcontract employees have successfully evacuated the work area(s). The SSO must notify emergency responders if any employee is unaccounted for and where on the site they were last seen.
- In the event of a project-related emergency, the SSO will provide off-site emergency responders or on-site HAZMAT teams or fire brigades (Incident Commander) with all available knowledge about the emergency situation upon their arrival to the scene.

4.5.9 Employees Who Remain to Operate Critical Site Operations Before They Evacuate

- All equipment and operations are required to cease in accordance with the established alarm signal procedures. The only exception will be related to health and safety. The SSO must determine at the time of the emergency if health and safety will be jeopardized by immediate stoppage of any particular piece of equipment. If such a determination is made, personnel involved in critical operations must be minimized. Once it is determined that the operation is no longer needed or the threat to the operators is imminent, operations will cease and the operators will immediately evacuate.

4.5.10 Rescue and Medical Duties

- Only currently trained individuals will administer first aid or CPR. If the injury is life threatening, the Emergency Medical System (EMS) should be called (911). Depending on the procedures established for the project, the SSO would contact an emergency responder directly or notify the facility representatives for medical assistance. If the employee needs medical attention that can not be provided on-site, the SSO shall escort the individual to the local hospital identified on the emergency reference sheet and shall remain with the person until release or admittance is determined. The escort will relay all appropriate medical information to the Project Manager and Regional SH&E Manager.

4.5.11 Preferred Means of Reporting

- Unless facility representatives specifically indicate that they prefer AECOM personnel to notify them first of an emergency, the SSO will directly contact the appropriate emergency responders listed on the emergency reference sheet.

4.5.12 Alarm Signals

- An emergency communication system must be in effect at all sites. The most simple and effective emergency communication system in many situations will be direct verbal communications. However, verbal communications must be supplemented any time voices cannot be clearly perceived above ambient noise levels and any time a clear line of sight can not be easily maintained among all AECOM personnel because of distance, terrain, or other obstructions.
- Portable two-way radio communications may be used when employees must work out of the line of sight of other workers.
- When verbal communications must be supplemented, the following emergency signals shall be implemented using handheld portable air horns, whistles, or similar devices. Signals must be capable of being perceived above ambient noise by all employees in the affected portions of the workplace.

- One Blast: General Warning—A relatively minor and localized, yet important, on-site event. An example of this type of an event would be a minor chemical spill where there is no immediate danger to life or health yet personnel working on the site should be aware of the situation so that unnecessary problems can be avoided. If one horn blast is sounded, personnel must stop all activity and equipment on-site and await further instructions from the SSO.
- Three Blasts: Medical Emergency—A medical emergency for which immediate first aid or emergency medical care is required. If three horn blasts are sounded, all first aid and/or CPR trained personnel should respond as appropriate. All other activity and equipment should stop and personnel should await further instructions from the SSO.
- Three Blasts Followed by One Continuous Blast: Immediate Threat to Life and Health—A situation that could present an immediate danger to life and health of personnel onsite. Examples include fires, explosions, large hazardous chemical release, severe weather-related emergencies, or security threats. If three horn blasts followed by a continuous blast are sounded, all activity and equipment must stop. All personnel must evacuate the site and meet in the designated assembly area where the SSO will account for all employees. The SSO will arrange for other emergency response actions if necessary. Information concerning the need to follow decontamination procedures during an emergency evacuation will be addressed in the emergency action plan.
- The SSO or his designate will acknowledge the distress signal with two short blasts on the air-horn or whistle.
- One Continuous Blast Following Any of the Above: All Clear/Return to Work—Personnel who sound the initial alarm are required to send an all clear signal when the emergency is over.

4.5.13 Emergency Reference Sheet

- An emergency reference sheet (see *S3NA-509-FM4 Emergency Information and Hazard Assessment*) must be prepared for projects not requiring a HASP. Each emergency reference sheet must list the following:
  - Emergency phone numbers for local police, fire, and ambulance service.
  - In-house facility extensions for reporting an emergency (applies to operating facilities only).
  - Phone number and address of closest hospital with an emergency room to the site.
  - Directions to the hospital from the site.
  - Map highlighting the site-to-hospital route.
  - Phone number for the Poison Control Center.
  - Names and phone numbers of AECOM representatives and facility representatives.

4.5.14 On-site and Off-site Communications

- Regardless of the size or location of AECOM's field projects, it is extremely important that both on-site and off-site communications be maintained so that in the event of an emergency employees can contact each other or place a phone call immediately with the appropriate responder(s).
- Walkie-talkies are required when members of the field team are working in separate areas of the site and verbal communications are no longer effective because of distance. A walkie-talkie must be available for each team that is working in a separate area of the site.
- When AECOM is working at an occupied facility, access to a telephone may not be a problem. When AECOM is working on abandoned properties or when there is no access to a phone, a cellular telephone must be brought to the work location.

4.5.15 Evacuation

- Although emergency evacuation procedures are included in AECOM's initial 40-hour HAZWOPER training, emergency procedures at each site will be different. Therefore, employees must be instructed about the specifics of the emergency procedures developed for the site during the site-specific pre-entry briefing that must be held daily prior to the

commencement of field activities. Update training is required anytime escape routes or procedures change. An evacuation drill will be conducted for projects that are scheduled for one month or longer. Visitors and untrained employees shall not be allowed into the project area until they receive a safety briefing including evacuation alarms and procedures.

4.5.16 First Responder

First responders shall have sufficient training or have had sufficient experience to objectively demonstrate competency in the following areas:

- An understanding of what hazardous substances are, and the risks associated with them in an incident.
- An understanding of the potential outcomes associated with an emergency.
- The ability to recognize the presence of hazardous substances and physical hazards in an emergency.
- An understanding of the role of the first responder.
- The ability to realize the need for additional resources and to make appropriate notifications to the communication center.

4.5.17 First Responder HAZWOPER Operations Level

First responders at the operations level are individuals who respond to releases or potential releases of hazardous substances as part of the initial response to the site for the purpose of protecting nearby persons, property, or the environment from the effects of the release. They are trained to respond in a defensive fashion without actually trying to stop the release. Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures. First responders at the operational level shall have received at least eight hours of training or have had sufficient experience to objectively demonstrate competency in the following areas in addition to those listed for the awareness level and the employer shall so certify:

- Knowledge of the basic hazard and risk assessment techniques.
- Know how to select and use proper personal protective equipment provided to the first responder operational level.
- An understanding of basic hazardous materials terms.
- Know how to perform basic control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available with their unit.
- Know how to implement basic decontamination procedures.
- An understanding of the relevant standard operating procedures and termination procedures.

4.5.18 Hazardous Materials Technician

Hazardous materials technicians shall have received at least 24 hours of training equal to the first responder operations level and in addition have competency in the following areas and the employer shall so certify:

- Know how to implement the employer's emergency response plan.
- Know the classification, identification, and verification of known and unknown materials by using field survey instruments and equipment.
- Be able to function within an assigned role in the Incident Command System.
- Know how to select and use proper specialized chemical PPE provided to the hazardous materials technician.
- Understand hazard and risk assessment techniques.
- Be able to perform advance control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available with the unit.
- Understand and implement decontamination procedures.
- Understand termination procedures.
- Understand basic chemical and toxicological terminology and behavior.

4.5.19 Hazardous Materials Specialist

Hazardous materials specialists shall have received at least 24 hours of training equal to the technician level and in addition have competency in the following areas and the employer shall so certify:

- Know how to implement the local emergency response plan.
- Understand classification, identification, and verification of known and unknown materials by using advanced survey instruments and equipment.
- Know the state emergency response plan.
- Be able to select and use proper specialized chemical PPE provided to the hazardous materials specialist.
- Understand in-depth hazard and risk techniques.
- Be able to perform specialized control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available.
- Be able to determine and implement decontamination procedures.
- Have the ability to develop a site safety and control plan.
- Understand chemical, radiological, and toxicological terminology and behavior.

4.6 Personal Protective Equipment (PPE) Ensembles

4.6.1 Defined HAZWOPER PPE ensembles are specified for general use on all AECOM HAZWOPER operations. The project HASP may specify modifications to these requirements to meet site-specific conditions.

4.6.2 Level D Ensemble

- The Level D ensemble provides a minimal level of skin protection (primarily against physical rather than chemical hazards) and no respiratory protection. Level D PPE is the minimum work uniform which will be used on HAZWOPER sites. Its use is appropriate when there is no significant potential for encountering hazardous substances or health hazards while working in controlled work areas.
- Level D Equipment List
  - Hard hat
  - Eye protection
  - Safety-toe work boots
  - Shirts with sleeves and long pants (shorts are unacceptable for use)
  - Hearing protection (as required)

4.6.3 Modified Level D Ensemble

- The Modified Level D ensemble provides moderate skin protection against contact with hazardous substances, but no respiratory protection. Its use is appropriate where there is a moderate-to-low potential for skin contact with known hazardous substances and health hazards, but no significant inhalation hazard is anticipated. The Modified Level D ensemble will consist of the Level D ensemble, supplemented by the addition of one or more of the following items:
- Modified Level D Equipment List
  - Chemical-resistant disposable outer coveralls
  - Chemical-resistant outer gloves taped to outer coveralls[1]
  - Chemical-resistant inner gloves1
  - Chemical-resistant safety-toe boots (taped to outer coveralls)

4.6.4 Level C Ensemble

1 Selection of specific glove types/materials will be provided in the project HASP based on consideration of the contaminants and the physical conditions of the work.

- The Level C ensemble provides moderate skin protection against contact with hazardous substances and moderate respiratory protection. Its use is appropriate where there is the potential for skin contact with known hazardous substances and health hazards, together with a limited and well-defined potential for exposure via inhalation.
- Level C Equipment List
  - Full-face air-purifying respirator (APR) equipped with cartridge types as designated in the project HASP[2]
  - Chemical-resistant disposable outer coveralls
  - Chemical-resistant outer gloves taped to outer coveralls[3]
  - Chemical-resistant inner gloves[3]
  - Hard hat
  - Safety-toe boots taped to coveralls; the use of boot covers (e.g., booties) or chemical-resistant boots may be specified
  - Hearing protection (as required)

4.6.5 Level B Ensemble

- The Level B ensemble provides both the highest level of inhalation exposure protection and considerable skin contact protection. Its use is appropriate where there are significant known or suspected hazardous substances and health hazards, involving both skin and inhalation exposure (up to and including Immediately Dangerous to Life or Health [IDLH] conditions) or where adverse atmospheric conditions cannot be mitigated by use of air purifying respirators (e.g., oxygen deficient atmospheres or chemicals with poor warning properties). The use of Level B PPE requires prior approval by the Regional SH&E Manager.
- Level B Equipment List
  - Supplied air respirator (SCBA or air line system with Grade D or better breathing air)
  - Chemical-resistant disposable outer coveralls
  - Chemical-resistant outer glove taped to outer coveralls[3]
  - Chemical-resistant inner gloves[3]
  - Hard hat
  - Chemical resistant safety-toe boots taped to coveralls
  - Hearing protection (as required)

4.6.6 Level A Ensemble

- The Level A ensemble provides the highest level of both respiratory and skin protection, up to and including protection against skin contact with vapor-phase contaminants. The use of Level A PPE requires prior approval by the Corporate SH&E Director.
- Specific Level A ensemble components will be determined on a case-by-case basis by the SH&E Department.

4.7 Employee Exposure Monitoring

4.7.1 Exposure monitoring at HAZWOPER sites will be conducted to determine explosive and oxygen levels, monitor and control employee exposures to airborne contaminants, and to determine and regulate controlled work area boundaries (e.g., support zone, contamination reduction zone, and exclusion zone) for the protection of non-HAZWOPER workers and the general public.

4.7.2 Direct Reading Exposure Monitoring Requirements

- Explosive levels, oxygen levels, and airborne contaminants present potential hazards to HAZWOPER personnel working within controlled work areas and to non-HAZWOPER workers and the general public present outside the controlled work areas. On-site exposure

2 Selection of specific cartridges will be made by the SH&E Department (or Competent Person – Respiratory Protection as designated by the DSM) based on contaminants present. A cartridge change-out frequency will also be specified in the HASP based on the manufacturer's cartridge performance data.

3 Selection of specific glove types/materials will be provided in the project HASP based on consideration of the contaminants and the physical conditions of the work.

monitoring will be utilized to assess the magnitude of these hazards and to provide indications of any necessary control procedures to mitigate unacceptable hazards. *S3NA-509-FM1 Direct Reading Instrument Monitoring Log* will be used to record all monitoring efforts using direct reading instruments and will remain part of the project file.

- Specific exposure monitoring requirements will be established in individual HASPs and will be implemented by the project team(s) subject to the following requirements:
  - Direct reading instrumentation will be used in accordance with the following table:

Direct Reading Instrument	Example Trade Names	Use
Flame Ionization Detector (FID)	OVA	Detection of select organic vapors
Photo ionization detector (PID)	miniRAE, Micro-TIP	Detection of select organic vapors
Portable gas chromatograph	OVA	Detection of select organic vapors
Explosive meter	MSA ALTAIR, QRAE II, BW GasAlert	Determine explosiveness (as a percent of the Lower Explosive Limit [LEL])
Oxygen monitor	MSA ALTAIR, QRAE II, BW GasAlert	Determine oxygen concentration (in percent)
Single gas meters (mono-tox) • Hydrogen sulfide • Carbon monoxide • Oxides of nitrogen • Cyanide		Determine airborne concentrations of selected contaminants (in parts per million)
Colorimetric Detector Tubes	Drager	Determine airborne concentrations of selected contaminants (in parts per million)
Aerosol monitor	Mini-RAM	Determine airborne particulate concentration (in milligrams per cubic meter)

- Selected instruments will be capable of discriminating contaminant concentrations to concentrations of at least one-half of the HASP-specified exposure limit. All direct-reading instrumentation will be calibrated daily as directed by the manufacturer. *S3NA-509-FM2 Instrument Calibration Log* will be used to record instrument calibrations.

4.7.3 Work Area Exposure Monitoring

- Work area exposure monitoring will include breathing zone readings for the maximum exposed worker(s).
- Results will be used to determine adequacy of PPE (especially respiratory protection). Specific criteria for upgrade/downgrade will be established in the HASP.

4.7.4 Perimeter Exposure Monitoring

- Perimeter air samples will be collected when the potential exists for airborne contaminants to migrate off-site.
- Perimeter exposure monitoring will be conducted at locations downwind from the project activities at a minimum (also upwind if the potential exists for offsite contamination to migrate onto the site).
- Sample results will be recorded in a log book or on the sample log form provided in *S3NA-509-FM3 Personal Sampling Data Sheet*.

- Records will indicate individual name, SSN (last 4 digits is acceptable), and job/operation at the time of sample collection.
- Samples sent out for independent laboratory analysis will follow chain of custody requirements.
- Exposure results will be posted on site and explained in a safety briefing.
- Employees will receive a written statement of results within 15 days of receipt from the laboratory.
- Results of all personal exposure monitoring will be provided to the SH&E department for inclusion in the employee medical records.

5.0 Records

5.1 All forms and documents generated during a HAZWOPER project will be maintained in the project file.

6.0 Attachments

6.1 S3NA-509-FM1 Direct Reading Instrument Monitoring Log

6.2 S3NA-509-FM2 Instrument Calibration Log

6.3 S3NA-509-FM3 Personal Sampling Data Sheet

6.4 S3NA-509-FM4 Emergency Information and Hazard Assessment

S3NA-510-PR Hearing Conservation Program

1.0 Purpose and Scope

1.1 Establishes procedures to confirm that personal noise exposure remains within acceptable limits and establishes the requirements of an acceptable hearing conservation program.

1.2 This procedure applies to all AECOM North America-based employees and operations.

2.0 Terms and Definitions

2.1 **Decibel (dB):** Logarithmic unit of measurement of sound level.

2.2 **Action Level:** An eight-hour, time-weighted average of 85 decibels measured on the A-scale, slow response, or equivalently; a noise dose of 50 percent.

2.3 **Standard Threshold Shift (STS):** When one's hearing threshold has changed (relative to the baseline audiogram) an average of 10 dB or more at 2000, 3000, or 4000 Hz in either ear).

2.4 **Noise Reduction Rating (NRR):** The measure, in decibels, of how well a hearing protector reduces noise, as specified by the Environmental Protection Agency.

3.0 References

None.

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Regional SH&E Managers** or their designate

- Provide access to initial and refresher hearing conservation training.
- Inform employees of noise monitoring results when full-shift noise exposure is at or above the action level.
- Designate areas and tasks where employees' exposure is at or above the action level.
- Conduct noise monitoring, as applicable, and support hazardous noise assessment/evaluation efforts.

4.1.2 **Project or Office Managers**

- Implement the hearing conservation program.
- Confirm that a hazardous noise assessment/evaluation has been conducted.
- Confirm that a hazardous noise assessment/evaluation is conducted when a change in equipment, procedures, or personnel may increase employee exposure to noise.
- Implement engineering controls to reduce noise levels when such measures are considered feasible and when required by regulation.
- Purchase, monitor, and replenish for employees' use a supply of hearing protection devices with a minimum Noise Reduction Rating (NRR) of 26 dBA.
- Confirm that individuals included in the program receive training and that the training meets the criteria outlined in this program.
- Investigate and implement corrective action to all reports of nonconformance with this procedure, including reports of standard threshold shifts or employees' failure to wear hearing protectors in designated areas.

4.1.3 **Supervisors**

- Maintain an awareness of the noise levels in work areas for which he/she is responsible.
- Place warning signs in areas where sound levels would require the use of hearing protectors.
- Request that a hazardous noise assessment/evaluation be conducted when a change in equipment, procedures, or personnel may increase employee exposure to noise.
- Confirm that all employees are aware of the requirements for hearing protection for any designated area or task.
- Enforce the use of hearing protection by employees in designated areas and for designated tasks.

4.1.4 **Employees**

- Comply with the requirements of the Hearing Conservation program.
- Wear hearing protection devices in designated areas or for designated tasks.
- Inspect and maintain hearing protection devices.
- Report any suspected change in noise levels of work area to supervisor.
- Report any signs or symptoms experienced that could be the result of overexposure to noise to supervisor.
- Participate in audiometric testing and hearing protection training when required.

4.2 **Requirements**

4.2.1 The requirements of this procedure apply to all locations/facilities/projects where employee noise exposure may equal or exceed 50 percent of the allowable noise dose or Permissible Exposure Limit (PEL). Table 1 provides information relative to the current PEL for noise exposure expressed as a time-weighted average.

Table 1. Permissible Exposure Limit

SOUND LEVEL (dBA)	TIME (hours)
85	8
90	4
95	2
100	1
105	0.5
110	0.25
115	0.125

4.2.2 Table 2 provides information relative to the Action Level (or 50 percent allowable noise dose) expressed as a time-weighted average. The action levels outlined in the table below and PELs described in Table 1 are calculated without regard to the protection afforded by the use of hearing protectors.

Table 2. Action Levels for Hearing Conservation Program

SOUND LEVEL (dBA)	TIME (hours)
85	4
90	2
95	1
100	0.5
105	0.25
110	0.125
115	0.0625

4.3 Training Program

4.3.1 All employees with potential exposure above the action levels established in Table 2 of this procedure or who otherwise utilize any type of hearing protector will participate in a hearing conservation training program.

4.3.2 Training Objectives

4.3.3 The initial and subsequent annual hearing conservation training will address, at a minimum, the following topics:

- The effects of noise on hearing, recognizing hazardous noise, and symptoms of overexposure to hazardous noise.
- When and/or where hearing protectors are required to be worn.
- The purpose of hearing protectors.
- The advantages, disadvantages, and effectiveness of various types of protectors.
- Instructions on how to select, use, fit, and care for hearing protectors.
- The purpose of audiometric testing, including an explanation of the test procedures.
- Hearing Conservation Program requirements and responsibilities.

4.3.4 Hearing protection training is conducted biannually for all affected employees or more frequently for employees who do not properly use hearing protectors or otherwise fail to comply with this policy.

4.4 Audiometric Testing

4.4.1 All AECOM personnel with exposure greater than the action level may be enrolled in the medical surveillance program and undergo a baseline audiogram. Thereafter, annual audiograms will be compared with the baseline exam.

4.4.2 Enrolled employees will receive audiograms during their exit physicals.

4.4.3 When a Standard Threshold Shift (STS), as identified by the AECOM Medical Consultant, is noted between the last valid baseline and the annual audiogram, the following steps will be taken:

- A retest will be conducted within 30 days to confirm the STS. The employee will not be exposed to workplace/hobby noise for 14 hours or will be provided with adequate hearing protection prior to testing.
- If the STS persists, ear protection will be upgraded to one with a greater NRR. The minimum NRR will be 26 dBA.
- The employee will be counseled and AECOM will obtain information regarding the employee's possible noise exposure away from the workplace or existing ear pathology.
- Qualified medical personnel will review the audiograms. This group will determine the need for a medical referral.
- The employee will be notified in writing by either the SH&E Department or the AECOM Medical Provider of the STS, within 21 days of determination, as required by regulation.
- The employee's supervisor will be notified of the shift in hearing threshold.

4.4.4 If the employee who has experienced an STS is exposed to 85 dBA for eight hours or 80 dBA for 12 hours, mandatory use of ear protection is required.

4.5 Monitoring of Noise Levels

4.5.1 As deemed necessary by an SH&E Professional, or a Project Safety Plan AECOM will periodically monitor personal and area noise levels using noise dosimetry and/or sound level meters.

4.6 Hearing Protectors

4.6.1 Selection of appropriate hearing protectors must be based on actual or anticipated exposure levels. At a minimum, hearing protectors must provide a level of protection that brings actual or anticipated exposure below the PEL established for the time period shown in the table above. Additional information relative to hearing protector use is as follows:

- Hearing protection will be mandatory for all employees exposed to 85 dBA for eight hours.

- Hearing protection will be mandatory for all employees working in any area that has not been evaluated for noise exposure and the ambient noise level in the area is such that you must raise your voice to have a normal conversation with someone less than four feet from you and/or when within 25 feet of an operating piece of heavy equipment.
- Hearing protection will be mandatory for all employees who work on or near heavy equipment unless personal dosimetry or other techniques have been used to document actual exposure.
- Hearing protectors will be made available to all employees who may be exposed to 85 dBA for eight hours.
- Hearing protection will be mandatory for all employees exposed to 85 dBA for any period of time and who have experienced an STS.

5.0 Records

5.1.1 Noise exposure measurement records will be retained for three years at the project/facility.

5.1.2 Audiogram records will be retained in the employee's medical records as per AECOM's Medical Surveillance Procedure for a period as directed by regulation or AECOM's Medical Provider.

5.1.3 Employee training session documentation will be retained for the duration of employment.

6.0 Attachments

6.1 S3NA-510-FM Site-Specific Hearing Conservation Program

6.2 S3NA-510-WI Hearing Protection Guidelines

Appendix D.
NYSDOH Generic Community Air Monitoring Plan

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APPENDIX D

NEW YORK STATE DEPARTMENT OF HEALTH GENERIC COMMUNITY AIR MONITORING PLAN

OVERVIEW

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

- **Continuous monitoring** will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.
- **Periodic monitoring** for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for

the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.
3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.
4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.
2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.
3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

Appendix E.
Biosparging System Design Calculations

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Table E-1
BEX Mass and Oxygen Demand Calculations

Variable	Units	Value	Notes
Length of Treatment Area (L)	ft	150	Parallel to groundwater flow.
Width of Treatment Area (W)	ft	300	Perpendicular to groundwater flow.
Thickness of Treatment Area (h)	ft	5	Smear zone thickness.
Volume of Soil Requiring Treatment (V_{Soil})	ft^3	225,000	$V_{soil} = L \times W \times h$
Volume of Soil Requiring Treatment	m^3	6,374	1 m^3 = 35.3 ft^3
Density of Soil (ρ_{Soil})	g/cm^3	1.91	Silty sand.
Density of Soil (ρ_{Soil})	kg/m^3	1,910	
Mass of Soil Requiring Treatment (M_{soil})	kg	12,174,221	$M_{Soil} = V_{Soil} \times \rho_{Soil}$
BEX Concentration in Soil Requiring Treatment [BEX]	mg/kg	10	Based on 2007 removal action confirmation sampling.
Mass of BEX in Soil Requiring Treatment (M_{BEX})	kg	122	$M_{BEX} = (M_{Soil} \times [BEX])/1{,}000{,}000$ mg/kg
Mass of BEX in Soil Requiring Treatment	lbs	**268**	1 kg = 2.2 lbs
Oxygen to Petroleum Ratio for Remediation	lbs/lbs	3.5	Typical range is 3.0 to 3.5. 3.5 is conservative.
Oxygen Demand to Remediate BEX	lbs	**937**	

Table E-2
Oxygen Supply Calculations

Variable	Units	Value	Notes
Air Flow Rate through Sparge Well (Q)	cfm	1	
Air Flow Rate through Sparge Well (Q)	cfd	1,440	
Oxygen Concentration ([Oxygen])	%	20.9	Atmospheric air is 20.9% oxygen by volume.
Density of Oxygen (ρ_{Oxygen})	g/L	1.429	
Number of Wells	--	30	
Volume of Air Supplied per Day (V_{Air})	ft^3	43,200	$V_{Air} = Q \times 30$
Volume of Air Supplied per Day	m^3	1,224	$1\ m^3 = 35.3\ ft^3$
Volume of Oxygen Supplied per Day (V_{Oxygen})	m^3	256	$V_{Oxygen} = V_{Air} \times [Oxygen]/100$
Mass of Oxygen Supplied per Day (M_{Oxygen})	kg	366	$M_{Oxygen} = V_{Oxygen} \times \rho_{Oxygen}$
Mass of Oxygen Supplied per Day	lbs	804	1 kg = 2.2 lbs
Mass of Oxygen Supplied per Year	lbs	278,822	
Mass of Oxygen Supplied per Year	Tons	139	1 ton = 2,000 lbs