Work Plan for the Regional Compliance Restoration Program Preliminary Assessment/Site Investigation Stewart Air National Guard Base Newburgh, New York

Draft Final

February 2014

Contract No. W912DR-12-D-0014
Task Order No. 0001

AIR NATIONAL GUARD
GUARDING AMERICA DEFENDING FREEDOM

Submitted to

U.S. Army Corps of Engineers
10 South Howard Street
Room 1000-S
Baltimore, Maryland 21201

Contract No. W912DR-12-D-0014
Task Order No. 0001

Submitted by

AECOM
675 North Washington Street,
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February 2014

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Qualified Environmental Professional Certification

I certify that I am currently a NYS registered professional engineer and that this Work Plan for Stewart Air National Guard Base, was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and that all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications.

Respectfully submitted,
AECOM

February 2014

Scott A. Underhill

Registered Professional Engineer
New York License No. 075332

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List of Acronyms and Abbreviations

AFCEE	Air Force Center for Environmental Excellence
AOC	Area of Concern
ANGB	Air National Guard Base
APP	Accident Prevention Plan
ARARs	Applicable or Relevant and Appropriate Requirements
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	Contaminants of Potential Concern
CP	Commissioner Policy
CPR	Cardiopulmonary resuscitation
CSM	Conceptual Site Model
DPT	Direct Push Technology
DQO	Data Quality Objective
EB	Equipment Blank
EESOH-MIS	Enterprise Environmental Safety and Occupational Health-Management Information System
EPA	Environmental Protection Agency
ERPIMS	Environmental Resources Program Information Management System
GIS	Geographic Information Systems
HAZWOPER	Hazardous Waste Operations and Emergency Response
IDW	Investigation Derived Waste
IRP	Installation Restoration Program
NFA	No Further Action
NYANG	New York Air National Guard
NYSDEC	New York State Department of Environmental Conservation
PA	Preliminary Assessment
PID	Photoionization Detector
PVC	Poly-vinyl chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
SI	Site Investigation
SOP	Standard Operating Procedure
SVOC	Semivolatile Organic Compounds
TOGS	Technical and Operational Guidance Series
TB	Trip Blank
UFP	Uniform Federal Policy
U.S.	United States
USACE	United State Army Corps of Engineers
USCS	Unified Soil Classification System
UST	Underground Storage Tank
VOC	Volatile Organic Compounds

Executive Summary

Under contract to the US Army Corps of Engineers Baltimore District and the Air National Guard, AECOM will conduct a Preliminary Assessment (PA) and Site Investigation at the Stewart Air National Guard Base, 105th Airlift Wing, Orange County, Newburgh, New York. In 1942, the Stewart Municipal Airport facility was activated as the US Army Air Forces Basic-Advance flying school for West Point pilots. In 1947, the facility became Stewart Air Force Base, which was then deactivated in 1970 and developed into Stewart International Airport. In 1983, the New York ANG relocated from Westchester County Airport and occupied the 267-acre facility at Stewart International Airport.

From 1942 to present, various military aircraft support activities have taken place at the base. The major support operations include aircraft fueling, aircraft deicing, aircraft maintenance, ground vehicle maintenance, fueling of ground vehicles, and facilities maintenance.

Based on findings from a Trip Report conducted under the One Clean environmental program by BB&E in 2011 and a Phase I Environmental Baseline Survey in 2002, two Areas of Concern (AOCs) have been identified as part of this contract, including:

- Hydraulic Lifts in Building 208
- Pesticides in facility monitoring well, MW-1

Table ES-1 presents a summary of the PA at Stewart Air National Guard Base.

Table ES-1. Summary of the Preliminary Assessment

AOC ID Code	Site Description (EESOH-MIS)	Recommendation	Rationale
208	AOC- Hydraulic Lifts in Building 208 (TT004)	Site Investigation	Based on information obtained during the PA, sampling data and closure documentation for hydraulic lift removal and repair do not appear to be available. Four borings are proposed next to the lifts in Building 208 to collect soil and groundwater samples for analysis of volatile organic compounds and semivolatile organic compounds.
MW-1	AOC-Pesticides in MW-1(SS005)	Site Investigation	Sources of organochlorine pesticides in vicinity of MW-1 are unknown. Three soil borings coupled with the installation of three new monitoring wells are proposed surrounding MW-1 for analysis of organochlorine pesticides.

EESOH-MIS Enterprise Environmental Safety and Occupational Health-Management Information System Site Identification

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1 Introduction

Under contract to the United States Army Corps of Engineers (USACE) Baltimore District and the Air National Guard (ANG), AECOM will conduct a Preliminary Assessment (PA) and Site Investigation (SI) at areas of concern (AOCs) that have been identified by the ANG. This PA/SI Work Plan addresses the AOCs located on Stewart Air National Guard Base (ANGB) (Figure 1-1 in Appendix A).

The PA is an assessment of AOCs to determine if there is sufficient information that would indicate that a release at the AOC could impact human health and the environment. The PAs, which consist of a site visit and record research, were conducted in November 2013 and the results are summarized in Section 5. Based on the results of the PAs, some AOCs have been recommended for no further action (NFA) and some AOCs require additional information through a SI to determine if they should be recommended for further investigation.

The SI, which follows the PA in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process, is not intended as a full-scale study of the nature and extent of contamination. The United States Environmental Protection Agency (EPA) identifies the SI as the on-site investigation to determine what hazardous substances are present and if they are being released to the environment. Its purpose is to augment the data collected in the PA and to generate, if necessary, sampling and other field data to determine if further response action or remedial investigation is appropriate. The objective of performing the SI is to gather data necessary to make this determination.

1.1 Scope and Objectives

This PA/SI Work Plan defines the overall project objectives, presents the results from the PA, outlines the site history and presents the investigation tasks that will be conducted to achieve the project objectives. This Work Plan identifies the equipment, methods, and staffing necessary to perform the following tasks:

- Review the initial PA and summarize the findings and recommendations for NFA or a SI.
- For AOCs that require additional investigation, incorporate relevant information into the SI approach;
- Gather site-specific information to evaluate the fate and transport mechanisms;
- Identify topography, vegetation, soil characteristics, climate, land use at the site and adjacent real estate, potential exposure pathways, and ground scars. and
- Collect and evaluate soil, sediment, surface water and groundwater samples to determine if the concentrations of contaminants of potential concern (COPCs) are present in quantities or concentrations that require the ANG to investigate the site.

All work under this task order will be completed in accordance with applicable and appropriate USACE and ANG policies, regulations and guidance, and Federal, State and local laws. Key references and policy documents for this investigation include, but are not limited to, the following:

- EPA Guidance for Performing Site Inspections Under CERCLA; Interim Final, September 1992 (http://www.hanford.gov/dqo/project/level5/sicercla.pdf)
- EPA Federal Facilities Remedial Site Inspection Summary Guide. July 2005. (http://www.epa.gov/fedfac/pdf/ff_si_guide.pdf)
- New York State Department of Environmental Conservation (NYSDEC). 2010. CP-51 / Soil Cleanup Guidance, 21 October.
- NYSDEC. 2004. Technical & Operational Guidance Series (TOGS), 1.1.1 Ambient Water Quality Standards and Guidance Values, June 1998, April 2000 Addendum, June 2004 Addendum.
- Air National Guard Readiness Center. 2009. Air National Guard, Environmental Restoration Program, Investigation Guidance. September.

1.2 Work Plan Organization

This PA/SI Work Plan is organized into the following seven sections:

- **Section 1** provides an introduction to the project including the scope and objectives.
- **Section 2** provides site background information including the site location, physical and environmental conditions.
- **Section 3** describes the history of Stewart ANGB.
- **Section 4** describes the exposure pathways at the installation.
- **Section 5** summarizes the results of PA.
- **Section 6** details the planned SI field operations that will be conducted to obtain required data including appropriate measures to ensure data quality and achievement of project objectives.
- **Section 7** provides a list of references used in this Work Plan.

The following appendices are included in this Work Plan:

- **Appendix A** presents the figures referred to in the Work Plan.
- **Appendix B** is the Uniform Federal Policy (UFP) – Tier II Quality Assurance Project Plan (QAPP). The Tier II QAPP is a streamlined version of the UFP-QAPP that includes worksheets applicable to an SI. This UFP-QAPP consists of the detailed procedures/methods for contaminant sampling and analysis, and addresses quality assurance (QA) and quality control (QC) methods used to control sampling activities on the project.
- **Appendix C** is the Accident Prevention Plan (APP). A site-specific Health and Safety Plan detailing the field hazards and methodologies to mitigate these hazards to ensure safe working conditions are established for site workers is included as part of the APP.
- **Appendix D** contains field-related Standard Operating Procedures (SOPs).
- **Appendix E** contains the Laboratory Accreditation Certificate.

1.3 Project Organization and Responsibilities

The AECOM project organization is provided on Figure 1-2 (Appendix A). This figure also shows the communication pathways and lines of authority for the overall project. Details on personnel and subcontractor roles/responsibilities are presented in the UFP-QAPP (Appendix B). For this SI, Mr. Mark MacEwan is the Project Manager, Jody Murata is the ANG Program Manager, Riadh Hossain is the USACE Project Manager, John Santacroce is the Task Manager, and Major Nicolas Caputo is the Installation Contact.

For the SI field operations, Greta White is the AECOM Field Operations Leader. She will supervise and coordinate field activities and will act as the liaison between site personnel, laboratory personnel, and the Quality Assurance Manager.

The AECOM field team will be supported by office-based personnel including the Project Chemist (Ms. Devon Chicoine), geographic information system (GIS) Data Manager (Ms. Brooke Perrigo), Health & Safety Manager (Mr. Michael Grasso), New York State regulatory specialist (Scott Underhill) and the Quality Assurance Manager (Mr. John Maier).

1.4 Quality Assurance/Quality Control

The UFP-QAPP details the quality assurance/quality control (QA/QC) procedures for the investigation activities that will be implemented to ensure the data quality objectives (DQOs) of the SI are achieved. The DQOs are qualitative and quantitative statements developed to clarify the study objectives, define the most appropriate data to collect under what conditions, and specify tolerable limits on decision errors that are used as the basis for establishing the quantity and quality of data needed to support decision-making. The specific DQOs are presented in the UFP-QAPP (Appendix B).

The quality of analytical data will be assessed through the collection and analysis of field and laboratory QC samples. QC samples will be used to check the sampling methodology and analytical precision, accuracy and representativeness.

1.5 Health and Safety Requirements

Health and safety requirements for SI field activities are provided in the APP (Appendix C). Field investigations will be carried out in Level D personal protective equipment. Detailed job hazard analyses identifying the physical, chemical, and biological hazards that may be encountered at the site and the associated mitigation methods are presented in the APP.

All on-site personnel who may be exposed to hazardous conditions will be required to meet training requirements identified in Federal Regulation 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response [HAZWOPER]). At least two personnel trained in first aid and cardiopulmonary resuscitation (CPR) will be onsite during field activities. Training certificates for personnel (HAZWOPER 40-hour training; current HAZWOPER 8-hour refresher training; and first aid/CPR) will be maintained onsite by the Field Operations Lead.

All personnel and visitors who enter the site will be required to review the APP and sign the acknowledgement form, and site workers will be required to sign the daily tailgate safety meeting form. Safety issues that arise during implementation of site activities will be addressed during tailgate safety meetings held daily before the workday and will be documented in the daily tailgate safety meeting form.

1.6 Public Affairs

A project-specific community relations plan is not required for this investigation. AECOM will not disclose any data resulting from the SI to the news media, the public, regulatory agencies, or any other non-project-involved personnel. Press or public contacts will be referred to the ANG Project Manager, Ms. Jody Murata.

1.7 Schedule

The following table summarizes the planned schedule for the completion of key project activities.

Table 1-1. Proposed Schedule- Stewart ANGB

Activities	Scheduled
Field Work Mobilization	Within 30 days of the approval of the Final Work Plan
Completion of the Field Work	Within 60 days of mobilization
Receipt of the Laboratory Data	30 days after demobilization
Prepare and Submit Draft PA/SI Report	90 days after receipt of the laboratory data
Prepare and Submit Draft Final PA/SI Report	60 days after receipt of review comments
Prepare and Submit Final PA/SI Report	60 days after receipt of Regulatory review comments

1.8 Data Management

Field and analytical data collected during this project are critical to site characterization efforts and the establishment of a conceptual site model (CSM). Investigation data will be recorded and maintained for future use and reporting. Logbooks and field data sheets will be used to record data collection activities. Project documentation will be collected and managed onsite during the field activities. Field and laboratory data will be recorded and entered into a computerized submission format in accordance with NGB/A70 Policy Letter A70 10-01 (NGB, 2010) and the Environmental Resources Program Information Management System (ERPIMS) Data Loading Handbook.

Field and laboratory data will be recorded and entered into a computerized submission format in accordance with NGB/A70 Policy Letter A70 10-01 (NGB, 2010) and the Environmental Resources Program Information Management System (ERPIMS) Data Loading Handbook. The field and analytical laboratory data required to complete Group 1, 2 and 3 data tables and satisfy ERPToolsX field, record and submission data validity requirements will be collected including:

- Sample site information
- Soil boring/sample location coordinates (latitude, longitude, elevation)
- Lithology/stratigraphy/hydrogeology

- Temporary/permanent groundwater monitoring well construction details
- Field tests (e.g., water level, temperature, pH, specific conductivity, turbidity)
- Sample type (e.g., normal, field QC), matrix, sampling method, collection date/time, depth interval
- Sample handling, preparation and analyses
- Sample results (analyte concentrations, dilutions, data qualifiers, method reporting/detection limits)

Samples collected during the SI will be analyzed by TriMatrix Laboratories using methods identified in the UFP-QAPP (Appendix B). Sample collection, data analysis, and data reporting are addressed in the Tier II UFP QAPP (Appendix B). GIS data will be compliant with the latest USACE and ANG spatial data requirements.

1.9 SI Report

AECOM will prepare a Draft, Draft Final, and Final SI Report for Stewart ANGB to the ANG Program Manager, Ms. Jody Murata, and the USACE Baltimore Corps, Mr. Riadh Hossain. The SI Report will be comprehensive describing the site history and source of COPC, site setting, current and future land use, scope of project investigation activities, investigation results and updated CSM, the rationale and data used to arrive at conclusions/recommendations concerning contaminants, and the QA/QC procedures utilized to check assumptions and verify findings. Detailed maps of the site including areas of concern, site boundaries, structures and other site-specific details will be provided. The SI Report will compile and analyze site data in a clear and concise manner as well as provide defensible justifications for recommendations.

Major elements of the SI Report will include:

EXECUTIVE SUMMARY
1.0 INTRODUCTION
2.0 INSTALLATION DESCRIPTION
3.0 ENVIRONMENTAL SETTING
4.0 FIELD PROGRAM
- 4.1 General Approach
- 4.2 Geophysical Surveys
- 4.3 Temporary Well/ Groundwater Samples
- 4.4 Soil Borings
- 4.5 Groundwater Sampling (low flow discussion)

5.0 INVESTIGATION RESULTS
- 5.1 Hydraulic Lifts in Building 208
  - 5.1.1 Field activities
  - 5.1.2 Investigation Results
- 5.2 Pesticides in MW-1
  - 5.2.1 Field activities
  - 5.2.2 Investigation Results
- 5.3 Investigation-Derived Waste Management
- 5.4 Deviations from the Work Plan

6.0 CONCLUSIONS
7.0 RECOMMENDATIONS
8.0 REFERENCES
APPENDICES (as warranted)
- APPENDIX A: BORING/WELL/PIEZOMETER LOGS
- APPENDIX B: TEMPORARY WELL CONSTRUCTION DIAGRAMS
- APPENDIX C: ANALYTICAL REPORTS
- APPENDIX D: FIELD CHANGE REQUEST FORMS
- APPENDIX E: DATA PACKAGE
- APPENDIX F: INVESTIGATION-DERIVED WASTE MANAGEMENT (Data Tables, Correspondence, etc.)
- APPENDIX G: CHAIN-OF-CUSTODY

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2 Site Description

This section describes the topography and site conditions for Stewart ANGB.

2.1 Site Topography and Drainage

Stewart ANGB is located at Stewart International Airport in the city of Newburgh, Orange County, southeastern New York State. The New York Air National Guard (NYANG) currently leases the approximately 268-acre property, which consists of Parcels 1, 3, 4, 5 and a power line right of way, from the New York Department of Transportation.

The installation is located in the Hudson-Champlain Lowland of the Valley and Ridge Province. The property is relatively flat with significant downward slopes to the south and east. Surface elevations range from 440 to 450 feet above mean sea level throughout the majority of the installation, to a low of 340 feet along the eastern property line and 400 feet along the southern property line (AFCEE, 2002).

Surface water runoff flows in an east and southeast direction. Runoff is moderately high due to the large amount of impermeable surfaces (e.g., aircraft parking apron) and predominantly glacial till soil types. Two stormwater lagoons collect runoff from the installation and discharge to the Recreation Pond, which discharges to Silver Stream and Modna Creek that both lie in the Hudson River drainage basin. Additional runoff flows eastward to wetlands in the vicinity of Murphy's Gulch, which is a tributary of the Hudson River (AFCEE, 2002).

2.2 Site Geology/Hydrogeology

The bedrock beneath Stewart ANGB is predominantly thinly bedded and fractured Martinsburg Shale, which is part of the Normanskill Formation, occurring at depths between 45 and 50 feet bgs near the base. Overlying the shale is a weathered shale-rock zone. The unconsolidated deposits overlying the weathered rock zone are primarily a dense, gray, fine sand and silty glacial till, which contain numerous pebbles, cobbles, and boulders.

Soil types at Stewart ANGB have been mapped by the Natural Resources Conservation Service (NRCS, 2013). The soil type primarily present at the area of the installation addressed by this PA/SI Work Plan is the Udorthants, smoothed. These soils are well to moderately well drained level areas consisting of gravelly, sandy loam, with the original soil surface altered by filling, excavation or grading activities.

The surficial aquifer at Stewart ANGB consists of a uniform glacial till deposit over the shale bedrock. The shallow portion of the bedrock aquifer that lies beneath the installation is confined by the glacial till. The Normanskill Formation and underlying bedrock have very low permeability and yield low volumes of groundwater.

Groundwater at the site is approximately 30 feet bgs and flows from the northwest to the southeast. Three possible modes of groundwater transport through two hydrogeologic units have been identified onsite:

- Perched water moving horizontally along top of the bedrock, primarily through a weathered rock zone at a rate of about 1.6 feet/year.
- Vertical and horizontal movement through pores in the sandier zones of a glacial till unit overlying the bedrock, at a rate of approximately 13 feet/year.
- Vertical and horizontal movement along fractures in the till unit.

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3 Site History

In 1930, Samuel L. Stewart donated a total of 1,552 acres to the city of Newburgh to create the Stewart Municipal Airport. In 1941, the field became part of West Point US Military Academy and underwent runway extensions and barracks construction. In 1942, the facility was activated as the US Army Air Forces Basic-Advance flying school for West Point pilots. In 1947, Stewart Municipal Airport was turned over to the Air Force who operated the facility as Stewart Air Force Base until 1969.

In 1970, Stewart Air Force Base was deactivated and the aviation facilities were turned over to the State of New York and operated by the New York Metropolitan Transit Authority. The State of New York added an additional 8,600 acres and a 4.7-mile long buffer zone to the original 1,552-acre facility creating Stewart International Airport.

In 1983, operation of the airport was transferred from the New York Metropolitan Transit Authority to the New York Department of Transportation. At this time, the NYANG 105th Tactical Air Support Group relocated from Westchester County Airport and occupied the 267-acre facility at Stewart International Airport. After various aircraft and mission changes (including conversion to the C-5 Galaxy), the unit assumed their current name of the 105th Airlift Wing in 1995.

The primary mission of the 105th Airlift Wing at Stewart ANGB is to provide peacetime and wartime inter-theater airlift operations using the Boeing C-17 Globemaster III, which replaced the C-5 Galaxy phased out in 2011.

Operations related to aircraft maintenance include corrosion control, non-destructive inspection, minor painting, fuel cell maintenance, engine maintenance, avionics repair, hydraulics, washing, and wheel and tire maintenance. Ground-vehicle maintenance operations include fluid changes (e.g., oil, transmission, antifreeze, etc.), filter changes (fuel, oil, transmission, air, etc.), brake repair, lube, grease and repair of axle and drive trains, body repair, welding, minor painting, and washing.

To support the activities listed above, aircraft and vehicle maintenance facilities are active and involve the use, storage, and disposal of hazardous materials including petroleum, oil, lubricants, acids, paints, thinners, strippers, and solvents (AFCEE, 2002).

Two AOCs have been identified at the Base:

- Hydraulic Lifts in Building 208
- Pesticides in facility monitoring well, MW-1

The AOCs are presently not included in any remediation program. The operational history, previous investigations and recommendations for each AOC are discussed in Section 5 of this Work Plan.

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4 Preliminary Pathway Evaluation

The purpose of the preliminary pathway evaluation is to identify the migration pathways and evaluate available data, including potential contamination sources, potential hazardous waste quantity, contamination concentrations, and potential targets. The proposed scope of work (see Section 5) has been developed to address data gaps identified in the preliminary pathway evaluation.

4.1 Groundwater Pathway

Groundwater in the Stewart International Airport area is used for public water supply purposes. There are 13 domestic water supply wells within a 1-mile radius of the base, as summarized below in Table 4-1 (AFCEE, 2002). None of the wells are located directly downgradient of the AOCs identified for this PA/SI Work Plan.

The town of New Windsor provides water service to Stewart ANGB and vicinity and obtains water from Lake Washington (AFCEE, 2002).

Table 4-1. Public Water Supply Well Information

Wells/Affiliation	Distance and direction from site	Potentiometric Location	Well Depth (ft.)
1-Newburgh Country Club	<0.1 mile WSW	Upgradient	Unknown
1-Unknown	0.25 mile NW	Upgradient	119
1-Unknown	<0.1 mile SSE	Downgradient	119
2-Jones Motor Company	0.25 mile ESE	Downgradient	Unknown
5-Mt Airy Trailer Court	0.25 mile SSW	Upgradient	Unknown
3-Newburgh City	0.335 mile SSW	Downgradient	Unknown

4.2 Surface Water Pathway

A detailed description of site topography and drainage is located in Section 2.1 of this work plan. While surface runoff into the Recreation Pond is a possibility, potential impacts to surface water from operations at Stewart ANGB are considered negligible for the purpose of this PA/SI Work Plan

4.3 Soil Exposure and Air Migration Pathways

A detailed site description is provided in Section 2 of this work plan. In addition, the future land-use map for Orange County indicates that the area around the site is zoned both residential (population in 2012 is estimated to be 374,512) and commercial. Therefore, if soil contamination exists, the soil exposure and air migration pathway may be of concern at the site (U.S. Department of Commerce, 2013).

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5 Preliminary Assessment

AECOM conducted the PA at Stewart ANGB on 14 November 2013 to review available information, evaluate current site conditions and develop recommendations for additional site investigation activities or NFA. This effort was based on findings from the Trip Report conducted by BB&E in 2011 (BB&E, 2011) and the Environmental Baseline Survey completed in 2002 (AFCEE, 2002).

Table 5-1 below is a list of persons interviewed during the PA.

Table 5-1. Points of Contact: Stewart ANGB

Name	Position	Phone	E-mail Address	Mailing Address
Jody Murata	ANG Program Manager	240-612-8120	Jody.Murata@ang.af.mil	NGB/A7OR Shepperd Hall 3501 Fetchet Avenue Joint Base Andrews, MD 20762-5157
SSgt Adam Watley	Base Environmental Support	845-563-2383	Adam.watley@ang.af.mil	Stewart ANGB 105 AW/EM One Maguire Way Newburg, NY 12550-5075
Capt. Ray Pifer	Base Civil Engineer	845-563-2702	ray.pifer@ang.af.mil	Stewart ANGB 105 AW/EM One Maguire Way Newburg, NY 12550-5075
Maj Nicolas Caputo	Base Environmental Manager	845-563-2366	nicolas.caputo@ang.af.mil	Stewart ANGB 105 AW/EM One Maguire Way Newburg, NY 12550-5075
Veronica Allen	BB&E Senior Environmental Engineer	248-489-9636 ext 304 (o) 248.212.7770 (c)	vallen@bbande.com	235 East Main Street Suite 107 Northville, MI 48167
Mark MacEwan	Project Manager	703-706-0133 (o) 202-375-9353 (c)	Mark.MacEwan@aecom.com	675 N. Washington Street Suite 300 Alexandria, VA 22314
John Santacroce	Task Manager	518-951-2265	John.Santacroce@aecom.com	40 British American Boulevard, Latham, NY 12110
Greta White	AECOM Site Manager	518-951-2341	Greta.White@aecom.com	40 British American Boulevard, Latham, NY 12110

Locations of the two AOCs identified during the PA are shown on Figure 5-1 (Appendix A). Their status and recommendations are discussed below. AOC identifications and recommendations are summarized on Table 5-2.

5.1 Regulatory Framework

For the purposes of the SI Report, soil and groundwater analytical testing results will be screened against Applicable or Relevant and Appropriate Requirements (ARARs) and other regulatory criteria including:

- New York State Department of Environmental Conservation (NYSDEC) Commissioner Policy (CP)-51, Soil Cleanup Guidance

- NYSDEC Technical & Operational Guidance Series (TOGS), 1.1.1 Ambient Water Quality Standards and Guidance Values
- EPA maximum contaminant levels (MCLs) for drinking water
- EPA regional screening levels (RSLs) for residential soil and tap water

If evidence of a release is identified at any of the AOCs, a spill case number will be opened and administered under the NYSDEC Spills Division. To obtain a NFA letter, chemical concentrations in soil must meet the soil cleanup objectives listed in the NYSDECs CP-51. Chemical concentrations in groundwater must also meet the groundwater standards in TOGS 1.1.1.

Direct push technology (DPT) will be utilized to collect soil cores for logging and sampling and to collect groundwater samples as described in Section 6 (SI Field Operations). Recommended sample analyses are based on the NYSDEC CP-51/Soil Cleanup Guidance (NYSDEC, 2010), and TOGs 1.1.1 (NYSDEC, 2004).

Rotary drilling techniques will also be used to collect split spoon soil samples and install permanent 2-inch groundwater monitoring wells where lithological conditions (e.g., tight glacial till) preclude the use of DPT.

5.2 AOC-Hydraulic Lifts in Building 208 (TU004)

5.2.1 Previous Investigations

Two hydraulic lifts were previously located in Building 208. One lift was reported to be leaking in 2005 but was repaired and put back in service. The second hydraulic lift was removed in 2010. There were no reports of leaks or signs of contamination identified during the removal of the second lift or the repair of the first. During the November 2013 site visit, a considerable volume (approximately 700 gallons) of hydraulic fluid/water mix were observed in the pit of the remaining lift possibly as the result of a fire that occurred in the building in January 2011. The oil/water fluid has since been removed from the lift pit and less than 15 gallons of hydraulic fluid was measured in the recovered material.

5.2.2 Recommendations

Sampling data and documentation for lift removal or leak repair are not available; therefore, soil and groundwater will be sampled and analyzed to evaluate potential impacts from released hydraulic fluid. Four DPT soil borings will be conducted at Building 208: two near the former lift location and two near the existing lift. Borings will be advanced to the water table, which is anticipated to be approximately 30 feet bgs.

A minimum of two soil samples will be collected at each boring location. Samples will be collected from the most impacted depth interval based on field observations including photoionization detector (PID) readings, odor or evidence of staining. If no impacts are noted, the sample will be collected from the 6 to 8 foot depth interval coinciding with the bottom of the lift pits. An additional sample will be collected from the soil/groundwater interface. Each soil sample will be analyzed for volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). An attempt will be made to collect one DPT groundwater sample from each lift location for VOCs and SVOCs analyses. If groundwater cannot be accessed using DPT, rotary drilling techniques will be used to install a 2-inch PVC monitoring well with a 10-foot screened interval bracketing the water table downgradient of the lifts and outside of building 208. See Figure 5-2 for the proposed boring locations.

5.3 AOC-Pesticides in MW-1 (SS005)

5.3.1 Previous Investigations

Elevated concentrations of chlorinated pesticides (i.e., 4,4'-DDD) have been detected in monitoring well MW-1, located hydraulically upgradient of Installation Restoration Program (IRP) Site 2, which was a former pesticide disposal burial pit that has been remediated. Well MW-1 is not considered to have been impacted from IRP Site 2 activities. The source of pesticide concentrations in MW-1 is unknown.

Obvious source areas were not identified during the November 2013 site visit. It was noted that two monitoring wells currently exist hydraulically upgradient of MW-1, which may be sampled under future tasking pending the findings of the PA/SI.

5.3.2 Recommendations

Since MW-1, located hydraulically upgradient of IRP Site 2, is not considered to have been impacted by IRP Site 2 activities, and the source(s) of the pesticide concentrations in the well are unknown, soil and groundwater in the vicinity of MW-1 should be sampled and analyzed to evaluate potential impacts from released pesticides. Three soil borings will be conducted around well MW-1 to evaluate and delineate potential sources of pesticides. The boring will be located approximately 25 feet from the well.

Two soil samples will be collected at each boring location: one from the 0 to 4 foot depth interval and one from the depth interval immediately above the soil/groundwater interface. Based on water levels measured at MW-1, groundwater is expected between 30 and 40 feet bgs. Each soil sample will be analyzed for the previously detected chlorinated pesticides, including 4,4'-DDT, 4,4'-DDD, and 4,4'-DDE.

One two-inch diameter PVC groundwater monitoring well with a 10-foot screened interval bracketing the water table (anticipated depth between 30 and 45 feet bgs) will be installed at each of the three borings using rotary drilling. Upon completion, development and surveying of the wells, groundwater samples will be collected and analyzed for pesticides along with MW-1. Groundwater sampling events will be conducted quarterly (total of four events) over a one-year period to evaluate trends and seasonal variability. See Figure 5-3 for the proposed boring and monitoring well locations.

5.4 Summary

Table 5-2 outlines the findings of the PA including recommendations and rationale for additional investigations at two AOCs. The field sampling approach for the additional investigation activities is summarized in Section 6.

Table 5-2. Summary of the Preliminary Assessment

AOC ID Code	Site Description (EESOH-MIS)	Recommendation	Rationale
208	AOC- Hydraulic Lifts in Building 208 (TT004)	Site Investigation	Based on information obtained during the PA, sampling data and closure documentation for hydraulic lift removal and repair do not appear to be available.
MW-1	AOC-Pesticides in MW-1 (SS005)	Site Investigation	Sources of pesticides in vicinity of MW-1 are unknown.

EESOH-MIS Enterprise Environmental Safety and Occupational Health-Management Information System Site Identification

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6 SI Field Operations

This section describes the SI field activities proposed for the two AOCs at Stewart ANGB as summarized in Table 6-1. The field investigation operations consist of site preparation activities including the mobilization/demobilization of field team personnel and equipment, utility clearance, DPT and rotary drilling subsurface soil and groundwater sampling for contaminants including VOCs, SVOCs, and pesticides. Specific details concerning sampling activities and analytical methodology are presented in the UFP-QAPP (Appendix B). Health and safety requirements for SI field activities are provided in the APP (Appendix C).

Table 6-1: Sampling Program

AOC ID Code	Site Description (EESOH-MIS)	Estimated Number of Borings	Depth of Borings (ft. bgs)	Analysis Required	Figure Showing Sampling Locations
208	AOC-Hydraulic Lifts in Building 208 (TU004)	4	30	**Soil:** 8 samples - VOCs & SVOCs **Groundwater:** 4 samples - VOCs & SVOCs	Figure 5-2
MW-1	AOC-Pesticides in MW-1 (SS005)	3	45	**Soil:** 6 samples - Pesticides **Groundwater:** 4 samples – Pesticides x 4 quarterly sampling events	Figure 5-3

6.1 Site Preparation

The site preparation activities for the SI field investigation operations include mobilization/ demobilization of field team personnel and equipment. No vegetation clearance is planned during field investigation activities; rather the field team will work around existing site vegetation.

6.2 Personnel Qualifications

All personnel mobilized to the site will meet applicable Occupational Safety and Health Administration training including hazardous waste operations and emergency response (HAZWOPER) training and medical surveillance requirements as specified in the APP (Appendix C).

6.3 Permits and Notifications

Utility clearance will be conducted by Stewart ANGB. AECOM will coordinate with the Base Civil Engineer to complete the utility clearance request (AF Form 103) and contact Dig Safe New York to obtain a dig permit 30 days before site activities begin. There are no permit requirements for conducting the proposed fieldwork.

6.4 Sample Identification

The sample identification number will consist of an alphanumeric designation related to the installation, site, event, media type, and consecutive number, according to the following conventions:

Installation: **Stewart ANGB**

Site: **ST-xxx** = **St**ewart. Note: **xxx** = site identification (AOC ID) codes are located in Table 6-1

Media Type: **SB** = **S**u**b**surface Soil, **GW** = **G**round**w**ater

Consecutive Number: 01, 02, 03, etc.

Depth: Depth below ground surface

Sample Type: D for duplicate

The sample identification numbers for the first subsurface soil and groundwater samples at AOC-Hydraulic Lifts in Building 208 will be ST-208-SB01 and ST-208-GW01, respectively. Duplicate sample identification numbers will be followed with a “D”.

Trip blank (TB) and equipment blank (EB) QC samples will be identified as follows:

Trip Blanks = ST-TB-date (mmddyr)
Equipment Blanks = ST-EB-date (mmddyr)

6.5 Analyses

Samples will be analyzed for VOCs by EPA Method 8260C, SVOCs by EPA Method 8270D, and pesticides by EPA Method 8081B as indicated in Table 6-1. Samples will be shipped to TriMatrix Laboratories, LLC, a Department of Defense (DoD) Environmental Laboratory Accreditation Program that is experienced in handling environmental samples, holds a New York state certifications to perform the analytical methods required, and meets DoD Installation Restoration QA Program requirements (Certificates of Accreditation provided in Appendix E). The laboratory will provide analytical results within 30 days of sample receipt. Data validation/review will be conducted on laboratory results in accordance with procedures specified in the QAPP.

6.6 Subsurface Soil Sampling- DPT

Soil samples will be collected via DPT. A track mounted DPT rig will be used where access is restricted such as in buildings. A GeoProbe® DT325 dual-tube sampling system (or equivalent) will be used to collect continuous soil cores to the target depth. Borings will be advanced to depths up to 45 feet bgs, or to probe refusal, whichever occurs first. If refusal is encountered before the desired depth of sample location, one attempt will be made adjacent to the original location to collect a soil sample below the depth of refusal. Soil cores will be collected in disposable 2.1-inch outer diameter 60-inch long thin-walled clear poly-vinyl chloride (PVC) tube liners.

Continuous soil sampling will be accomplished by advancing a 5-foot (60-inch) coring barrel fitted with dedicated, disposable PVC liners. The soil core will be screened for VOCs immediately upon opening the sleeve with a PID utilizing an 11.7 electron-Volt bulb. Details regarding the air monitoring procedures and specific action levels are provided in the APP. The soils from the core will be screened with the PID in open air and after containerizing in a plastic zipper bag. The soil core will be logged for lithological descriptions by a field geologist. Observations and measurements will be recorded on a soil boring log. Photographs will also be taken of the boring cores. At a minimum, depth interval, recovery thickness, PID concentrations, moisture, relative density, color (using a Munsell soil color chart), and texture [using the Unified Soil Classification System (USCS)] will be recorded. Additional observations to be recorded may include detectable odors, groundwater or perched water depth, organic material, cultural debris, or color changes indicating staining.

Subsurface soil samples will be collected from each direct push location as specified in Section 5. Generally, a minimum of two soil samples will be collected from each boring in accordance with ANG 2009 Investigation Guidance. Samples will be collected at depth intervals where field screening or observations indicate the potential presence of contaminants, and from above the soil/groundwater interface. VOC samples will be collected using a sampling corer (Terra Core or equivalent) and in accordance with SOP 3-21 (see Appendix D).

Each sample will be collected into laboratory-supplied glassware and submitted to the laboratory for analysis of selected parameters. The laboratory method detection limits for these analytes are presented in the Tier II UFP-QAPP (Attachment B). Samples will be packaged on ice and transported daily via overnight commercial carrier under standard chain-of-custody procedures to the laboratory.

Field duplicate samples will be collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. Matrix spike and matrix spike duplicates will be collected at the rate of 5% and analyzed for the same parameters as the accompanying samples. Trip blanks will accompany each cooler containing samples for VOC analysis and will be analyzed for select VOCs. Equipment blanks will not be prepared or analyzed unless a deviation from this plan requires sample handling using non-dedicated equipment. If non-dedicated sampling equipment is used, an equipment blank will be collected and will be analyzed for the same analytes as the soil samples. A temperature blank shall be placed in each cooler to ensure that samples are preserved at or below four degrees Celsius during shipment.

DPT borings will be abandoned at completion of sampling activities. Borings in grass will be abandoned by backfilling with bentonite chips. Borings in asphalt or concrete shall be abandoned by backfilling with bentonite chips to approximately 6 inches bgs, and the remainder of the borehole will be patched with asphalt cold patch or hydraulic concrete. The surface will be restored at each location to match the surrounding area.

6.7 Groundwater Sampling- DPT

Groundwater samples will be collected using DPT methodology through temporary well points, or a GeoProbe® discrete interval, screen point sampler (or equivalent). The borehole for a temporary well will be created using a GeoProbe® DT325 dual-tube sampling system (or equivalent). Once the hole has been pushed to depth, a 10-foot section of 1-inch Schedule 40 PVC screen will be installed in the borehole with sufficient casing to reach ground surface. Temporary wells will be installed at boring locations at AOC-Hydraulic Lifts in Building 208 with depths up to 30 feet bgs. If refusal is encountered before the desired depth of sample location, one attempt will be made adjacent to the original location to collect a groundwater sample below the depth of refusal. Filter sand will be placed in the annulus surrounding the well screen to a depth of 1 foot above the top of screen. A 2-foot thick bentonite seal will be placed above the filter sand and hydrated with distilled water. Following installation, the temporary wells will be allowed to equilibrate with the surrounding formation until they contain a sufficient amount of water to fill the required sample containers.

The GeoProbe® discrete interval, screen point sampler consists of a 1.625-inch outer diameter, 51.5-inch long steel sheath equipped with an expendable steel drive point, which contains a retractable 41-inch long stainless-steel screen. The DPT sampler and tool string is driven to the desired depth interval, retracted approximately 44-inches to release the expendable drive point, and the screen is deployed into the groundwater using an internal push rod.

Samples will be collected via low-flow sampling methods using bladder pumps or peristaltic pumps with disposable tubing (See SOP 3-37, Appendix D). Groundwater samplers will be decontaminated between boring locations, as warranted (See SOP 3-06, Appendix D).

Each sample will be collected into laboratory-supplied glassware and submitted to the laboratory for analysis of selected parameters. The laboratory method detection limits for these analytes are presented in the UFP-QAPP, Attachment B to this work plan. Samples will be packaged on ice and transported daily via overnight commercial carrier under standard chain-of-custody procedures to the laboratory (See SOP 3-04, Appendix D).

Field duplicate samples will be collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. Matrix spike and matrix spike duplicates will be collected at the rate of 5% and analyzed for the same parameters as the accompanying samples. Trip blanks will accompany each cooler containing samples for VOC analysis and will be analyzed for select VOCs. Equipment blanks will not be prepared or analyzed unless a deviation from this plan requires sample handling using non-dedicated equipment. If non-dedicated sampling equipment is used, an equipment blank will be collected and will be analyzed for the same analytes as the groundwater samples. A temperature blank shall be placed in each cooler to ensure that samples are preserved at or below four degrees Celsius during shipment.

6.8 Monitoring Well Installation

If warranted by the subsurface conditions that preclude the use of DPT, rotary drilling will be used to collect soil samples and install groundwater monitoring wells (See SOP 3-12, Appendix D). Soil borings will be advanced using 4.25-inch inner diameter hollow-stem augers, and 2-inch diameter x 4-foot long split spoon samplers (or equivalent) will be used to collect continuous soil cores from the surface to the final depth. Soil lithology and other observations will be recorded as described in Section 6.6. Split spoon samplers will be decontaminated prior to collecting the next sample, and augers will be decontaminated between boring locations (See SOP 3-06, Appendix D). Soil sample collection and handling, and IDW management will be conducted as described in Sections 6.6 and 6.10, respectively.

Monitoring wells will be installed inside the drill stem at selected boring locations and constructed using 2-inch diameter, schedule 40 PVC riser tubing with flush joined threads. The riser tubing will be connected at the bottom to the appropriate length of PVC slotted screen, with an opening width of 0.010 inches. Monitoring well screen intervals will bracket the water table with a 10-foot section of screen on the bottom of the casing down to the maximum boring depth as determined by field observation. A sand-cement (1:1 ratio by weight) grout will be placed into the borehole up to 4 feet below the proposed screen bottom elevation. Bentonite pellets will be placed in the borehole up to 1 foot below the proposed screen bottom elevation. Sand (e.g., Morie Sand No. 1) will then be placed and compacted with a tamping hammer of suitable size and weight to ensure that no bulking of sand or voids occurs. Sand will be placed up to the bottom of the screen, the screen then installed, and then more sand placed and compacted to 1 foot minimum above the top elevation of the screen. A 4-foot thick bentonite seal will be placed above the sand envelope, using 3/8-inch bentonite pellets. The annular space between the ground and the riser tubing will be backfilled with a sand-cement-bentonite grout.

Surface protection for the monitoring wells will be flush-mount, bolt-down manholes embedded in 2-foot square, concrete pads. The protective surface casing will extend below the ground surface and be set in concrete at least 4 inches thick around the perimeter of the casing. The surface of the concrete seal will be placed in a manner that will prevent standing water from accumulating in the vicinity of the surface casing. The monitoring well number will be marked permanently and legibly on the casing. Well installation logs will be prepared that will contain the following:

- Well number, date, and time
- Subcontractor, driller and drill crew Superintendent, inspector
- Coordinates, and ground and top of casing elevations (established by others)
- Well construction details showing borehole diameter, type and length of riser casing, location and type of annular seal and screen pack, type and length of well screen
- Depth of bottom of screen
- Depth of groundwater table
- Method and time of well development

Newly installed groundwater monitoring wells will be developed no sooner than 24 hours after installation to allow for grout curing. Monitoring wells will be developed by pumping in accordance with the procedures outlined in SOP 3-13 (Appendix D) until clear water appears. The subcontractor will continue pumping clear water for at least five minutes following the time that the return water appears clear of mud, or as directed by the Field Supervisor. No sediment will remain in the bottom of the well. The development equipment will be decontaminated before use (See SOP 3-06, Appendix D). Well sampling will be conducted in accordance with SOP 3-14 (Appendix D). Sample collection and handling, and IDW management (i.e. development water) will be conducted as described in Section 6.7.

6.9 Groundwater Sampling- Permanent Wells

Permanent groundwater monitoring wells will be sampled in accordance with AECOM SOP 3-14 (Appendix D). Samples will be collected via low-flow sampling methods using bladder pumps or peristaltic pumps with disposable tubing. Groundwater samplers will be decontaminated between boring locations, as warranted (See SOP 3-06, Appendix D). Sample collection and handling, and IDW management will be conducted as described in Section 6.6.

6.10 IDW Management

Investigation Derived Waste (IDW) generated during SI activities (e.g., decontamination water, excess soil) will be containerized in 55-gallon drums. IDW will be sampled and characterized for waste profiling and the results returned within one week. The IDW will be labeled and stored within the fenced in area of the facility until it is disposed of by a licensed disposal subcontractor within 30 days of demobilization. IDW will be managed in accordance with ANG Policy 05-1 for IDW (ANG, 2009). AECOM will be responsible for arranging transportation and disposal of the IDW.

6.11 Documentation

The field logbook will serve as the primary record of field sampling activities. Entries will be made chronologically and in sufficient detail to allow the writer or a knowledgeable reviewer to reconstruct each day's events (See SOP 3-02, Appendix D).

7 References

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Air Force Center for Environmental Excellence (AFCEE). 2002. Environmental Baseline Survey 105th Airlift Wing, New York Air National Guard, Stewart International Airport, Newburgh, New York. 2 November.

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Appendix A

Figures

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CONTRACT NO 60308608	Stewart Air National Guard Base	AECOM
CARTOGRAPHY BY A. Weber	Figure 1-1 Stewart Air National Guard Base Vicinity Map Newburgh, New York	
CHECKED BY M. Donahue / DATE December 2013		
SCALE 1" = 900' / SHEET 1 of 1		
Fig_1-1_Stewart_ANGB_Vicinity.mxd		

Source: Esri, 2013; Bing Maps, 2011

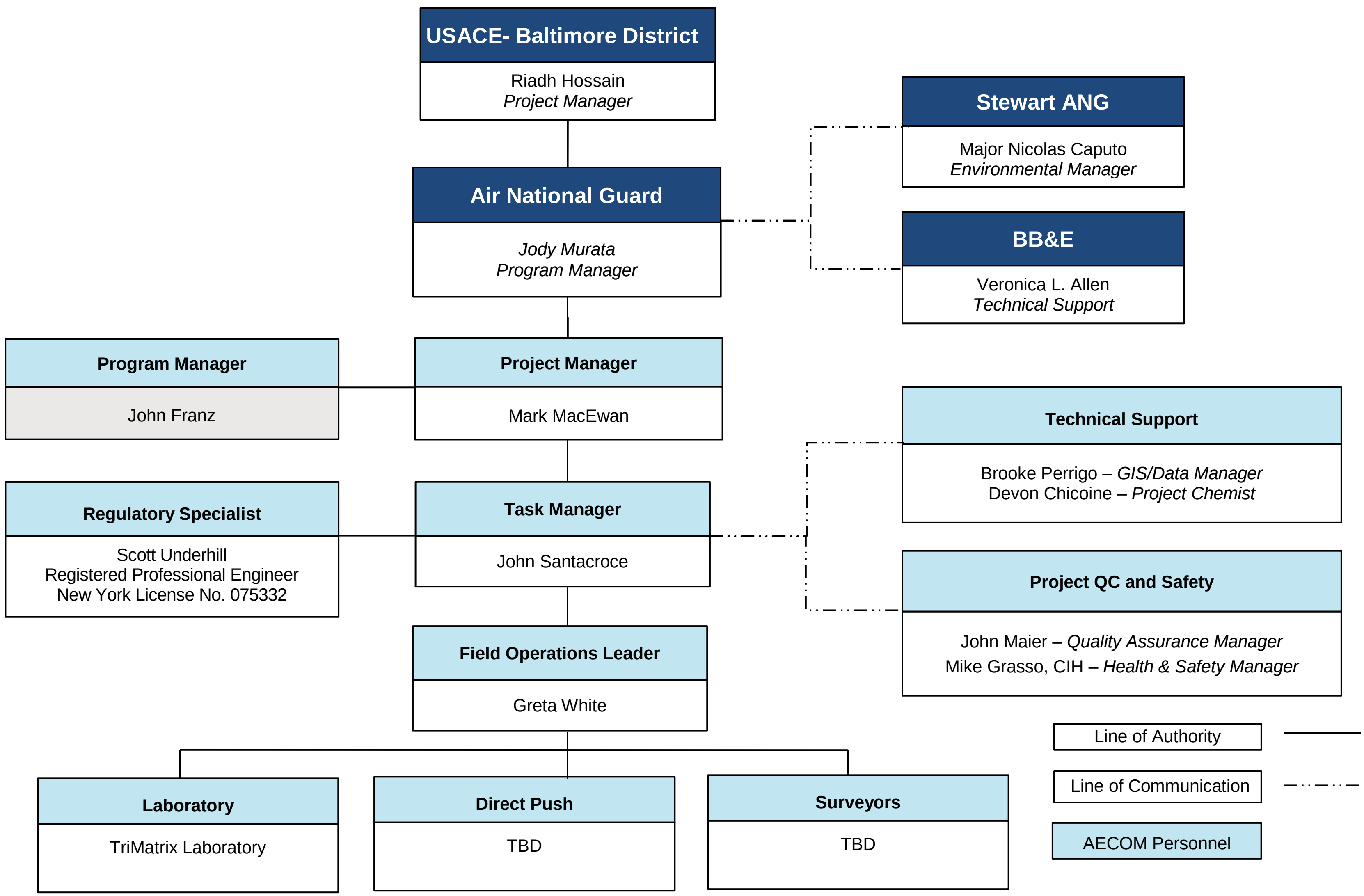

Figure 1-2: Organization Chart

CONTRACT NO 60308608	Stewart Air National Guard Base	AECOM
CARTOGRAPHY BY A. Weber	Figure 5-1 Stewart Air National Guard Base Areas of Concern Locations Newburgh, New York	
CHECKED BY M. Donahue; DATE December 2013		
SCALE 1" = 500'; SHEET 1 of 1		
Fig_5-1_Stewart_ANGB_AOC.mxd		

Source: Bing Maps, 2011

CONTRACT NO 60308608	Stewart Air National Guard Base	AECOM
CARTOGRAPHY BY A. Weber	Figure 5-2 Stewart Air National Guard Base AOC-Hydraulic Lifts in Building 208 SI Sampling Locations Newburgh, New York	
CHECKED BY M. Donahue; DATE December 2013		
SCALE 1" = 30'; SHEET 1 of 1		
Fig_5-2_Stewart_Sampling_ Locations_AOC-208.mxd		

Source: Bing Maps, 2011

CONTRACT NO 60308608	Stewart Air National Guard Base	AECOM
CARTOGRAPHY BY A. Weber	Figure 5-3 Stewart Air National Guard Base AOC-Pesticides in MW-1 SI Sampling Locations Newburgh, New York	
CHECKED BY M. Donahue; DATE December 2013		
SCALE 1" = 40'; SHEET 1 of 1		
Fig_5-3_Stewart_Sampling_ Locations_AOC-MW1.mxd		

Source: Bing Maps, 2011

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Appendix B

Tier II UFP-QAPP

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APPENDIX B
TIER II QUALITY ASSURANCE PROJECT PLAN

DRAFT FINAL

Regional Compliance Restoration Program
Preliminary Assessment/Site Investigation
Stewart Air National Guard Base
Newburgh, New York

QAPP WORKSHEET #1 – TITLE AND APPROVAL PAGE

DRAFT FINAL QUALITY ASSURANCE PROJECT PLAN
Stewart ANGB

February 2014

Revision: 0

Regional Compliance Restoration Program
Preliminary Assessment/Site Inspection at
Multiple Air National Guard Installations Northeast

Prepared for:

US Army Corps of Engineers
10 South Howard Street
Room 10000-S
Baltimore, MD 21201-2505

Prepared by:

AECOM
675 North Washington Street
Suite 300
Alexandria, VA 22314

Prepared under:

Contract Number: W912DR-09-D-0014
Task Order: 0001

Review Signatures:

John Santacroce
Task Manager

____
Signature Date

Devon Chicoine
Project Chemist

____
Signature Date

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EXECUTIVE SUMMARY

This Tier II Quality Assurance Project Plan (QAPP) has been prepared by AECOM to support the proposed Preliminary Assessment (PA)/Site Inspection (SI) at the Stewart Air National Guard Base (ANGB), Newburgh, New York. This QAPP is intended to ensure that environmental data collected and compiled are scientifically sound, of known and documented quality, and suitable for intended uses. This work is being done under the US Army Corps of Engineers (USACE), Baltimore District, Contract W912DR-09-D-0014, Task Order 0001, for the Air National Guard (ANG).

This QAPP is Appendix B to the PA/SI Work Plan. The USACE and the ANG are following the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process for the investigations at Stewart ANG.

With the concurrence of the USACE, this Tier II QAPP was developed based on guidance from the current version of the Department of Defense (DoD) Quality Systems Manual (QSM) and the Uniform Federal Policy (UFP) for Implementing Environmental Quality Systems. It consists of text and selected UFP worksheets containing detailed procedures/methods for sampling and analyses including the associated quality assurance/quality control (QA/QC) methods used during the environmental investigation process, and serves as a guideline for the field activities and data quality assessment.

The PA/SI involves the following areas of concern (AOCs) at Stewart ANG:

AOC- Hydraulic Lifts in Building 208 (TU004)

AOC-Pesticides in Monitoring Well MW-1 (SS005)

Contaminants of potential concern (COPCs) may be present at the AOCs from past operations. However, environmental sampling to evaluate potential impacts from COPC releases or closure documentation for decommissioned facilities are not available. The objective of this SI to evaluate the presence and to further define the nature and extent of COPCs at the facility AOCs listed above.

This objective will be accomplished by performing the following field and laboratory activities: 1) site preparation activities including the mobilization/demobilization of field team personnel and equipment; 2) utility clearance for subsurface investigations; 3) sampling and analyses of soil and groundwater to evaluate potential impacts from released COPCs; and 4) documentation of sampling locations and conditions. The results of the SI field investigation will be used to determine if a response action or remedial investigation is appropriate for any of the AOCs.

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CONTENTS

ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
ANG	Air National Guard
ANGB	Air National Guard Base
APP	Accident Prevention Plan
BB&E	BB&E Consulting Engineers and Professionals
CAS	Chemical Abstract Service
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chain of Custody
COPC	Contaminant of Potential Concern
CRP	Compliance Restoration Program
DoD	Department of Defense
DIUF	Deionized Ultra-Filtered
DL	Detection Limit
DPT	Direct Push Technology
DQI	Data Quality Indicator
DQO	Data Quality Objective
EB	Equipment Blank
EDD	Electronic Data Deliverable
EPA	Environmental Protection Agency
ERPIMS	Environmental Resources Program Information Management System
GC	Gas Chromatography
GIS	Geographic Information System
IDW	Investigation-derived Waste
IS	Internal Standards
LCS	Laboratory Control Sample
LOD	Limit of Detection
LOQ	Limit of Quantitation
MB	Method Blank
MCL	Maximum Contaminant Level
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MPC	Measurement Performance Criteria
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MW	Monitoring Well
PA	Preliminary Assessment
PAL	Project Action Limit
PID	Photo Ionization Detector
PPE	Personal Protective Equipment
PQOs	Project Quality Objectives
PVC	Polyvinyl chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSM	Quality Systems Manual
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
RSL	Regional Screening Levels
SD	Standard Deviation

SI	Site Investigation
SOP	Standard Operating Procedure
SVOC	Semivolatile Organic Compounds
TB	Trip Blank
TBD	To Be Determined
UFP	Uniform Federal Policy
µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter
USACE	United States Army Corps of Engineers
VOC	Volatile Organic Compounds
WP	Work Plan
WS	Worksheet

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QAPP WORKSHEET #3 – DISTRIBUTION LIST

Name of QAPP Recipients	Title/Role	Organization	Telephone Number (Optional)	E-mail Address or Mailing Address	Document Control Number (Optional)
Riadh Hossain	Project Manager	USACE-Baltimore District	410-962-2342	Riadh.hossain@usace.army.mil	N/A
Jody Murata	Program Manager	ANG	240-612-8120	Jody.murata@ang.af.mil	N/A
Maj Nicolas Caputo	Environmental Manager	Stewart ANG	845-563-2366	nicolas.caputo@ang.af.mil	N/A
Mark MacEwan	Program Manager	AECOM	703-706-0133	Mark.macewan@aecom.com	N/A
John Santacroce	Task Manager	AECOM	518-951-2265	john.santacroce@aecom.com	N/A
Michael Grasso, CIH	Health and Safety Manager	AECOM	607-277-5716	michael.grasso@aecom.com	N/A
Devon Chicoine	Project Chemist	AECOM	703-739-4723	devon.chicoine@aecom.com	N/A
Greta White	Field Team Leader	AECOM	518-951-2200	greta.white@aecom.com	N/A
Brooke Perrigo	Geographic Information System (GIS)/Data Manager	AECOM	703-706-0138	brooke.perrigo@aecom.com	N/A
Phil Komar	Laboratory Manager	TriMatrix	616-846-9528	komarp@trimatrixlabs.com	N/A

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QAPP WORKSHEET #5 – PROJECT ORGANIZATIONAL CHART

The organization chart is Figure 1-2 located in Appendix A of the Work Plan.

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QAPP WORKSHEET #6 – COMMUNICATION PATHWAYS

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Army Point of Contact	USACE Project Manager	Riadh Hossain	410-962-2342	AECOM will submit all formal deliverables to Riadh Hossain.
Air National Guard	ANG Program Manager	Jody Murata	240-612-8120	All materials and information about the project will be forwarded to the ANG Program Managers by Riadh Hossain.
Manages Project Phases	AECOM Project Manager	Mark MacEwan	703-706-0133	Mark MacEwan is AECOM's liaison to USACE Project Manager. Notifies USACE Project Manager of field related QA/QC problems by phone or email by close of business (COB) the next business day.
Manages Installation Activities	AECOM Task Manager	John Santacroce	518-951-2265	Notify Project Manager by phone and email of changes and obtain approval within 2 working days.
Real time modification, notification, and approval	AECOM QA Officer	John Maier	703-706-0548	Notify Task Manager by phone and email of changes and obtain approval within 2 working days.
QAPP changes in the field	AECOM Field Team Leader	Greta White	518-951-2200	Notify QA Officer by phone and email of changes within COB the same day.
Daily Field QC Reports	AECOM Field Team Leader	Greta White	518-951-2200	E-mail daily QC reports to Project Manager.
Field sampling activities coordination with laboratory	AECOM Project Chemist	Devon Chicoine	703-706-0544	The Project Chemist will contact the laboratory by e-mail to order the necessary sample containers and appropriate shipping for delivery on site before field sampling begins and throughout the project.
Daily COC reports and shipping documentation	AECOM Field Team Leader	Greta White	518-951-2200	Chain of custodies (COCs) and shipping records will be submitted via fax or e-mail to the Project Chemist at the end of each day that samples are collected.
Sample shipment coordination with laboratory	AECOM Field Team Leader	Greta White	518-951-2200	Coordinate with the laboratory on days of sample shipment to inform it of anticipated shipment arrival dates, including number of coolers shipped. Provide laboratory with COCs, shipment tracking numbers, and any other pertinent information.
Laboratory results	TriMatrix Laboratory Project Manager	Phil Komar	616-846-9528	Laboratory results will be reported to the Project Chemist in accordance with the laboratory SOW.

WORKSHEET #6 COMMUNICATION PATHWAYS (CONTINUED)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Reporting laboratory data quality issues	TriMatrix Laboratory Project Manager	Phil Komar	616-846-9528	QA/QC issues that potentially affect data usability will be reported by the Laboratory Project Manager to the Project Chemist by e-mail within 1 business day.
Field and analytical corrective actions	AECOM Project Chemist	Devon Chicoine	703-706-0544	The Project Chemist will immediately notify the Project Manager and Program QC Manager by e-mail of field or analytical procedures that were not performed in accordance with the planning documents. The Project Chemist, in coordination with the Program QC Manager, will complete documentation of the nonconformance, and corrective actions to be taken. The Project Chemist will verify that the corrective actions have been implemented.
Release of analytical data	AECOM Project Chemist	Devon Chicoine	703-706-0544	The Project Chemist will review faxed/e-mailed data to verify that data quality objectives are met as described in the planning documents before the data are released.
Sampling procedure revision during field activities	AECOM Field Team Leader	Greta White	518-951-2200	The Field Team Leader will prepare a field change request for any changes in sampling procedures that occur because of conditions in the field. This request will be submitted to the Project Manager for approval prior to initiation of the change.
Data usability	AECOM Project Chemist and Field Team Leader	Devon Chicoine / Greta White	703-706-0544 / 518-951-2200	The Project Chemist will notify the Project Manager of any data usability issues that are identified during data analysis or validation immediately. Similarly, the Field Team Leader will notify the Project Manager of any field conditions, sample collection techniques, or sample shipping issues that impact data usability at the end of the same day of occurrence or earlier as deemed appropriate.

WORKSHEET #6 COMMUNICATION PATHWAYS (CONTINUED)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Corrective action, audit, findings, and management review records	AECOM QA Officer	Devon Chicoine	703-706-0544	Problems or audit findings indicating QAPP not being properly implemented will be reported to Megan Donahue within 24 hours of problem notation.
QAPP Amendments Approval	ANG Program Manager	Jody Murata	240-612-8120	Any changes to the QAPP that would impact the project specific DQOs must be approved by USACE before changes can be implemented.

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QAPP WORKSHEET #9 – PROJECT SCOPING SESSION PARTICIPANTS SHEET

There was no formal project scoping session associated with this project. The information presented below was ascertained from the SI Kickoff Meeting and the Site visit and is therefore provided for information purposes.

Project Name: Regional Compliance Restoration Program (CRP) Preliminary Assessment/Site Inspection (PA/SI) Projected Date(s) of Sampling: Spring 2014				Site Name: Stewart ANG Site Location: Newburgh, New York	
Date of Session: 14 November 2013 **Scoping Session Purpose: SI Kickoff Meeting and Site Visit**					
Name	**Title**	**Affiliation**	**Phone #**	**E-mail Address**	**Project Role**
Jody Murata	Program Manager	ANG	240-612-8120	jody.murata@ang.af.mil	Project Management
Veronica Allen	Senior Environmental Engineer	BB&E	248-489-9636 ext 304	vallen@bbande.com	Technical Support
Maj Nicolas Caputo	Environmental Manager	Stewart ANG	845-563-2366	nicolas.caputo@ang.af.mil	Installation Contact
John Santacroce	Task Manager	AECOM	518-951-2265	john.santacroce@aecom.com	Installation Task Manager
Greta White	Geologist	AECOM	518-951-2200	greta.white@aecom.com	Field Team Leader

AECOM conducted the PA at Stewart ANG on 14 November 2013 to evaluate whether the sites proposed for investigation should be investigated or should be recommended for No Further Action. Locations of the two AOCs are shown in Figure 5-1 (Appendix A) and the results of PA are discussed in Section 5 of the Work Plan. This QAPP will only address sites that have been proposed for additional investigation.

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QAPP WORKSHEET #10 – CONCEPTUAL SITE MODEL

Historic operations of hydraulic lifts and a former pesticide burial pit area, which have been closed, may have resulted in the release of COPCs (e.g., hydraulic fluid, organochlorine pesticides) from the two AOCs identified at Stewart ANG to subsurface soil and groundwater.

Groundwater Pathway

Groundwater in the Stewart International Airport area (where Stewart ANG is located) is used for public water supply purposes. There are ten domestic water supply wells within a 1-mile radius of the base, as summarized in Table 4-1 of the Work Plan (AFCEE, 2002). None of the wells are located directly downgradient of the AOCs identified for this PA/SI Work Plan.

The town of New Windsor provides water service to Stewart ANG and vicinity and obtains water from Lake Washington (AFCEE, 2002).

Surface Water Pathway

A detailed description of site topography and drainage is located in Section 2.1 of the Work Plan. While surface runoff into the Recreation Pond is a possibility, potential impacts to surface water from operations at Stewart ANG are considered negligible for the purpose of this SI.

Soil Exposure and Air Migration Pathways

A detailed site description is provided in Section 2 of the Work Plan. In addition, the future land-use map for Orange County indicates that the area around the site is zoned both residential (population in 2012 is estimated to be 374,512) and commercial. Therefore, if soil contamination exists, the soil exposure and air migration pathway may be of concern at the site (U.S. Department of Commerce, 2013).

QAPP WORKSHEET #11 – PROJECT QUALITY OBJECTIVES/SYSTEMATIC PLANNING PROCESS STATEMENTS

1. State the Problem (Step 1)

Potential releases of COPCs to the environment may have occurred during historic operations at the following AOCs:

AOC- Hydraulic Lifts in Building 208 (TU004)

AOC-Pesticides in MW-1 (SS005)

There are no available sampling data or closure documents to confirm that COPCs were not released to the environment at Building 208. In addition, the source of organochlorine pesticides detected in MW-1 is unknown. The environmental questions being answered by this project include:

- Did past operations at any of the AOCs result in the environmental release of COPCs?
- If so, are the concentrations of the released COPCs above specified screening criteria for soil and groundwater?

2. Identify the Goal of the Study (Step 2)

Evaluate from a CERCLA-release perspective, the environmental presence of COPCs at the identified AOCs and the potential for their migration. Recommendations for further investigation will be developed for AOCs where COPCs are detected above Project Action Levels (PALs), which are based on specified screening criteria for unrestricted use. No further action will be recommend for AOCs where COPCs are not detected above PALs.

For Stewart ANG, the PALs are based on the most stringent of the following screening criteria:

Soil: New York State Department of Environmental Conservation (NYSDEC), Commissioner Policy (CP-51) / Soil Cleanup Guidance, 21 October 2010, or USEPA Regional Screening Levels (RSL) for Residential Soil (November 2013).

Groundwater: USEPA Maximum Contaminant Levels (MCLs), and either NYSDEC Technical & Operational Guidance Series (TOGS), 1.1.1 Ambient Water Quality Standards and Guidance Values, June 1998, April 2000 Addendum, June 2004 Addendum, or USEPA Regional Screening Level for Tapwater (November 2013).

3. Identify information inputs (Step 3)

Soil and groundwater samples will be collected at each AOC as defined in the Work Plan and analyzed for the COPCs based on CP-51 and TOGS guidance. The COPCs include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs) and organochlorine pesticides.

4. Define the boundaries of the study (Step 4)

Spatial boundaries: The initial sampling activities will be limited to the identified sampling locations at each AOC.

Temporal boundaries: The temporal boundaries for this study will be the period of the actual field investigation, anticipated to occur in the spring of 2014. There are no seasonal variations anticipated to affect this investigation.

5. Develop the analytical approach (Step 5)

VOC, SVOC, and pesticide analyses methods and their respective PALs for soil and groundwater matrices are provided in Worksheet #15. VOC, SVOC, and pesticide analyses data will be evaluated against their respective PALs for use in the following project decisions:

- If the concentrations of COPCs in soil and groundwater at a particular AOC are all below their respective PALs, a no further action determination will be recommended with respect to an environment release.
- If the concentrations of COPCs in soil or groundwater at a particular AOC are above a PAL, recommendations for potential further action at that location including the selection of revised PALs and, if warranted, additional site investigation and COPC delineation will be developed.

6. Specify performance or acceptance criteria (Step 6)

The objective of this section is to complete the following:

- Identify potential sources of study error (i.e., field error, analytical error)
- Establish and identify the methods used to reduce potential sources of error
- Determine how decision errors will be managed during the project

Sampling Strategy: The SI sampling design was developed to detect COPCs that may have been released to the environment (soil and groundwater) at the AOCs at Stewart ANG as the result of historic releases.

Sources of Error: Sources of error in the SI may be divided into two main categories: sampling errors and measurement errors. A sampling error occurs when the sampling design, planning, and implementation do not provide for a representative range of heterogeneity at the site. A measurement error occurs because of performance variance from laboratory instrumentation, analytical methods, and operator error. The EPA identifies the combination of all these errors as a "total study error" (USEPA 2006). One objective of the investigation is to reduce the total study error so that decision-makers can be confident that the data collected accurately represent the chemical characteristics of the site.

Managing Decision Error: The investigation will utilize decision-error minimization techniques in sampling design, sampling methodologies, and laboratory measurement of mercury. Possible decision errors will be minimized during the field investigation by using the following methods:

- Use standard field sampling methodologies.
- Use applicable analytical methods for sample analysis by a competent analytical laboratory certified by the DoD Environmental Laboratory Accreditation Program (ELAP) to reduce measurement errors.
- Confirm analytical data to identify and control potential laboratory error and sampling error by using spikes, blanks, and replicated samples.

Decision errors associated with judgmental sampling are based on sample design and measurement errors. Assuming that the best possible professional judgment was used to develop the judgmental sampling plan (i.e., position sampling locations), the most important decision errors will be associated with field and laboratory techniques involved in the collection and analysis of the data.

Sampling Methodologies and Procedures: Possible decision errors generated by sampling errors will be minimized during the field investigation by applying standardized field sampling methodologies (discussed on Worksheets #14 and #21). Sampling activities will be performed in accordance with the Standard Operating Procedures (SOPs) specified in this SAP.

Laboratory Measurement of VOC, SVOC and Pesticides: Possible decision errors generated by laboratory measurement errors will be minimized by using applicable analytical methods (discussed on Worksheet #23) for sample analysis by a competent analytical laboratory evaluated and certified by the DoD ELAP.

Managing Laboratory Sampling Error: Control of potential laboratory error and sampling error will be minimized using spikes, blanks, and duplicates. Sampling error may be introduced when the laboratory chemist selects a single portion of the field sample for laboratory analysis. However, this issue is less relevant to the discrete sampling approach as sub-sampling is generally not implemented at the laboratory.

7. Develop the plan for obtaining data (Step 7)

The sampling design for the site was developed to optimize resources and generate data to satisfy the PALs. Details of the sampling design and rationale are provided on Worksheet #17 and sample locations and analysis conducted at each location are identified on Worksheet #18.

Field Data Logs: All sample information will be transcribed into a field logbook and/or onto field data sheets, as described in SOP 3-02.

Analytical Laboratory Sample Management: The sample matrix, number of samples, and number and type of laboratory quality assurance/quality control (QA/QC) samples are summarized on Worksheets #18 and 20. Details on the analytical group, sample volumes, sample container specifications, preservation requirements, and maximum holding times are summarized on Worksheet #19.

The laboratory will provide full electronic data deliverable files, portable document format (PDF) files of the data deliverables for project data, and a hard copy of data deliverables for results including results from secondary subcontract laboratories. Designated samples will be used to obtain necessary subsamples for laboratory QC measurements (i.e., analytical sample duplicate and sample matrix spike/matrix spike duplicate [MS/MSD]). Tasks will be completed using the laboratory SOPs summarized on Worksheet # 23.

AECOM will provide data validation services and verify and evaluate the usability of the data as identified on Worksheets #34 - 36: Verification and Validation (Steps I and IIA/IIB) Process Table.

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QAPP WORKSHEET #12 – MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix Soil
Concentration Level Low

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria
Trip Blank (VOCs only)	VOCs, SVOCs, Pesticides	One per cooler containing VOC samples	Bias/Accuracy	No analytes detected > ½ RL and >0 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants (acetone and methylene chloride), no analytes detected > RL
Equipment Rinsate Blank [1]		One per twenty samples per matrix per type of sampling equipment used	Bias/Accuracy	No analytes detected > ½ RL and >0 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants (acetone and methylene chloride), no analytes detected > RL
Cooler Temperature Blank		One per cooler	Accuracy/ Representativeness	Temperature Cool to ≤ 6 degrees Celsius.
Field Duplicate		One per ten samples per matrix	Precision	Relative Percent Difference (RPD) ≤ 20% if both results are ≥5 x LOQ
Matrix Spike/Matrix Spike Duplicate		Submitted: One per twenty samples per matrix (Analyzed: One per ten samples per matrix)	Bias/Accuracy/ Precision (lab)	RPD ≤ 20%; Recovery 80-120%

Notes:

(1) = If dedicated or disposable equipment is used to collect samples then equipment blank will not be collected.

Matrix Groundwater
Concentration Level Low

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria
Trip Blank (VOCs only)	VOCs, SVOCs, Pesticides	One per cooler containing VOC samples	Bias/Accuracy	No analytes detected > ½ RL and >0 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants (acetone and methylene chloride), no analytes detected > RL
Equipment Rinsate Blank [1]		One per twenty samples per matrix per type of sampling equipment used	Bias/Accuracy	No analytes detected > ½ RL and >0 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants (acetone and methylene chloride), no analytes detected > RL
Cooler Temperature Blank		One per cooler	Accuracy/ Representativeness	Temperature Cool to ≤ 6 degrees Celsius.
Field Duplicate		One per ten samples per matrix	Precision	RPD ≤ 20% if both results are ≥5 x LOQ
Matrix Spike/Matrix Spike Duplicate		Submitted: One per twenty samples per matrix (Analyzed: One per ten samples per matrix)	Bias/Accuracy/ Precision (lab)	RPD ≤ 20%; Recovery 80-120%

Notes:

(1) = If dedicated or disposable equipment is used to collect samples then equipment blank will not be collected.

QAPP WORKSHEET #14 – SUMMARY OF PROJECT TASKS

Project-specific SOPs and Field Forms for field tasks referenced in this worksheet are identified by title in Worksheet #21 and copies of each SOP are provided in Appendix D of the Work Plan. The field tasks are as follows:

- Mobilization/Demobilization
- Investigation Derived Waste Management
- Sample Collection and Sample Handling Tasks
- Monitoring Equipment Calibration
- Land Surveying
- Soil/Groundwater Sampling
- Monitoring Well Installation and Sampling
- Field Documentation Procedures
- Quality Control Tasks
- Additional Project-Related Tasks

Mobilization/Demobilization

Mobilization will consist of the delivery of equipment, materials, and supplies to the site, complete assembly (in satisfactory working order) of equipment at the site, and secure storage at the site of materials and supplies, along with the acquisition of personnel and vehicle base access badges. The Field Team Leader or designee will coordinate with the Stewart ANG point of contact to identify appropriate locations for the temporary storage of equipment and supplies. Site-specific health and safety training for field personnel and subcontractors will be conducted as part of site mobilization.

Demobilization will consist of the prompt and timely removal of equipment, materials, and supplies from the site following completion of the work. Demobilization also includes the cleanup and removal of waste generated during the performance of the investigation. .

IDW Management

Investigation Derived Waste (IDW) generated during SI activities (e.g., decontamination water, excess soil) will be managed in accordance with ANG Policy 05-1 for IDW (ANG, 2009) and consistent with SOP 3-05 located in Attachment D of the Work Plan. IDW will be containerized in 55-gallon drums. IDW will be sampled and characterized for waste profiling and the results returned within one week. The IDW will be labeled and stored within the fenced in area of the facility until it is disposed of by a licensed disposal subcontractor within 30 days of demobilization. AECOM will be responsible for arranging transportation and disposal of the IDW.

Sample Collection and Sample Handling Tasks

The sampling and analysis program is outlined in Worksheets 10 and 18. Sample collection and handling will be in accordance with the SOPs listed in Worksheet 21. Sample labeling will be in accordance with SOP-3-03. Methods for sample handling will be in accordance with SOP-3-04. Sample containers will be provided in "certified-clean" condition (I-Chem 300 or equivalent) from the analytical laboratory. The selection of sample containers, sample preservation, packaging, and shipping will be in accordance with SOP-3-04.

Monitoring Equipment Calibration

Field equipment will be calibrated in accordance with manufacturer's guidance by the Field Operations Leader or designee. Documentation of the field equipment calibration is required. Field equipment will be calibrated at the beginning and end of each day, unless otherwise stated by the equipment manufacturer (See SOP 3-20).

Land Surveying

Land surveying activities will be performed by a Professional Land Surveyor at the site and the background locations to locate, mark, and acquire coordinates and elevations of sampling locations and pertinent site features. Land-surveying activities will be conducted after collection of the soil/groundwater samples. Coordinates of surveyed locations will be referenced to the North American Datum 1983 and/or the Universal Transverse Mercator World Geodetic System.

Soil/Groundwater Sampling

Subsurface soil samples will be collected using direct push technology (DPT) in accordance with SOP 3-17, SOP-3-21. All soil samples will be collected as discrete grab samples. Any visual signs of potential contamination (such as soil staining) will be noted in the log book. Groundwater samples will be collected from temporary monitoring wells installed using DPT and in accordance with SOP-3-17

Monitoring Well Installation and Sampling

Groundwater monitoring wells will be installed using rotary drilling in accordance with SOP 3-12. Monitoring wells will be installed inside the drill stem at selected boring locations and constructed using 2-inch diameter, schedule 40 poly-vinyl chloride (PVC) riser tubing with flush joined threads. The riser tubing will be connected at the bottom to the appropriate length of PVC slotted screen, with an opening width of 0.010 inches. Monitoring well screen intervals will bracket the water table with a 10-foot section of screen on the bottom of the casing down to the maximum boring depth as determined by field observation. A sand-cement (1:1 ratio by weight) grout will be placed into the borehole up to 4 feet below the proposed screen bottom elevation. Bentonite pellets will be placed in the borehole up to 1 foot below the proposed screen bottom elevation. Sand (e.g., Morie Sand No. 1) will then be placed and compacted with a tamping hammer of suitable size and weight to ensure that no bulking of sand or voids occurs. Sand will be placed up to the bottom of the screen, the screen then installed, and then more sand placed and compacted to 1 foot minimum above the top elevation of the screen. A 4-foot thick bentonite seal will be placed above the sand envelope, using 3/8-inch bentonite pellets. The annular space between the ground and the riser tubing will be backfilled with a sand-cement-bentonite grout.

Surface protection for the monitoring wells will be flush-mount, bolt-down manholes embedded in 2-foot square, concrete pads. The protective surface casing will extend below the ground surface and be set in concrete at least 4 inches thick around the perimeter of the casing. The surface of the concrete seal will be placed in a manner that will prevent standing water from accumulating in the vicinity of the surface casing. The monitoring well number will be marked permanently and legibly on the casing.

Newly installed groundwater monitoring wells will be developed no sooner than 24 hours after installation to allow for grout curing. Monitoring wells will be developed by pumping in accordance with the procedures outlined in SOP 3-13 (Appendix D) until clear water appears. The subcontractor will continue pumping clear water for at least five minutes following the time that the return water appears clear of mud, or as directed by the Field Supervisor. No sediment will remain in the bottom of the well. The development equipment will be decontaminated before use (See SOP 3-06, Appendix D). Well sampling will be conducted in accordance with SOP 3-14 (Appendix D). Sample collection and handling, and IDW management (i.e. development water) will be conducted as described in Section 6.7 of the Work Plan.

<u>Field Documentation Procedures</u>

Field documentation will be performed in accordance with SOP-3-02. Matrix-specific sample log sheets will be maintained for each sample collected. In addition, sample collection information will be recorded in bound field notebooks. Samples will be packaged and shipped according to SOP-3-04.

A summary of field activities will be properly recorded in indelible ink in a bound logbook with consecutively numbered pages that cannot be removed. If an incorrect entry is made, striking a single line through the incorrect information will make the correction; and the person making the correction will initial and date the change. Logbooks will be assigned to field personnel and stored in a secured area when not in use. Boring logs, sampling forms, and other field forms will also be used to document field activities.

Boring logs, sampling forms, well installation logs, and other field forms will also be used to document field activities.

<u>Quality Control Tasks</u>

QC samples including trip blanks, equipment blanks, field duplicates and matrix spike/matrix spike duplicates will be collected at frequencies listed in Worksheets #12 and #20.

<u>Additional Project-Related Tasks</u>

Additional project-related tasks include:

- Analytical Tasks
- Data Management
- Data Tracking
- Data Storage, Archiving, and Retrieval
- Data Security

Electronic Data

- Data Review
- Project Reports

<u>Analytical Tasks</u>

Chemical analyses will be performed by TriMatrix Laboratories, which is a current Department of Defense (DoD) Environmental Laboratory Accreditation Program-accredited laboratory for these analyses. Copies of the pertinent laboratory accreditations are included in Appendix E of the SI Work Plan. Analyses will be performed in accordance with the analytical methods identified in Worksheets 19 and 30. TriMatrix Laboratories will meet the screening criteria specified in Worksheet #15 and will perform the chemical analyses following the laboratory-specific SOPs identified in Worksheet 23. Copies of the Laboratory SOPs are available upon request.

The analytical data packages provided by TriMatrix Laboratories will be in a Contract Laboratory Program-like format and will be fully validatable and contain raw data, summary forms for sample and laboratory method blank data, and summary forms containing method-specific QC information (results, percent recoveries [%Rs], RPDs, relative standard deviations [RSDs], percent differences or percent drifts [%Ds], etc.).

Data Management

The principal data generated for this project will be from field data and laboratory analytical data. The field logbooks for this project will be categorized and maintained in the project files after the completion of the field program. The field logbooks will be titled based on date and activity. The data handling procedures to be followed by TriMatrix Laboratories will meet the requirements of DoD and AECOM's technical specifications. The Chemist (or designee) is responsible for the overall tracking and control of data generated for the project.

Data Tracking

Data are tracked from generation to archiving in the AECOM project-specific files. The Project Chemist (or designee) is responsible for tracking the samples collected and shipped to TriMatrix Laboratories. Upon receipt of the data packages from TriMatrix Laboratories, the AECOM Project Chemist will monitor the data validation effort, which includes verifying that the data packages are complete and results for all samples have been delivered by TriMatrix Laboratories.

Data Storage, Archiving, and Retrieval

The data packages received from TriMatrix Laboratories are tracked in the data validation logbook. After the data are validated, the data packages are entered into the AECOM file system and archived in secure files. The field records including field log books, sample logs, chain-of-custody records, and field calibration logs will be submitted by the Field Team Leader to be entered into the AECOM file system prior to archiving in secure project files. Project files are audited for accuracy and completeness. At the completion of the contract, the records will be stored by AECOM.

Data Security

Access to AECOM project files is restricted to designated personnel only. Records can only be borrowed temporarily from the project file using a sign-out system. The AECOM Data Manager maintains the electronic data files, and access to the data files is restricted to qualified personnel only. File and data backup procedures are routinely performed.

Electronic Data

Field and laboratory data will be recorded and entered into a computerized submission format in accordance with NGB/A70 Policy Letter A70 10-01 (NGB, 2010) and the Environmental Resources Program Information Management System (ERPIMS) Data Loading Handbook. The field and analytical laboratory data required to complete Group 1, 2 and 3 data tables and satisfy ERPToolsX field, record and submission data validity requirements will be collected including:

- Sample site information
- Soil boring/sample location coordinates (latitude, longitude, elevation)
- Lithology/stratigraphy/hydrogeology
- Temporary/permanent groundwater monitoring well construction details
- Field tests (e.g., water level, temperature, pH, specific conductivity, turbidity)
- Sample type (e.g., normal, field QC), matrix, sampling method, collection date/time, depth interval
- Sample handling, preparation and analyses
- Sample results (analyte concentrations, dilutions, data qualifiers, method reporting/detection limits)

Data Review

Data validation (Level IV) will be conducted on laboratory results.

Project Reports

All data will be presented in the SI Report.

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QAPP WORKSHEET #15 – REFERENCE LIMITS AND EVALUATION TABLE

Matrix: Soil
Analytical Group: VOCs

Analyte	CAS Number	Project Action Limit	Project Action Limit Reference	Laboratory-specific Quantitation Limits		
				LOQ (µg/kg)	LOD (µg/kg)	DL (µg/kg)
Acetone	67-64-1	50	CP-51	15	5	1.73
Benzene	71-43-2	60	CP-51	1	0.2	0.048
Bromobenzene	108-86-1	300	N-RSL	2	0.2	0.14
Bromochloromethane	74-97-5	160	N-RSL	1	0.5	0.113
Bromodichloromethane	75-27-4	0.27	C-RSL	1	0.2	0.0613
Bromoform	75-25-2	62	C-RSL	2	0.2	0.105
Bromomethane	74-83-9	7.3	N-RSL	4	0.2	0.0696
n-Butylbenzene	104-51-8	3900	N-RSL	1	0.5	0.127
sec-Butylbenzene	135-98-8	7800	N-RSL	2	0.5	0.12
tert-Butylbenzene	98-06-6	5900	CP-51	2	0.2	0.054
Carbon Disulfide	75-15-0	820	N-RSL	1	0.2	0.12
Carbon Tetrachloride	56-23-5	0.61	C-RSL	2	0.2	0.11
Chlorobenzene	108-90-7	290	N-RSL	1	0.2	0.0504
Chloroethane	75-00-3	15000	N-RSL	2	1	0.26
Chloroform	67-66-3	0.29	C-RSL	1	0.2	0.0665
Chloromethane	74-87-3	120	N-RSL	1	1	0.233
2-Chlorotoluene	95-49-8	1600	N-RSL	1	0.2	0.064
4-Chlorotoluene	106-43-4	1600	N-RSL	1	0.5	0.182
1,2-Dibromo-3-chloropropane	96-12-8	0.0054	C-RSL	5	1	1
Dibromochloromethane	124-48-1	0.68	C-RSL	1	0.2	0.12
1,2-Dibromoethane	106-93-4	0.034	C-RSL	3	0.2	0.092
Dibromomethane	74-95-3	25	N-RSL	3	0.5	0.119

Analyte	CAS Number	Project Action Limit	Project Action Limit Reference	Laboratory-specific Quantitation Limits		
				LOQ (µg/kg)	LOD (µg/kg)	DL (µg/kg)
1,2-Dichlorobenzene	95-50-1	1900	N-RSL	1	0.5	0.173
1,3-Dichlorobenzene	541-73-1	N/A	N/A	1	0.2	0.0536
1,4-Dichlorobenzene	106-46-7	2.4	C-RSL	1	0.2	0.0504
Dichlorodifluoromethane	75-71-8	94	N-RSL	2	1	0.264
1,1-Dichloroethane	75-34-3	3.3	C-RSL	2	0.2	0.0897
1,2-Dichloroethane	107-06-2	0.43	C-RSL	1	0.5	0.114
1,1-Dichloroethene	75-35-4	240	N-RSL	2	0.2	0.0846
cis-1,2-Dichloroethene	156-59-2	160	N-RSL	1	0.2	0.0509
trans-1,2-Dichloroethene	156-60-5	150	N-RSL	1	0.5	0.123
1,2-Dichloropropane	78-87-5	0.94	C-RSL	3	0.2	0.095
1,3-Dichloropropane	142-28-9	1600	N-RSL	2	0.2	0.054
2,2-Dichloropropane	594-20-7	N/A	N/A	1	0.2	0.0557
1,1-Dichloropropene	563-58-6	N/A	N/A	2	0.2	0.0586
cis-1,3-Dichloropropene	10061-01-5	N/A	N/A	1	0.2	0.0923
trans-1,3-Dichloropropene	10061-02-6	N/A	N/A	3	0.2	0.2
Ethylbenzene	100-41-4	5.4	C-RSL	1	0.2	0.2
Hexachlorobutadiene	87-68-3	6.2	C-RSL	3	0.5	0.144
2-Hexanone	591-78-6	210	N-RSL	10	1	0.254
Isopropylbenzene	98-82-8	2100	N-RSL	1	0.2	0.0851
4-Isopropyltoluene	99-87-6	N/A	N/A	1	0.2	0.0536
Methylene Chloride	74-87-3	120	N-RSL	15	1	0.34
2-Butanone (MEK)	78-93-3	300	CP-51	10	1	0.915
4-Methyl-2-pentanone (MIBK)	108-10-1	5300	N-RSL	10	0.5	0.129
Naphthalene	91-20-3	3.6	C-RSL	5	0.2	0.0809
n-Propylbenzene	103-65-1	3400	N-RSL	1	0.2	0.0764

Analyte	CAS Number	Project Action Limit	Project Action Limit Reference	Laboratory-specific Quantitation Limits		
				LOQ (µg/kg)	LOD (µg/kg)	DL (µg/kg)
Styrene	100-42-5	6300	N-RSL	1	0.2	0.0846
1,1,1,2-Tetrachloroethane	630-20-6	1.9	C-RSL	1	0.5	0.12
1,1,2,2-Tetrachloroethane	79-34-5	0.56	C-RSL	2	0.2	0.0621
Tetrachloroethene	127-18-4	22	C-RSL	2	0.2	0.0544
Toluene	108-88-3	700	CP-51	2	0.5	0.144
1,2,3-Trichlorobenzene	87-61-6	49	N-RSL	2	0.5	0.189
1,2,4-Trichlorobenzene	120-82-1	22	C-RSL	2	0.2	0.0544
1,1,1-Trichloroethane	71-55-6	680	CP-51	2	0.2	0.0699
1,1,2-Trichloroethane	79-00-5	1.1	C-RSL	2	0.5	0.139
Trichloroethene	79-01-6	0.91	C-RSL	2	0.2	0.0594
Trichlorofluoromethane	75-69-4	790	N-RSL	2	0.2	0.0504
1,2,3-Trichloropropane	96-18-4	0.005	C-RSL	2	0.5	0.117
1,2,4-Trimethylbenzene	95-63-6	62	N-RSL	1	0.5	0.134
1,3,5-Trimethylbenzene	108-67-8	780	N-RSL	1	0.5	0.164
Vinyl Chloride	75-01-4	0.06	C-RSL	1	0.2	0.111
Xylene, Meta + Para	179601-23-1	N/A	N/A	2	1	0.227
Xylene, Ortho	95-47-6	690	N-RSL	1	0.2	0.0865

Notes:
CAS – Chemical Abstracts Service
µg/kg – micrograms per kilogram
The Project Action Limit (PAL) references for soil are: CP-51 = NYSDEC Commissioner Policy-51 Soil Cleanup Guidance or Residential RSL – USEPA Regional Screening Level for Soil (November 2013) whichever is the more stringent.
N-RSL – Noncarcinogen RSL
C-RSL – Carcinogen RSL
N/A – Not applicable

Matrix: Water
Analytical Group: VOCs

Analyte	CAS Number	Project Action Limit	Project Action Limit Reference	Laboratory-specific Quantitation Limits		
				LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
Acetone	67-64-1	50	TOGs 1.1.1	5	2	1.73
Benzene	71-43-2	5	MCL	1	1	0.319
Bromobenzene	108-86-1	5	TOGs 1.1.1	1	0.25	0.11
Bromochloromethane	74-97-5	5	TOGs 1.1.1	1	1	0.299
Bromodichloromethane	75-27-4	50	TOGs 1.1.1	1	0.5	0.122
Bromoform	75-25-2	50	TOGs 1.1.1	1	1	0.245
Bromomethane	74-83-9	5	TOGs 1.1.1	1	1	0.234
n-Butylbenzene	104-51-8	5	TOGs 1.1.1	1	0.5	0.203
sec-Butylbenzene	135-98-8	5	TOGs 1.1.1	1	1	0.229
tert-Butylbenzene	98-06-6	5	TOGs 1.1.1	1	1	0.25
Carbon Disulfide	75-15-0	720	Tapwater	5	1	0.282
Carbon Tetrachloride	56-23-5	5	MCL	1	1	0.229
Chlorobenzene	108-90-7	100	MCL	1	0.5	0.214
Chloroethane	75-00-3	5	TOGs 1.1.1	1	0.5	0.222
Chloroform	67-66-3	7	TOGs 1.1.1	1	1	0.255
Chloromethane	74-87-3	190	Tapwater	1	0.5	0.201
2-Chlorotoluene	95-49-8	180	Tapwater	1	1	0.27
4-Chlorotoluene	106-43-4	190	Tapwater	1	0.5	0.179
1,2-Dibromo-3-chloropropane	96-12-8	0.2	MCL	1	1	0.635
Dibromochloromethane	124-48-1	5	TOGs 1.1.1	1	0.5	0.139
1,2-Dibromoethane	106-93-4	0.05	MCL	1	1	0.233
Dibromomethane	74-95-3	5	TOGs 1.1.1	1	0.5	0.154
1,2-Dichlorobenzene	95-50-1	600	MCL	1	0.5	0.118
1,3-Dichlorobenzene	541-73-1	3	TOGs 1.1.1	1	0.5	0.169

Analyte	CAS Number	Project Action Limit	Project Action Limit Reference	Laboratory-specific Quantitation Limits		
				LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
1,4-Dichlorobenzene	106-46-7	75	MCL	1	0.25	0.111
Dichlorodifluoromethane	75-71-8	5	TOGs 1.1.1	1	1	0.229
1,1-Dichloroethane	75-34-3	5	TOGs 1.1.1	1	1	0.279
1,2-Dichloroethane	107-06-2	5	MCL	1	0.5	0.147
1,1-Dichloroethene	75-35-4	7	MCL	1	0.5	0.207
cis-1,2-Dichloroethene	156-59-2	70	MCL	1	0.5	0.202
trans-1,2-Dichloroethene	156-60-5	100	MCL	1	0.5	0.218
1,2-Dichloropropane	78-87-5	5	MCL	1	0.5	0.177
1,3-Dichloropropane	142-28-9	5	TOGs 1.1.1	1	0.5	0.133
2,2-Dichloropropane	594-20-7	5	TOGs 1.1.1	1	1	0.301
1,1-Dichloropropene	563-58-6	5	TOGs 1.1.1	1	1	0.27
cis-1,3-Dichloropropene	10061-01-5	0.4	TOGs 1.1.1	1	1	0.282
trans-1,3-Dichloropropene	10061-02-6	0.4	TOGs 1.1.1	1	0.5	0.145
Ethylbenzene	100-41-4	700	MCL	1	1	0.273
Hexachlorobutadiene	87-68-3	0.26	Tapwater	1	1	0.291
2-Hexanone	591-78-6	34	Tapwater	5	2	1.51
Isopropylbenzene	98-82-8	390	Tapwater	1	1	0.226
4-Isopropyltoluene	99-87-6	5	TOGs 1.1.1	1	1	0.302
Methyl tert-Butyl Ether	1634-04-4	12	Tapwater	1	0.25	0.103
Methylene Chloride	74-87-3	5	TOGs 1.1.1	1	1	0.243
2-Butanone (MEK)	78-93-3	50	TOGs 1.1.1	5	2	1.62
4-Methyl-2-pentanone (MIBK)	108-10-1	1000	Tapwater	5	2	1.44
Naphthalene	91-20-3	0.14	Tapwater	5	1	0.559
n-Propylbenzene	103-65-1	5	TOGs 1.1.1	1	0.5	0.145
Styrene	100-42-5	100	MCL	1	0.5	0.123
1,1,1,2-Tetrachloroethane	630-20-6	0.5	Tapwater	1	0.5	0.182

Analyte	**CAS Number**	**Project Action Limit**	**Project Action Limit Reference**	**Laboratory-specific Quantitation Limits**		
				LOQ (µg/L)	**LOD (µg/L)**	**DL (µg/L)**
1,1,2,2-Tetrachloroethane	79-34-5	0.066	Tapwater	1	0.5	0.217
Tetrachloroethene	127-18-4	5	MCL	1	0.5	0.16
Toluene	108-88-3	1000	MCL	1	1	0.285
1,2,3-Trichlorobenzene	87-61-6	5	TOGs 1.1.1	2	1	0.229
1,2,4-Trichlorobenzene	120-82-1	70	MCL	2	0.25	0.0713
1,1,1-Trichloroethane	71-55-6	200	MCL	1	1	0.297
1,1,2-Trichloroethane	79-00-5	5	MCL	1	0.5	0.224
Trichloroethene	79-01-6	5	MCL	1	1	0.244
Trichlorofluoromethane	75-69-4	5	TOGs 1.1.1	1	0.25	0.107
1,2,3-Trichloropropane	96-18-4	0.00065	Tapwater	1	1	0.267
1,2,4-Trimethylbenzene	95-63-6	5	TOGs 1.1.1	1	0.5	0.189
1,3,5-Trimethylbenzene	108-67-8	5	TOGs 1.1.1	1	0.5	0.199
Vinyl Chloride	75-01-4	2	MCL	1	0.5	0.135
Xylene, Meta + Para	179601-23-1	N/A	N/A	2	0.5	0.214
Xylene, Ortho	95-47-6	5	TOGs 1.1.1	1	1	0.228

Notes:
CAS – Chemical Abstracts Service
µg/L – micrograms per liter
MCL – USEPA Maximum Contaminant Level
The PAL references are MCLs, or either TOGS 1.1.1 =NYSDEC Technical and Operational Guidance 1.1.1 Ambient Water Quality Standards and Guidance Values, or Tapwater based on the USEPA Regional Screening Level for Water (November 2013), whichever is the more stringent.
N/A – Not applicable

Matrix: Soil
Analytical Group SVOC

Analyte	CAS Number	Project Action Limit	Project Action Limit Reference	Laboratory-specific Quantitation Limits		
				LOQ (µg/kg)	LOD (µg/kg)	DL (µg/kg)
Acenaphthene	83-32-9	3400	N-RSL	16.7	16.7	4.63
Acenaphthylene	208-96-8	100000	CP-51	16.7	16.7	4.17
Anthracene	120-12-7	17000	N-RSL	16.7	16.7	4.01
Benzo(a)anthracene	56-55-3	0.15	C-RSL	16.7	8.33	2.75
Benzo(a)pyrene	50-32-8	0.015	C-RSL	16.7	8.33	2.3
Benzo(b)fluoranthene	205-99-2	0.15	C-RSL	16.7	8.33	1.91
Benzo(k)fluoranthene	207-08-9	1.5	C-RSL	16.7	8.33	1.95
Benzo(g,h,i)perylene	191-24-2	100000	CP-51	16.7	8.33	1.89
Benzoic Acid	65-85-0	240000	N-RSL	167	167	69.2
Benzyl Alcohol	100-51-6	6100	N-RSL	16.7	16.7	4.61
4-Bromophenyl Phenyl Ether	101-55-3	N/A	N/A	16.7	16.7	4.04
Butyl Benzyl Phthalate	85-68-7	260	C-RSL	33.3	16.7	4
Carbazole	86-74-8	N/A	N/A	167	16.7	4.03
4-Chloro-3-methylphenol	59-50-7	6100	N-RSL	16.7	16.7	5
4-Chloroaniline	106-47-8	2.4	C-RSL	66.7	16.7	8.85
Bis(2-chloroethoxy)methane	111-91-1	180	N-RSL	16.7	16.7	4.05
Bis(2-chloroethyl) Ether	111-44-4	0.21	C-RSL	16.7	16.7	3.95
Bis(2-chloroisopropyl) Ether	108-60-1	4.6	C-RSL	16.7	6.67	3.67
2-Chloronaphthalene	91-58-7	6300	N-RSL	16.7	16.7	4.91
2-Chlorophenol	95-57-8	390	N-RSL	16.7	16.7	3.94
4-Chlorophenyl Phenyl Ether	7005-72-3	N/A	N/A	16.7	16.7	3.8
Chrysene	218-01-9	15	C-RSL	16.7	16.7	3.89
Dibenz(a,h)anthracene	53-70-3	0.015	C-RSL	16.7	8.33	1.91
Dibenzofuran	132-64-9	78	N-RSL	16.7	16.7	4.9

Analyte	CAS Number	Project Action Limit	Project Action Limit Reference	Laboratory-specific Quantitation Limits		
				LOQ (µg/kg)	LOD (µg/kg)	DL (µg/kg)
Di-n-butyl Phthalate	84-74-2	6100	N-RSL	66.7	33.3	13.5
1,2-Dichlorobenzene	95-50-1	1900	N-RSL	16.7	16.7	5.47
1,3-Dichlorobenzene	541-73-1	N/A	N/A	16.7	16.7	5.66
1,4-Dichlorobenzene	106-46-7	2.4	C-RSL	16.7	16.7	4.82
3,3´-Dichlorobenzidine	91-94-1	1.1	C-RSL	833	666	278
2,4-Dichlorophenol	120-83-2	180	N-RSL	33.3	16.7	4.08
Diethyl Phthalate	84-66-2	49000	N-RSL	16.7	6.67	4.84
2,4-Dimethylphenol	105-67-9	1200	N-RSL	167	133.3	36.3
Dimethyl Phthalate	131-11-3	N/A	N/A	16.7	16.7	4.72
4,6-Dinitro-2-methylphenol	534-52-1	4.9	N-RSL	167	66.6	21.4
2,4-Dinitrophenol	51-28-5	120	N-RSL	167	167	55.8
2,4-Dinitrotoluene	121-14-2	1.6	C-RSL	33.3	8.33	3.28
2,6-Dinitrotoluene	606-20-2	0.33	C-RSL	16.7	6.67	4.01
Di-n-octyl Phthalate	117-84-0	610	N-RSL	16.7	16.7	3.87
1,2-Diphenylhydrazine	122-66-7	0.61	C-RSL	16.7	8.33	3.36
Bis(2-ethylhexyl) Phthalate	117-81-7	35	C-RSL	33.3	16.7	11.5
Fluoranthene	206-44-0	2300	N-RSL	16.7	16.7	4.47
Fluorene	86-73-7	2300	N-RSL	16.7	16.7	4.03
Hexachlorobenzene	118-74-1	0.3	C-RSL	16.7	16.7	4.75
Hexachlorobutadiene	87-68-3	6.2	C-RSL	16.7	16.7	4.58
Hexachloroethane	67-72-1	12	C-RSL	16.7	16.7	5.01
Indeno(1,2,3-cd)pyrene	193-39-5	0.15	C-RSL	16.7	3.33	2.68
Isophorone	78-59-1	510	C-RSL	16.7	16.7	3.85
2-Methylnaphthalene	91-57-6	230	N-RSL	16.7	16.7	4.56
2-Methylphenol	95-48-7	3100	N-RSL	16.7	8.33	3.55
3+4-Methylphenol	108-39-4	3100	N-RSL	32.3	8.33	3.67

Analyte	CAS Number	Project Action Limit	Project Action Limit Reference	Laboratory-specific Quantitation Limits		
				LOQ (µg/kg)	LOD (µg/kg)	DL (µg/kg)
Naphthalene	91-20-3	3.6	C-RSL	16.7	16.7	5.6
2-Nitroaniline	88-74-4	610	N-RSL	16.7	8.33	3.58
3-Nitroaniline	99-09-2	N/A	N/A	330	33.3	16.4
4-Nitroaniline	100-01-6	24	C-RSL	330	33.3	24.5
Nitrobenzene	98-95-3	4.8	C-RSL	16.7	16.7	4.6
4-Nitrophenol	100-02-7	N/A	N/A	667	167	102
2-Nitrophenol	88-75-5	N/A	N/A	16.7	16.7	4.47
N-Nitroso-dimethylamine	62-75-9	0.0023	C-RSL	33.3	6.67	3.31
N-Nitroso-diphenylamine	86-30-6	99	C-RSL	16.7	8.33	3.44
N-Nitroso-di-n-propylamine	621-64-7	0.069	C-RSL	16.7	16.7	4.04
Pentachlorophenol	87-86-5	0.89	C-RSL	167	33.3	13.2
Phenanthrene	85-01-8	N/A	N/A	16.7	16.7	4.08
Phenol	108-95-2	330	CP-51	167	16.7	3.89
Pyrene	129-00-0	1700	N-RSL	16.7	16.7	4.31
1,2,4-Trichlorobenzene	120-82-1	22	C-RSL	16.7	16.7	4.43
2,4,6-Trichlorophenol	88-06-2	44	C-RSL	16.7	8.33	2.53
2,4,5-Trichlorophenol	95-95-4	6100	N-RSL	16.7	16.7	4.49

Notes:
CAS – Chemical Abstracts Service
µg/kg – micrograms per kilogram
The Project Action Limit (PAL) references for soil are: CP-51 = NYSDEC Commissioner Policy-51 Soil Cleanup Guidance or Residential RSL – USEPA Regional Screening Level for Soil (November 2013) whichever is the more stringent,
N-RSL – Noncarcinogen RSL
C-RSL – Carcinogen RSL
N/A – Not applicable

Matrix: Water
Analytical Group: SVOCs

Analyte	CAS Number	Project Action Limit	Project Action Limit Reference	Laboratory-specific Quantitation Limits		
				LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
Acenaphthene	83-32-9	20	TOGs 1.1.1	0.5	0.05	0.0323
Acenaphthylene	208-96-8	N/A	N/A	0.5	0.05	0.0171
Anthracene	120-12-7	50	TOGs 1.1.1	0.5	0.1	0.0615
Benzo(a)anthracene	56-55-3	0.002	TOGs 1.1.1	0.5	0.1	0.0454
Benzo(a)pyrene	50-32-8	0.2	MCL	0.5	0.1	0.0403
Benzo(b)fluoranthene	205-99-2	0.002	TOGs 1.1.1	0.5	0.1	0.0581
Benzo(k)fluoranthene	207-08-9	0.002	TOGs 1.1.1	0.5	0.1	0.0596
Benzo(g,h,i)perylene	191-24-2	N/A	N/A	0.5	0.1	0.0609
Benzoic Acid	65-85-0	58000	Tapwater	5	2	0.478
Benzyl Alcohol	100-51-6	1500	Tapwater	0.5	0.1	0.0486
4-Bromophenyl Phenyl Ether	101-55-3	N/A	N/A	0.5	0.1	0.0428
Butyl Benzyl Phthalate	85-68-7	14	Tapwater	1	0.2	0.0557
Carbazole	86-74-8	N/A	N/A	0.5	0.1	0.07
4-Chloro-3-methylphenol	59-50-7	1100	Tapwater	0.5	0.2	0.115
4-Chloroaniline	106-47-8	0.32	Tapwater	1	0.25	0.102
Bis(2-chloroethoxy)methane	111-91-1	5	TOGs 1.1.1	0.5	0.05	0.0184
Bis(2-chloroethyl) Ether	111-44-4	0.012	Tapwater	0.5	0.05	0.0237
Bis(2-chloroisopropyl) Ether	108-60-1	0.31	Tapwater	0.5	0.05	0.0258
2-Chloronaphthalene	91-58-7	550	Tapwater	0.5	0.05	0.0171
2-Chlorophenol	95-57-8	71	Tapwater	0.5	0.05	0.0267
4-Chlorophenyl Phenyl Ether	7005-72-3	N/A	N/A	0.5	0.1	0.048
Chrysene	218-01-9	2.9	Tapwater	0.5	0.1	0.0453
Dibenz(a,h)anthracene	53-70-3	0.0029	Tapwater	0.5	0.2	0.113
Dibenzofuran	132-64-9	5.8	Tapwater	0.5	0.05	0.0408

Analyte	CAS Number	Project Action Limit	Project Action Limit Reference	Laboratory-specific Quantitation Limits		
				LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
Di-n-butyl Phthalate	84-74-2	670	Tapwater	1	0.5	0.135
1,2-Dichlorobenzene	95-50-1	600	MCL	0.5	0.05	0.0396
1,3-Dichlorobenzene	541-73-1	N/A	N/A	0.5	0.05	0.041
1,4-Dichlorobenzene	106-46-7	75	MCL	0.5	0.05	0.0197
3,3´-Dichlorobenzidine	91-94-1	0.11	Tapwater	10	0.5	0.124
2,4-Dichlorophenol	120-83-2	50	TOGs 1.1.1	0.5	0.2	0.0915
Diethyl Phthalate	84-66-2	11000	Tapwater	0.5	0.2	0.0651
2,4-Dimethylphenol	105-67-9	270	Tapwater	1	0.25	0.168
Dimethyl Phthalate	131-11-3	50	TOGs 1.1.1	0.5	0.1	0.0455
4,6-Dinitro-2-methylphenol	534-52-1	1.2	Tapwater	5	2	1.02
2,4-Dinitrophenol	51-28-5	50	TOGs 1.1.1	5	5	1.16
2,4-Dinitrotoluene	121-14-2	0.2	Tapwater	0.5	0.1	0.0475
2,6-Dinitrotoluene	606-20-2	0.042	Tapwater	0.5	0.1	0.0801
Di-n-octyl Phthalate	117-84-0	50	TOGs 1.1.1	0.5	0.1	0.0766
1,2-Diphenylhydrazine	122-66-7	0.067	Tapwater	0.5	0.1	0.0805
Bis(2-ethylhexyl) Phthalate	117-81-7	6	MCL	0.5	0.5	0.113
Fluoranthene	206-44-0	50	TOGs 1.1.1	0.5	0.1	0.0627
Fluorene	86-73-7	50	TOGs 1.1.1	0.5	0.1	0.0413
Hexachlorobenzene	118-74-1	1	MCL	0.5	0.1	0.0627
Hexachlorobutadiene	87-68-3	0.26	Tapwater	0.5	0.1	0.0395
Hexachloroethane	67-72-1	0.79	Tapwater	0.5	0.1	0.0418
Indeno(1,2,3-cd)pyrene	193-39-5	0.029	Tapwater	0.5	0.2	0.0798
Isophorone	78-59-1	50	TOGs 1.1.1	0.5	0.05	0.045
2-Methylnaphthalene	91-57-6	27	Tapwater	0.5	0.05	0.0149
2-Methylphenol	95-48-7	720	Tapwater	0.5	0.2	0.0475

Analyte	CAS Number	Project Action Limit	Project Action Limit Reference	Laboratory-specific Quantitation Limits		
				LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
3+4-Methylphenol	108-39-4	720	Tapwater	5	0.2	0.0566
Naphthalene	91-20-3	0.14	Tapwater	0.5	0.05	0.0307
2-Nitroaniline	88-74-4	5	TOGs 1.1.1	0.5	0.5	0.116
3-Nitroaniline	99-09-2	5	TOGs 1.1.1	1	0.5	0.244
4-Nitroaniline	100-01-6	3.3	Tapwater	1	1	0.33
Nitrobenzene	98-95-3	0.12	Tapwater	0.5	0.2	0.0585
4-Nitrophenol	100-02-7	N/A	N/A	5	5	1.25
2-Nitrophenol	88-75-5	N/A	N/A	0.5	0.2	0.0475
N-Nitroso-dimethylamine	62-75-9	0.00042	Tapwater	0.5	0.1	0.046
N-Nitroso-diphenylamine	86-30-6	10	Tapwater	0.5	0.1	0.0676
N-Nitroso-di-n-propylamine	621-64-7	0.0093	Tapwater	0.5	0.1	0.0753
Pentachlorophenol	87-86-5	1	MCL	0.5	0.5	0.126
Phenanthrene	85-01-8	50	TOGs 1.1.1	0.5	0.1	0.0426
Phenol	108-95-2	4500	Tapwater	0.5	0.05	0.0337
Pyrene	129-00-0	50	TOGs 1.1.1	0.5	0.1	0.0656
1,2,4-Trichlorobenzene	120-82-1	70	MCL	0.5	0.05	0.0266
2,4,6-Trichlorophenol	88-06-2	3.5	Tapwater	0.5	0.25	0.0851
2,4,5-Trichlorophenol	95-95-4	890	Tapwater	0.5	0.25	0.0992

Notes:
CAS – Chemical Abstracts Service
µg/L – micrograms per liter
MCL – USEPA Maximum Contaminant Level
The PAL references are MCLs, or either TOGS 1.1.1 =NYSDEC Technical and Operational Guidance 1.1.1 Ambient Water Quality Standards and Guidance Values, or Tapwater based on the USEPA Regional Screening Level for Water (November 2013), whichever is the more stringent.
N/A – Not applicable

Matrix: Soil
Analytical Group: Organochlorine Pesticides

Analyte	CAS Number	Project Action Limit	Project Action Limit Reference	Laboratory-specific Quantitation Limits		
				LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
4,4' DDD	72-54-8	0.0033	CP-51	0.017	0.0006667	0.000226
4,4' DDE	72-55-9	0.0033	CP-51	0.017	0.0006667	0.00022
4,4' DDT	50-29-3	0.0033	CP-51	0.017	0.0006667	0.00022
Aldrin	309-00-2	0.005	CP-51	0.017	0.0006667	0.000231
alpha-BHC	319-84-6	0.02	CP-51	0.017	0.0006667	0.000194
beta-BHC	319-85-7	0.036	CP-51	0.017	0.0006667	0.000271
Chlordane (alpha)	5103-71-9	0.094	CP-51	0.017	0.0006667	0.000242
Chlordane (gamma)	5103-74-2	0.54	CP-51	0.017	0.0006667	0.000196
delta-BHC	319-86-8	0.04	CP-51	0.017	0.0006667	0.000208
Dieldren	60-57-1	0.005	CP-51	0.017	0.0006667	0.000203
Endosulfan I	959-98-8	2.4	CP-51	0.017	0.0006667	0.000207
Endosulfan II	33213-65-9	2.4	CP-51	0.017	0.0006667	0.000272
Endosulfan sulfate	1031-07-8	2.4	CP-51	0.017	0.0006667	0.000242
Endrin	72-20-8	0.014	CP-51	0.017	0.0006667	0.00026
Heptachlor	76-44-8	0.042	CP-51	0.017	0.0006667	0.000209
Lindane	58-89-9	0.1	CP-51	0.017	0.0006667	0.0002

Notes:
CAS – Chemical Abstracts Service
mg/kg – milligrams per kilogram
The Project Action Limit (PAL) reference for soil is CP-51 = NYSDEC Commissioner Policy-51 Soil Cleanup Guidance

Matrix: Water
Analytical Group: Organochlorine Pesticides

Analyte	CAS Number	Project Action Limit	Project Action Limit Reference	Laboratory-specific Quantitation Limits		
				LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
4,4' DDD	72-54-8	0.3	TOGS 1.1.1	0.01	0.008	0.0019
4,4' DDE	72-55-9	0.3	TOGS 1.1.1	0.01	0.008	0.0021
4,4' DDT	50-29-3	0.2	TOGS 1.1.1	0.01	0.01	0.0027
Aldrin	309-00-2	ND	TOGS 1.1.1	0.01	0.01	0.0025
alpha-BHC	319-84-6	0.01	TOGS 1.1.1	0.01	0.002	0.0011
beta-BHC	319-85-7	0.04	TOGS 1.1.1	0.02	0.01	0.0036
Chlordane (alpha)	5103-71-9	0.05	TOGS 1.1.1	0.01	0.01	0.0031
Chlordane (gamma)	5103-74-2	0.05	TOGS 1.1.1	0.01	0.01	0.0031
delta-BHC	319-86-8	0.04	TOGS 1.1.1	0.01	0.01	0.0033
Dieldren	60-57-1	0.004	TOGS 1.1.1	0.01	0.01	0.0038
Endosulfan I	959-98-8	NR	TOGS 1.1.1	0.02	0.01	0.0049
Endosulfan II	33213-65-9	NR	TOGS 1.1.1	0.01	0.01	0.0035
Endosulfan sulfate	1031-07-8	NR	TOGS 1.1.1	0.01	0.001	0.0004
Endrin	72-20-8	ND	TOGS 1.1.1	0.01	0.01	0.0032
Heptachlor	76-44-8	0.04	TOGS 1.1.1	0.01	0.01	0.0027
Lindane	58-89-9	0.05	TOGS 1.1.1	0.01	0.01	0.0033

Notes:
CAS – Chemical Abstracts Service
µg/L – micrograms per liter
The PAL reference is TOGS 1.1.1 =NYSDEC Technical and Operational Guidance 1.1.1 Ambient Water Quality Standards and Guidance Values
ND - Non-detectable concentration by approved analytical method
NR = Not Regulated

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QAPP WORKSHEET #17 – SAMPLING DESIGN AND RATIONALE

This section describes sampling locations, methods, and rationale for the field investigation activities to be conducted as part of the SI at Stewart ANG. All referenced field SOPs are presented in Appendix D of the SI Work Plan.

Subsurface Soil/Groundwater Sampling

As described in Sections 5 and 6 of the Work Plan and summarized on Worksheet #18, subsurface soil and Groundwater samples (if encountered) (including QC and QA samples) will be collected to confirm the presence of COPC at each of the two identified AOCs.

Soil samples will be collected using DPT methods. Samples will be collected with certified clean, disposable sample scoops. Soil/sediment will be removed and transferred to a disposable aluminum container or re-sealable plastic bag. Samples for VOCs will be collected prior to sample homogenization to avoid volatilizing analytes. Terra Core (or equivalent) sample container kits containing vials for both low-level and high-level analysis will be used for VOC samples. VOC samples will be collected and the remaining soil will then be homogenized for the additional SVOC and pesticide analyses. Homogenization will consist of mixing the soil sample until a uniform color, texture, and particle size. Any non-homogenous particles, organic matter, and projectile debris will be removed from the samples. After homogenization, the sample will be transferred to the appropriate sample container for laboratory analysis and placed in a cooler on ice. The required sample containers, preservatives, and holding times are specified on Worksheet 19.

Groundwater samples will be collected using a bladder or peristaltic pump as described in the Work Plan. VOC samples will be the first samples collected after the wells have been purged. The required sample containers, preservatives, and holding times are specified on Worksheet 19.

As specified in the Work Plan, the sample identification number will consist of an alphanumeric designation related to the installation, site, event, media type, and consecutive number, according to the following conventions:

Installation: **Stewart ANG**
Site: **ST-xxx** = **St**ewart. Note: **xxx** = site identification (Site ID) codes are located in Table 6-1 of the Work Plan
Media Type: **SB** = **S**u**b**surface Soil, **GW** = **G**round**w**ater
Consecutive Number: 01, 02, 03, etc.
Depth: Depth below ground surface
Sample Type: D for duplicate

The sample identification numbers for the first subsurface soil and groundwater samples at AOC-Hydraulic Lifts in Building 208 will be: ST-208-SB01 and ST-208-GW01, respectively. Duplicate sample identification numbers will be followed with a “D”.

Trip blank (TB) and equipment blank (EB) QC samples will be identified as follows:

Trip Blanks = ST-TB-date (mmddyr)
Equipment Blanks = ST-EB-date (mmddyr)

Samples will be analyzed for VOCs, SVOCs and organochlorine pesticides. Samples will be packaged on ice and transported daily via overnight commercial carrier under standard chain-of-custody procedures to TriMatrix Laboratories. The laboratory will provide analytical results within 30 days of sample receipt. Data validation (Level IV) will be conducted on all laboratory results.

The field logbook will serve as the primary record of field sampling activities. Entries will be made chronologically and in sufficient detail to allow the writer or a knowledgeable reviewer to reconstruct each day's events.

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QAPP WORKSHEET #18 – SAMPLING LOCATIONS AND METHODS/SOP REQUIREMENTS TABLE

AOC ID Code	Site Description	Number of Borings	Depth of Borings (ft. bgs)	Analysis Required	Sampling SOP References
208	AOC-Hydraulic Lifts in Building 208	4	30	**Soil:** 8 samples-VOCs and SVOCs **Groundwater:** 4 samples-VOCs and SVOCs	**AECOM SOPs** 3-02 Logbooks 3-03 Recordkeeping, Sample Labeling and Chain-of-Custody 3-04 Sample Handling, Storage, and Shipping 3-05 IDW Management 3-06 Equipment Decontamination 3-14 Monitoring Well Sampling 3-17 Direct Push Sampling Techniques 3-20 Operation and Calibration of a PID 3-21 Surface and Subsurface Soil Sampling 3-37 Grab Groundwater Sampling Techniques
MW-1	AOC-Pesticides in MW-1	3	45	**Soil:** 6 samples-Organochlorine Pesticides **Groundwater**: 4 samples- Organochlorine Pesticides x 4 quarterly sampling events (total = 16 samples)	

QAPP WORKSHEET #19 – ANALYTICAL SOP REQUIREMENTS TABLE

Matrix	Analytical Group	Analytical and Preparation Method/ SOP Reference	Containers (Number, Size, and Type)	Sample Volume	Preservation Requirements (Chemical, Temperature, Light Protected)	Maximum Holding Time (Preparation/Analysis)[2]
Groundwater	VOCs	SW-846 5030B/8260C; SOP GR-04-108	3 - 40mL clear glass vials	40mL	Hydrochloric acid (HCl) to pH <2; Cool to (4 ± 2) °C	14 days to analysis
	SVOCs	SW-846 3510C/8270D; SOPs GR-09-101, GR-04-109	2 - 1L (liter) amber glass bottles	1000mL	Cool to (4 ± 2) °C	7 days to extraction; 40 days analysis
	Organochlorine Pesticides	SW-846 3510C/8081B; SOPs GR-09-107, GR-03-120	2 - 1L (liter) amber glass bottles	1000mL	Cool to (4 ± 2) °C	7 days to extraction; 40 days analysis
Soil	VOCs	SW-846 5035A/8260C; SOPs GR-04-105, GR-04-108	3 - 5 gram (g) Terra Cores into blank tare weighted 40 milliliter (mL) clear glass vials	5g (gram)	Cool to (4 ± 2) °C (high conc. sample following preservation with methanol); Freeze < -7 °C but > -20 °C (low conc. sample until analysis)	Freeze at laboratory within 48 hours of collection. At laboratory, add methanol to one vial within 48 hours of collection. 14 days from collection to analysis.
	SVOCs	SW-846 3550B/8270D; SOPs GR-09-103, GR-04-109	1- 8oz wide mouth clear glass jar	8oz	Cool to (4 ± 2) °C	14 days to extraction; 40 days analysis
	Organochlorine Pesticides	SW-846 3550C/8081B; SOPs GR-09-108, GR-03-120	1- 8oz wide mouth clear glass jar	8oz	Cool to (4 ± 2) °C	14 days to extraction; 40 days analysis

QAPP WORKSHEET #20 – FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE

Matrix	Analytical Group	Concentration Level	Number of Samples	No. of Field Duplicates	No. of MS/MSDs	Total No. of Samples to Lab
Soil	VOCs	Low to Moderate	8	2	1	11
	SVOCs	Low to Moderate	8	2	1	11
	Organochlorine Pesticides	Low to Moderate	6	1	1	8
Groundwater	VOCs	Low to Moderate	4	1	1	6
	SVOCs	Low to Moderate	4	1	1	6
	Pesticides	Low to Moderate	16	1 x 4 events	1 x 4 events	24
Trip Blank	VOCs	Low to Moderate	1	0	0	1
Equipment Blank	VOCs	Low to Moderate	1	0	0	1
	SVOCs	Low to Moderate	1	0	0	1
	Organochlorine Pesticides	Low to Moderate	1 x 4 events	0	0	4

QAPP WORKSHEET #21 – PROJECT SAMPLING SOP REFERENCES TABLE

Reference Number	Title, Revision Date and / or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
SOP-3-02	Logbooks	AECOM	Permanent ink markers, logbooks	N	None
SOP-3-03	Record Keeping, Sample Labeling, and Chain-of-Custody Procedures	AECOM	Permanent ink markers, forms	N	None
SOP-3-04	Sample Handling, Storage, and Shipping Procedures	AECOM	Permanent ink markers, forms	N	None
SOP-3-05	IDW Management	AECOM	DOT approved 55-gallon drums and material to cover waste to protect from weather (e.g., plastic covering); Hazardous /non-hazardous waste drum labels (weatherproof); Permanent marking pens; Inventory forms for project file; plastic garbage bags, zip lock storage bags, roll of plastic sheeting;	N	None
SOP-3-06	Equipment Decontamination	AECOM	Phosphate-free detergent; Isopropyl Alcohol; Tap water; Deionized Ultra-Filtered (DIUF) Water; plastic buckets or washbasins; brushes; and polyethylene sheeting.	N	None
SOP-3-12	Monitoring Well Installation	AECOM	Drill rig, drill rods, hollow stem augers, decon equipment, well construction materials	N	None
SOP-3-13	Monitoring Well Development	AECOM	Surge blocks, disposable bailers, electric submersible pump, 12-volt power supply for pump, containers for purge water, water-level and multi-parameter meters.	N	None
SOP-3-14	Monitoring Well Sampling	AECOM	Peristaltic or bladder pump, Teflon or Teflon-lined tubing, water level and water quality meters.	N	None
SOP-3-17	Direct Push Sampling Techniques	AECOM	Boring Logs; Spoons or scoops; Sample kit (bottles, labels, custody records and tape, cooler, ice), if laboratory analysis is required; sample collection pan; folding rule or tape measure; Plastic sheeting; Utility knife; Field project notebook/pen.	N	None

Reference Number	Title, Revision Date and / or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
SOP-3-21	Surface and Subsurface Soil Sampling	AECOM	Stainless steel bowls; stainless steel trowels; appropriate sample containers for laboratory analysis; personal protective equipment (PPE); logbook; cooler and ice for preservation; and stakes and flagging to document sampling location	N	None
SOP-3-37	Grab Groundwater Sampling Techniques	AECOM	Peristaltic or bladder pump, Teflon or Teflon-lined tubing, water level and water quality meters.	N	None

QAPP WORKSHEET #23 – ANALYTICAL SOP REFERENCES TABLE

TriMatrix Laboratories, LLC
Phil Komar
616-846-9528

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
GR-04-105	Closed System Purge and Trap Extraction for Volatile Organic Compounds, 12/26/13, rev. 1.4, 5035A	Definitive	Soil - VOCs	P&T Autosampler	TriMatrix	N
GR-04-108	Volatile Organic Compounds by Purge and Trap Capillary Column Gas Chromatography/Mass Spectrometry, 01/15/13, rev 0.1, 5030B/8260C	Definitive	Water and Soil - VOCs	GC/MSD	TriMatrix	N
GR-04-109	Base/Neutral/Acid Compounds by Gas Chromatography/Mass Spectrometry, 12/10/13, rev. 0.0, 8270D	Definitive	Water and Soil - SVOCs	GC/MSD	TriMatrix	N
GR-09-101	The Extraction of Base Neutrals and Acids from Water, 01/15/14, rev 3.6, 3510C	Definitive	Water - SVOCs	NA	TriMatrix	N
GR-09-103	Extraction of BNA Semi-Volatiles from Soil, Sediment and Sludge, 01/31/13, rev. 3.8, 3550C	Definitive	Soil - SVOCs	NA	TriMatrix	N
GR-09-107	Extraction of Organochlorine Pesticides and PCBs from Water, 01/31/13, rev. 5.4, 3510C	Definitive	Water – Organochlorine Pesticides	NA	TriMatrix	N
GR-09-108	Extraction of PCBs/Pesticides from Soil, Sediment and Sludge, 11/05/11, rev. 4.4, 3550C	Definitive	Soil – Organochlorine Pesticides	NA	TriMatrix	N
GR-03-120	Organochlorine Pesticide Analysis by Gas Chromatography , 9/19/11, rev.4.6,8081B	Definitive	Water and Soil – Organochlorine Pesticides	GC/ECD	TriMatrix	N
GR-15-100	Sample Receipt and Log-In, 12/23/13, rev. 3.4	NA	Sample Login and Storage	NA	TriMatrix	N
GR-15-101	Bottle Order Preparation, 10/25/13, rev 0.3	NA	Sample Container Preparation	NA	TriMatrix	N

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
GR-15-102	Laboratory Waste Disposal Guidelines, 12/02/13, rev 2.4	NA	Sample Waste Disposal	NA	TriMatrix	N

QAPP WORKSHEET #28 – LABORATORY QC SAMPLES TABLE

Matrix	Soil
Analytical Group	VOCs
Analytical Method/ SOP Reference	SW-846 8260C / SOP GR-04-108

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL.
Laboratory Control Sample (LCS) containing all analytes to be reported, including surrogates	One per preparatory batch of up to 20 samples.	QC acceptance criteria specified in DoD QSM v4.1, if available. Otherwise use in-house limits.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	QC acceptance criteria specified in DoD QSM v4.1, if available. Otherwise use in-house limits.
Matrix Spike (MS)	One per preparatory batch of up to 20 samples.	For matrix evaluation use QC acceptance criteria specified for LCS.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.	Analyst/ Laboratory Area Supervisor	Accuracy / Bias	For matrix evaluation use QC acceptance criteria specified for LCS.

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix Spike Duplicate (MSD)	One per preparatory batch of up to 20 samples.	MSD: For matrix evaluation, use QC acceptance criteria specified for LCS. MSD: RPD ≤ 30% (between MS and MSD).	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.	Analyst / Laboratory Area Supervisor	Precision / Accuracy / Bias	MSD: For matrix evaluation, use QC acceptance criteria specified for LCS. MSD: RPD ≤ 30% (between MS and MSD).
Internal Standards (IS) verification	Every field sample, standard, and QC sample	Retention times for internal standards must be ± 30 seconds from retention time of the midpont standard in the ICAL and the responses within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and/or gas chromatograph for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	Analyst / Laboratory Area Supervisor	Precision / Accuracy / Bias	Retention times for internal standards must be ± 30 seconds from retention time of the midpont standard in the ICAL and the responses within -50% to +100% of ICAL midpoint standard.
Surrogate spike	All field and QC samples.	Percent recoveries: 1,2-Dichloroethane-d4 66-124; Dibromofluoromethane 78-121; Toluene-d8 85-115%; 4-Bromofluorobenzene 85-120%	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	Percent recoveries: 1,2-Dichloroethane-d4 66-124; Dibromofluoromethane 78-121; Toluene-d8 85-115%; 4-Bromofluorobenzene 85-120%

Matrix	Water
Analytical Group	VOCs
Analytical Method/ SOP Reference	SW-846 8260C / SOP GR-04-108

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL.
Laboratory Control Sample (LCS) containing all analytes to be reported, including surrogates	One per preparatory batch of up to 20 samples.	QC acceptance criteria specified in DoD QSM v4.2, if available. Otherwise use in-house limits.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	QC acceptance criteria specified in DoD QSM v4.2, if available. Otherwise use in-house limits.
Matrix Spike (MS)	One per preparatory batch of up to 20 samples.	For matrix evaluation use QC acceptance criteria specified for LCS.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.	Analyst/ Laboratory Area Supervisor	Accuracy / Bias	For matrix evaluation use QC acceptance criteria specified for LCS.

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix Spike Duplicate (MSD)	One per preparatory batch of up to 20 samples.	MSD: For matrix evaluation, use QC acceptance criteria specified for LCS. MSD: RPD ≤ 30% (between MS and MSD).	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.	Analyst / Laboratory Area Supervisor	Precision / Accuracy / Bias	MSD: For matrix evaluation, use QC acceptance criteria specified for LCS. MSD: RPD ≤ 30% (between MS and MSD).
Internal Standards (IS) verification	Every field sample, standard, and QC sample	Retention times for internal standards must be ± 30 seconds from retention time of the midpont standard in the ICAL and the responses within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and/or gas chromatograph for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	Analyst / Laboratory Area Supervisor	Precision / Accuracy / Bias	Retention times for internal standards must be ± 30 seconds from retention time of the midpont standard in the ICAL and the responses within -50% to +100% of ICAL midpoint standard.
Surrogate spike	All field and QC samples.	Percent recoveries: 1,2-Dichloroethane-d4 70-120; Dibromofluoromethane 85-115; Toluene-d8 85-120%; 4-Bromofluorobenzene 75-120%	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	Percent recoveries: 1,2-Dichloroethane-d4 70-120; Dibromofluoromethane 85-115; Toluene-d8 85-120%; 4-Bromofluorobenzene 75-120%

Matrix	Soil
Analytical Group	SVOCs
Analytical Method/ SOP Reference	SW-846 8270D / SOP GR-04-109

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL.
Laboratory Control Sample (LCS) containing all analytes to be reported, including surrogates	One per preparatory batch of up to 20 samples.	QC acceptance criteria specified in DoD QSM v4.2, if available. Otherwise use in-house limits.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	QC acceptance criteria specified in DoD QSM v4.2, if available. Otherwise use in-house limits.
Matrix Spike (MS)	One per preparatory batch of up to 20 samples.	For matrix evaluation use QC acceptance criteria specified for LCS.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.	Analyst/ Laboratory Area Supervisor	Accuracy / Bias	For matrix evaluation use QC acceptance criteria specified for LCS.
Matrix Spike Duplicate (MSD)	One per preparatory batch of up to 20 samples.	MSD: For matrix evaluation, use QC acceptance criteria specified for LCS. MSD: RPD $\leq$ 30% (between MS and MSD).	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.	Analyst / Laboratory Area Supervisor	Precision / Accuracy / Bias	MSD: For matrix evaluation, use QC acceptance criteria specified for LCS. MSD: RPD $\leq$ 30% (between MS and MSD).

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal Standards (IS) verification	Every field sample, standard, and QC sample	Retention times for internal standards must be ± 30 seconds from retention time of the midpont standard in the ICAL and the responses within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and/or gas chromatograph for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	Analyst / Laboratory Area Supervisor	Precision / Accuracy / Bias	Retention times for internal standards must be ± 30 seconds from retention time of the midpont standard in the ICAL and the responses within -50% to +100% of ICAL midpoint standard.
Surrogate spike	All field and QC samples.	Nitrobenzene-d5 35-100; 2-Fluorobiphenyl 45-105; o-Terphenyl 30-125; Phenol-d6 40-100; 2-Fluorophenol 35-105; 2,4,6-Tribromophenol 35-125	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	Nitrobenzene-d5 35-100; 2-Fluorobiphenyl 45-105; o-Terphenyl 30-125; Phenol-d6 40-100; 2-Fluorophenol 35-105; 2,4,6-Tribromophenol 35-125

Matrix	Water
Analytical Group	SVOCs
Analytical Method/ SOP Reference	SW-846 8270D / SOP GR-04-109

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL.
Laboratory Control Sample (LCS) containing all analytes to be reported, including surrogates	One per preparatory batch of up to 20 samples.	QC acceptance criteria specified in DoD QSM v4.2, if available. Otherwise use in-house limits.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	QC acceptance criteria specified in DoD QSM v4.2, if available. Otherwise use in-house limits.
Matrix Spike (MS)	One per preparatory batch of up to 20 samples.	For matrix evaluation use QC acceptance criteria specified for LCS.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.	Analyst/ Laboratory Area Supervisor	Accuracy / Bias	For matrix evaluation use QC acceptance criteria specified for LCS.
Matrix Spike Duplicate (MSD)	One per preparatory batch of up to 20 samples.	MSD: For matrix evaluation, use QC acceptance criteria specified for LCS. MSD: RPD $\leq$ 30% (between MS and MSD).	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.	Analyst / Laboratory Area Supervisor	Precision / Accuracy / Bias	MSD: For matrix evaluation, use QC acceptance criteria specified for LCS. MSD: RPD $\leq$ 30% (between MS and MSD).

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal Standards (IS) verification	Every field sample, standard, and QC sample	Retention times for internal standards must be ± 30 seconds from retention time of the midpont standard in the ICAL and the responses within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and/or gas chromatograph for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	Analyst / Laboratory Area Supervisor	Precision / Accuracy / Bias	Retention times for internal standards must be ± 30 seconds from retention time of the midpont standard in the ICAL and the responses within -50% to +100% of ICAL midpoint standard.
Surrogate spike	All field and QC samples.	Nitrobenzene-d5 40-110; 2-Fluorobiphenyl 50-110; o-Terphenyl 50-135; Phenol-d6 10-115; 2-Fluorophenol 20-110; 2,4,6-Tribromophenol 40-125	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	Nitrobenzene-d5 40-110; 2-Fluorobiphenyl 50-110; o-Terphenyl 50-135; Phenol-d6 10-115; 2-Fluorophenol 20-110; 2,4,6-Tribromophenol 40-125

Matrix	Soil
Analytical Group	Organochlorine Pesticides
Analytical Method/ SOP Reference	SW-846 8081B / SOP GR-03-120

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results.
Laboratory Control Sample (LCS) containing all analytes to be reported, including surrogates	One per preparatory batch of up to 20 samples.	QC acceptance criteria specified in DoD QSM v4.2, if available. Otherwise use in-house limits.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	QC acceptance criteria specified in DoD QSM v4.2, if available. Otherwise use in-house limits.
Matrix Spike (MS)	One per preparatory batch of up to 20 samples.	For matrix evaluation use QC acceptance criteria specified for LCS.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	For matrix evaluation use QC acceptance criteria specified for LCS.
Matrix Spike Duplicate (MSD)	One per preparatory batch of up to 20 samples.	MSD: For matrix evaluation, use QC acceptance criteria specified for LCS. MSD: RPD $\leq$ 30% (between MS and MSD).	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.	Analyst / Laboratory Area Supervisor	Precision / Accuracy / Bias	MSD: For matrix evaluation, use QC acceptance criteria specified for LCS. MSD: RPD $\leq$ 30% (between MS and MSD).

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Surrogate spike	All field and QC samples.	TCMX: 70-125%; DCB: 55-130%	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	TCMX: 70-125%; DCB: 55-130%
Confirmation of positive results (second column and second detector)	All positive results must be confirmed.	Calibration and QC criteria same as for initial or primary column analysis; Results between primary and second column RPD ≤ 40%.	NA.	Analyst / Laboratory Area Supervisor	Accuracy	Calibration and QC criteria same as for initial or primary column analysis; Results between primary and second column RPD ≤ 40%.

Matrix	Water
Analytical Group	Organochlorine Pesticides
Analytical Method/ SOP Reference	SW-846 8081B / SOP GR-03-120

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results.
Laboratory Control Sample (LCS) containing all analytes to be reported, including surrogates	One per preparatory batch of up to 20 samples.	QC acceptance criteria specified in DoD QSM v4.2, if available. Otherwise use in-house limits.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	QC acceptance criteria specified in DoD QSM v4.2, if available. Otherwise use in-house limits.
Matrix Spike (MS)	One per preparatory batch of up to 20 samples.	For matrix evaluation use QC acceptance criteria specified for LCS.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	For matrix evaluation use QC acceptance criteria specified for LCS.
Matrix Spike Duplicate (MSD)	One per preparatory batch of up to 20 samples.	MSD: For matrix evaluation, use QC acceptance criteria specified for LCS. MSD: RPD $\leq$ 30% (between MS and MSD).	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.	Analyst / Laboratory Area Supervisor	Precision / Accuracy / Bias	MSD: For matrix evaluation, use QC acceptance criteria specified for LCS. MSD: RPD $\leq$ 30% (between MS and MSD).

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Surrogate spike	All field and QC samples.	TCMX: 70-125%; DCB: 55-130%	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	TCMX: 70-125%; DCB: 55-130%
Confirmation of positive results (second column and second detector)	All positive results must be confirmed.	Calibration and QC criteria same as for initial or primary column analysis; Results between primary and second column RPD ≤ 40%.	NA.	Analyst / Laboratory Area Supervisor	Accuracy	Calibration and QC criteria same as for initial or primary column analysis; Results between primary and second column RPD ≤ 40%.

QAPP WORKSHEET #30 – ANALYTICAL SERVICES TABLE

Matrix	Analytical Groups	Sample Locations/ID Number	Analytical Methods	Data Package Turnaround Time	Laboratory / Organization (name and address, contact person and telephone number)	Backup Laboratory / Organization (name and address, contact person and telephone number)
Subsurface Soil and Groundwater	VOCs, SVOCs, and organochlorine pesticides	See Worksheet #18	SW-8260C, SW-8270D, SW-8081B	21 calendar days	Phil Komar TriMatrix Laboratory 616-846-8529 Corporate / Laboratory 5560 Corporate Exchange Court Grand Rapids, Michigan 49512	N/A

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QAPP WORKSHEETS #34 – 36: DATA VERIFICATION AND VALIDATION (STEPS I AND IIA/IIB) PROCESS TABLE

Data Review Input	Description	Responsible for Verification (name, organization)	Step I/IIa/ IIb [1]	Internal/ External
Project Readiness Review	Project readiness review to be performed by AECOM Project Manager and USACE Project Manager, including Work Plan and Accident Prevention Plan (APP) reviews.	Mark MacEwan, Project Manager, AECOM	I	External
Project Plan Review and Site-Specific Training	Verification that on-site personnel have read and understand the data collection/quality requirements outlined in the project plans (including WP, APP, QAPP, SOPs), and have received site-specific training on these requirements	Field Team Leader, AECOM	I	External
Personnel Qualifications	Personnel Qualifications will be verified, inclusive of reviewing resumes and training records, to ensure that required safety training (e.g., OSHA training, medical surveillance, etc.) and experience requirements have been completed for each crew member, inclusive of subcontractors.	Mark MacEwan, Project Manager, AECOM	I	External
Equipment Check-out	Equipment verification and training will be conducted by each technical lead to verify their personnel or subcontract personnel have access to functional equipment for use in field activities and the operators are proficient in the use of this equipment.	Field Team Leader, AECOM	I	External
Chain-of-Custody Forms	The AECOM Field Team Leader or designee will review and sign each chain-of-custody form to verify that samples listed are included in the shipment to the laboratory and the sample information is accurate. The chain-of-custody forms will be signed by the sampler and a copy will be retained for the project file, the AECOM Project Manager, and the Subcontract Data Validator.	Field Team Leader, AECOM	I	External
Chain-of-Custody Forms	The Laboratory Sample Custodian will review the sample shipment for completeness and integrity and will sign accepting the shipment.	Laboratory Sample Custodian	I	Internal

Data Review Input	Description	Responsible for Verification (name, organization)	Step I/IIa/ IIb [1]	Internal/ External
Chain-of-Custody Forms	The data validator will check that the chain-of-custody form was signed and dated by the AECOM sample shipper or designee relinquishing the samples and also by the Laboratory Sample Custodian receiving the samples for analyses. The data validator will confirm that the custody and integrity of the samples were maintained from collection to analysis and that custody records are complete and any deviations are recorded.	Data Validator, AECOM	I	External
Field SOPs/Field Logs/Sample Collection	Confirm that sampling SOPs were followed. Verify that deviations have been documented and performance criteria have been achieved, that samples were correctly identified, that sampling location coordinates are accurate, and that documentation establishes an unbroken chain of custody from sample collection to report generation. Verify that the correct sampling and analytical procedures were applied. Verify that the QAPP was followed as written and that any deviations are documented.	Project Manager or designee, AECOM	IIa	External
Sample Tables	Proposed samples verified to have been collected.	Field Team Leader, AECOM	IIa	External
Sample Log Sheets	Log sheets completed as samples are collected in the field, are verified for completeness, and are maintained at the project office.	Field Team Leader, AECOM	IIa	External
Field QC Samples	Verify that field QC samples listed in Worksheet #12 were collected as required.	Field Team Leader, AECOM	IIa	External
Sample Coordinates	Sample locations will be validated to be correct and in accordance with the QAPP (compare map of proposed locations to map of actual locations).	Field Team Leader, AECOM	IIa	External
Analytical SOPs	Confirm that laboratory SOPs were followed. Verify that the correct analytical methods/SOPs were applied.	Laboratory Quality Assurance Manager	IIa	Internal
Documentation of Method QC Results	Establish that method QC samples were analyzed and in control as listed in the analytical SOPs. If method QA is not in control, the Laboratory Quality Assurance Manager will contact AECOM for guidance prior to report preparation.	Laboratory Quality Assurance Manager	IIa	Internal
Analytical Data Packages	All analytical data packages will be verified internally for completeness by the laboratory performing the work. The Laboratory Quality Assurance Manager will sign the case narrative for each data package.	Laboratory Quality Assurance Manager	IIa	Internal

Data Review Input	Description	Responsible for Verification (name, organization)	Step I/IIa/ IIb [1]	Internal/ External
Analytical Data Packages	Verify that the data package contains the elements required by the laboratory Master Services Agreement and laboratory work order. Missing information will be requested from the laboratory, and data validation (if applicable) will be suspended until missing data are received.	Data Validator, AECOM	IIa	External
Documentation of Analytical Reports for Completeness	Confirm that the required analytical samples have been collected, appropriate sample identifications have been used, and correct analytical methods have been applied. Data Validator will verify that elements of the data package required for validation is present, and if not, the laboratory will be contacted and the missing information will be requested. Validation will be performed as described in Worksheet #34 - 36. Verify data have been transferred correctly and completely to the final SQL database.	Data Validator, AECOM	IIa	External
Electronic Data Deliverables	The electronic data will be compared to the chain-of-custody form and hard copy data package to verify accuracy and completeness.	Data Validator, AECOM	IIa	External
Analytical Data Packages	Data validation will be conducted by AECOM on the fixed laboratory data.	Data Validator, AECOM	IIb	External
Analytical Data Packages (in addition to Level III Validation)	<u>Data Results:</u> Verify that the summary form results are consistent with those presented on the EDD. <u>Project Quantitation Limits for Sensitivity</u>: Verify that the LOQs and LODs listed in Worksheet #15 were achieved.	Data Validator, AECOM	IIa/IIb	External
Data Validation Report	Data validation reports will be generated according to the AECOM SOPs presented under "Analytical Data Packages" in this table.	Data Validator, AECOM	IIa/IIb	External
Project Action Limits	Discuss the impact of matrix interferences or sample dilutions performed, because of the high concentration of one or more contaminants, on the other target compounds reported as not detected. Document this usability issue and inform the AECOM Project Chemist, who will inform the Project Manager.	Data Validator, AECOM	IIa/IIb	External
QAPP QC Sample Documentation	Verify that QC samples specified in the QAPP were collected and analyzed and that the associated results were within prescribed QAPP acceptance limits. Verify that QC samples and standards prescribed in analytical SOPs were analyzed and within the prescribed control limits. If any significant QC deviations occur, the Laboratory Quality Assurance Manager shall have contacted the project chemist or Project manager.	Project Chemist, AECOM	IIa/IIb	External

Data Review Input	Description	Responsible for Verification (name, organization)	Step I/IIa/ IIb [1]	Internal/ External
Analytical Data Deviations	Determine the impact of any deviation from sampling or analytical methods, SOP requirements, and matrix interferences on the analytical results.	Project Chemist, AECOM	IIa/IIb	External

Notes:
1. IIa=compliance with methods, procedures, and contracts (see Table 10, page 117, UFP-QAPP manual, V.1, March 2005).
   IIb=comparison with measurement performance criteria in the QAPP (see Table 11, page 118, UFP-QAPP manual, V.1, March 2005).

Appendix C

Accident Prevention Plan

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US Army Corps of Engineers, Baltimore District
Contract No. W912DR-12-D-0014
Task/Delivery Order No. 0001
Air National Guard Project Number. ANG2013NEASTCRP

ACCIDENT PREVENTION PLAN

Regional Compliance Restoration Program Preliminary Assessment/Site Investigation at Multiple Air National Guard Installations Northeast

Stewart Air National Guard Base Newburgh, New York

Contract Number: W912DR-12-D-0014
Work Order Number: 0001

Prepared for:

US Army Corps of Engineers
10 South Howard Street
Room 10000-S
Baltimore, MD 21201-2505

Prepared by:

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

Project No: 60308608

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List of Acronyms and Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
APP	Accident Prevention Plan
BCT	BRAC Cleanup Team
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cDCE	cis-1,2-dichloroethene
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CHST	Construction Health and Safety Technician
CPR	Cardiopulmonary Resuscitation
CSP	Certified Safety Professional
DCE	Dichloroethene
DOT	Department of Transportation
EM	Engineering Manual
ERP	Emergency Response Plan
ERT	Emergency Response Team
FFRAG	Former Fort Ritchie Army Garrison
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSA	Hollow-Stem Auger
HSI	Hazardous Substance Inventory
HTRW	Hazardous Toxic Radiological Waste
IAW	In Accordance With
IDW	Investigation-Derived Waste
ISCO	In Situ Chemical Oxidation
LOC	Level of Concern
LOD	Limit of Detection
LTGM	Long-Term Groundwater Monitoring
LTGMP	Long-Term Groundwater Monitoring Plan
LTM	Long-Term Monitoring
LUC	Land Use Control
LUCRD	Land Use Control Remedial Design
MCL	Maximum Contaminant Level
MDE	Maryland Department of the Environment
MDL	Method Detection Limit
mg/L	milligrams per liter
MRL	Method Reporting Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSDS	Material Safety Data Sheet
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health

OSHA	Occupational Safety and Health Administration
OU4	Operable Unit 4
PCE	Tetrachloroethene
PEL	Permissible Exposure Limit
PM	Project Manager
POV	Privately Owned Vehicle
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
QC	Quality Control
RBC	Risk-Based Concentration
RI	Remedial Investigation
ROD	Record of Decision
SH&E	Safety, Health & Environmental
SI	Site Investigation
SOPs	Standard Operating Procedures
SOW	Statement of Work
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SZ	Support Zone
TCE	Trichloroethene
TCL	Target Compound List
TLV	Threshold Limit Value
U.S.	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
WP	Work Plan
µg/L	micrograms per liter

1 Signature Sheet

This Accident Prevention Plan (APP) was prepared for employees performing site investigation activities under the ANG2013NEASTCRP contract at multiple Air National Guard Sites in the Northeastern United States. It was prepared based on the best available information regarding the physical and chemical hazards known or suspected to be present at the project sites. While it is not possible to discover, evaluate, and protect in advance against all possible hazards that may be encountered during the completion of the project, adherence to the safety and health program requirements of this APP will significantly reduce the potential for occupational injury.

Plan Concurrence:

____ Date: ____________________

Michael Grasso, CIH
Site Safety and Health Officer, AECOM

Plan Approver:

____ Date: ____________________

Russell Reynolds, CSP
Safety and Health Manager, AECOM

Plan Concurrence:

____ Date: ____________________

Mark MacEwan, PE
Project Manager, AECOM

Plan Concurrence:

____ Date: ____________________

John Franz, PE
Program Manager, AECOM

2 Background Information

2.1 Contractor

The prime contractor for the Regional Compliance Restoration Program (CRP) Preliminary Assessment/Site Investigation (PA/SI) at Multiple Air National Guard Installations, Northeast is AECOM.

2.2 Contract Number

The project is being conducted under the USACE Baltimore District contract numbers W912DR-12-D-0014, Task/Delivery Order No. 0001.

2.3 Project Name

The project name is Regional Compliance Restoration Program (CRP) Preliminary Assessment/Site Investigation (PA/SI) at Multiple Air National Guard Installations, Northeast (hereinafter, ANG2013NEASTCRP).

2.4 Project Description

The primary objective of the Task Order is to collect data to support PA/SI reports at multiple Air National Guard Installations. NGB/A7OR's goal for the PA/SI is to obtain either a No Further Action (NFA) decision with regulatory concurrence, or determine the presence of contamination and identify the Data Quality Objectives (DQOs) required for conducting follow on Remedial Investigations at the AOCs that do not meet the criteria for No Further Action (NFA).

AECOM will conduct PAs/SIs at nineteen subject installations. This APP is applicable to the Stewart ANGB, Newburgh, New York.

2.4.1 Description of Work to Be Performed

ANG2013NEASTCRP PA/SI activities are being performed under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). The state and federal environmental agencies in which the respective site resides is the regulatory lead for this project. The field investigation tasks planned as part of the field operations at the various installations include:

- **Utility Clearance and Geophysical Survey.** Utility clearance will be conducted by Stewart ANG. A geophysical survey, if required, will be conducted by a subcontractor.
- **Concrete Coring.** If required, concrete coring will be conducted to access subsurface soils for sampling.
- **Soil Borings and Soil Sample Collection.** Soil samples will be collected at designated locations via direct-push technology (DPT). A GeoProbe® DT325 dual-tube sampling system (or equivalent) will be used to collect continuous soil cores to the target depth. Borings will be advanced to depths specified in the Work Plan, or to probe refusal, whichever occurs first.
- **Monitoring Well Installation.** Temporary wells will be installed using DPT methodology. Permanent wells, if warranted, will be installed using rotary drilling methodology. Temporary and permanent wells will be installed as specified in the Work Plan.
- **Groundwater Measurement and Sampling.** Groundwater samples will be collected from the temporary and permanent monitoring wells. Samples will be collected via low-flow sampling methods using bladder pumps.

2.4.2 Project Location

Location maps of each ANG installation included in this task order are provided in the Work Plan.

2.4.3 Project Phases of Work

The project phases of work and hazardous activities requiring Activity Hazards Analyses (AHAs) in the SSHP include the following:

- Mobilization and Demobilization;
- Soil Borings and Soil Sample Collection;
- Groundwater Sampling; and
- Concrete Coring

2.5 AECOM's Accident Experience

AECOM Environment utilizes the skills and capabilities from across its global environmental operations. AECOM Environment is devoted to providing quality environmental services to its global clients and provides a blend of global reach, local knowledge, innovation, and technical excellence in delivering solutions that enhance and sustain the world's built, natural, and social environments. AECOM Environment's activities are primarily classified in the Engineering Services industry (NAICS 54133).

AECOM's recordable cases and rates for United States-based projects are presented in Table 2-1. A copy of AECOM's latest OSHA 300 log is located in Attachment A.

Table 2-1
United States Recordable Cases and Rates

Year	Hours Worked	EMR	TRI	TRI Rate	DART	DART Rate
2013	10,997,854	0.53	28	0.51	110	0.22
2012	21,531,000	0.66	57	0.53	661	0.16
2011	21,466,000	0.64	61	0.57	580	0.23
2010	26,228,258	0.71	63	0.48	1,223	0.24

Notes:
EMR = Experience Modification Rate (interstate)
TRI = Total Recordable Incident
DART = Days Away Restricted Transferred

3 Statement of Safety and Health Policy

AECOM management and employees are fully committed to providing a safe and healthful workplace for all employees and maintaining compliance with the Safety, Health and Environment policy. AECOM's current corporate safety and health policy statement detailing this commitment is included at Attachment B.

4 Responsibilities and Lines of Authority

4.1 Statement of Responsibility

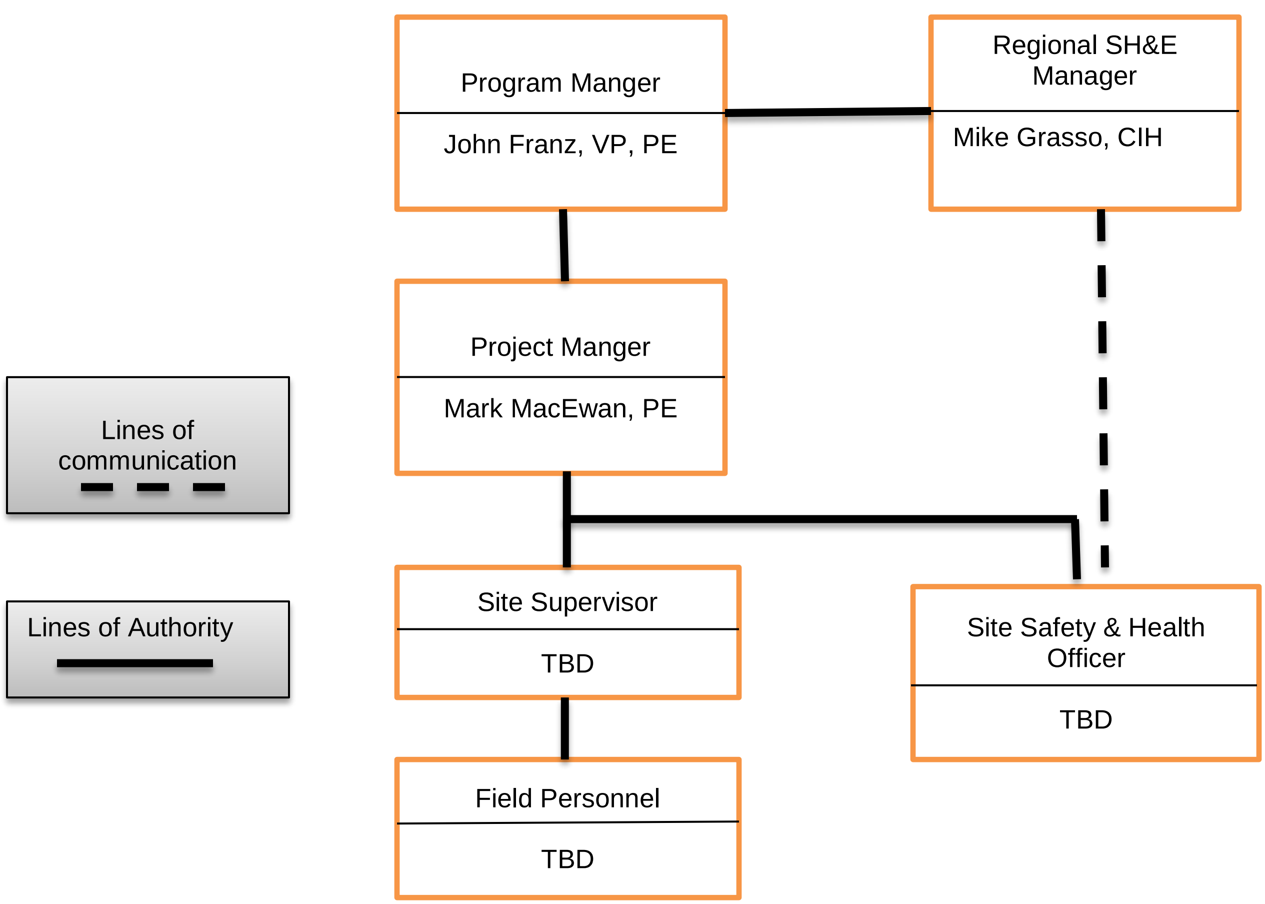
AECOM has the ultimate responsibility for the successful implementation and management of the ANG2013NEASTCRP safety and health program.

4.2 Personnel Responsible for Safety

All personnel are responsible for continuous adherence to the safety and health procedures presented in this APP and attached SSHP during the performance of work. No person may work in a manner that conflicts with the intent of, or the inherent safety and environmental precautions expressed in these procedures. After due warnings, the company will dismiss from the site any person who violates safety procedures.

The AECOM organization chart for the management of safety at both the corporate and project level for the ANG2013NEASTCRP project is presented as Figure 4-1. The positions/responsibilities presented in the organization chart are discussed below.

Figure 4-1
Safety Organization Chart



4.2.1 Program Manager [Mr. John Franz, V.P., P.E.]

The AECOM Program Manager is responsible for supporting the establishment and oversight of the overall health and safety program presented in the APP. The Program Manager will sign the APP prior to final submittal.

4.2.2 Regional SH&E Manager [Michael Grasso, CIH]

The AECOM SH&E Manager is a Certified Safety Professional (CSP) with over 10 years of experience in managing safety and occupational health at hazardous waste site cleanup operations.

The SH&E Manager is responsible for developing, maintaining, and overseeing the implementation of the APP and SSHP. The SH&E Manager will approve the APP and SSHP prior to final submittal. Specific responsibilities of the SH&E Manager includes the following:

- Approve the appointment of the Site Safety and Health Officer (SSHO) and ensure that he/she has the appropriate training and competencies to perform the duties;
- Participate in quality control (QC) planning such as development of Quality Control Plans, safety and health checklists, and perform design and system safety analyses as appropriate;
- Visits the project as needed to audit the effectiveness of the safety and health program;
- Provide safety and health expectations and flow down requirements for subcontractor statements of work;
- Be available on a 24-hour basis for consultation with the SSHO during on-site emergencies or as needed;
- Coordinate any modifications to the safety plans with the SSHO and PM, as required;
- Evaluate occupational exposure monitoring/air sampling data and adjust APP/SSHP requirements as necessary;
- Provide continued support for upgrading and/or downgrading the level of personal protective equipment (PPE);
- Participate in the investigation of unplanned events, high loss potential incidents, and accidents; and
- Assist in development of on-site training, which will be provided by the SSHO.

4.2.3 Project Manager [Mr. Mark MacEwan, P.E.]

The AECOM Project Manager (PM) represents the company in all aspects of the project work and is responsible for the following:

- Providing leadership by, among other things, setting an example for all site personnel through actions and words regarding the importance of proper health and safety practices and holding project staff accountable for safety performance;
- Coordinating all work performed by AECOM personnel and subcontractors for the project;
- Ensuring the APP/SSHP is approved prior to commencing field operations;
- Ensuring all required PPE, other types of equipment and instruments, safety incentives, and other safety-related items are budgeted and provided;
- Ensuring that subcontractor Statements of Work include appropriate safety provisions and expectations;
- Ensuring that safety and health requirements are covered during kickoff meetings;
- Participating in the investigation of, and ensuring that unplanned events, high loss potential incidents, and accidents are properly reported to USACE;
- Notifying the Regional SH&E Manager of any changes in the scope of work or site conditions, and ensuring that the APP/SSHP is updated to address new hazards;

- Immediately stopping operations in the event of an emergency or serious hazard, in order to protect personnel and the environment; and
- Preparing and submitting required work progress reports.

4.2.4 Site Safety and Health Officer [TBD]

The AECOM SSHO will be responsible for managing, implementing, and enforcing AECOM's health and safety program in accordance with the accepted APP. The SSHO will be a competent person that can identify existing and predictable hazards in the working environment or working conditions that are dangerous to personnel, and who has authorization to take prompt corrective measures to eliminate them. The SSHO will have the authority and is responsible for the following actions:

- Review investigation operations to implement the APP/SSHP;
- Inspect site activities to identify safety and occupational health deficiencies and correct them;
- Coordinate changes/modifications to the APP/SSHP with the Regional SH&E Manager, PM, and Site Supervisor;
- Conduct project-specific OSHA training;
- Ensure all field personnel, including any subcontractor personnel assigned to the project, have satisfied requirements for training and medical surveillance as specified by 29 CFR 1910.120, and that records of training and medical approval are available and maintained for each person;
- Oversee compliance with the APP/SSHP procedures and OSHA regulations;
- Serve as a member of the QC staff on matters relating to safety and health;
- Stop work if unacceptable safety and health conditions exist, and take necessary action to re-establish and maintain safe working conditions;
- Review operations and maintenance records of air monitoring equipment required at a site for airborne contaminants and prepare air monitoring reports; and
- Maintain all required safety and health records (e.g., OSHA 300 Logs, incident/accident reports, training certificates and qualifications, equipment checklists, safety plans, air monitoring data and reports, etc.) throughout the life of the project.

4.2.5 Site Supervisor

The Site Supervisor will manage the on-site investigation operations in accordance with the approved Work Plan and APP/SSHP. The Site Supervisor will coordinate all on-site personnel and equipment conducting investigation operations in a safe manner. The Site Supervisor will coordinate all work with the SSHO to address all safety concerns adequately. The Site Supervisor will immediately stop work in the event of an emergency or serious hazard in order to protect personnel and the environment. The Site Supervisor will work with the Regional SH&E Manager, PM, and SSHO in coordinating changes/modifications to the APP/SSHP, as needed.

4.2.6 Field Personnel

Field Personnel will be responsible for understanding and following the APP/SSHP and performing their work in a safe and responsible manner. Specific responsibilities will include the following:

- Act in a responsible manner at all times in order to prevent incidents, injury, and/or exposure to themselves and their co-workers;
- Report any and all incidents, including near misses, to the Site Supervisor or SSHO;
- Attend and participate in all daily health and safety tailgate meetings;
- Participate in the development of AHAs as required, and follow the provisions as outlined in the final AHAs;
- Follow instructions and directions of the Site Supervisor and SSHO;

- Utilize the prescribed PPE provided for each task;
- Following all field safety procedures for safe work practices (e.g., the buddy system, communication, site control, decontamination, evacuations, and related emergency procedures);
- Perform only those tasks they have been instructed to perform if they are trained, qualified, and capable of performing safely at the time of assignment;
- Report any personal condition that could affect their safety and/or the safety of co-workers (e.g., fatigue, drowsiness, severe illness, impairment by prescription medications, influence by drugs and alcohol, emotional stress, or other condition); and
- Ensure that no work tasks are performed in deviation from the APP/SSHP and/or the initial instructions of the Site Supervisor and SSHO.

4.3 Competent Person Work Requirements

In order to complete investigation tasks, an OSHA-designated competent person must be on site to perform the required daily inspections of equipment and/or operations. No work will be performed unless a designated competent person is present on the job site. The training requirements for competent persons are specified in the SH&E SOP 202, *Competent Person Designation* (refer to Attachment C).

4.4 Lines of Authority

Figure 4-1 illustrates the lines of authority for the personnel responsible for project safety.

4.5 Safety Disciplinary Policy

Employee non-compliance with safety requirements is taken very seriously by AECOM management. Personnel not following procedures are warned and counseled on the proper safety procedures and if the problem persists, are again counseled with notations made in their permanent record. Continued non-compliance can lead to termination of employment.

AECOM has developed the following progressive discipline policy for the violation of safety requirements. Extremely careless or reckless violations may results in immediate termination.

First Violation: An oral warning will be given for the first violation of a SH&E requirements depending on the severity of the violation. The employee will be informed by his or her supervisor of the violation and of the correct safe practice or procedure. The supervisor will review with the employee all applicable safety and health workplace requirements and guidelines. The employee must sign a statement indicating understanding of those requirements and guidelines. The supervisor should inform the employee that future violations will result in higher levels of discipline and may lead to dismissal.

Second Violation: The employee may be given a written warning for the second documented safety and health requirement violation. This warning will specifically identify the violation. The warning will also refer the employee to applicable safety and health requirements and guidelines for review, and also show the date the employee previously read and signed the statement of understanding of safety and health requirements and guidelines. The employee, the employee's supervisor, the department head, Human Resources, and the employee's personnel file receive copies of the warning.

Third Violation: the employee may be given a final warning for the third documented violation of safety and health requirements or guidelines. This warning will specifically identify the violation. It will also state that any further violation of safety and health requirements and guidelines will result in dismissal. All persons who receive a copy of the previously written warning will receive a copy of the final warning.

Any Subsequent Violation: the employee may be dismissed for a subsequent violation. If dismissed, the employee will receive a letter specifically identifying the violation of the safety and health requirement or guideline, as well as rights of appeal through the grievance process.

Immediate Termination: On occasion, an employee will commit a violation of a safety and health requirement or guideline that is so careless and reckless, or that so endangers life or property, that it can be considered imminently dangerous. When this occurs, an employee may be dismissed immediately, without benefit of any warnings. An employee dismissed in this fashion will receive a letter specifically identifying the violation and setting out his/her right of appeal within the grievance process.

Discipline for Subcontractor Personnel: If noncompliance actions are committed by subcontractor personnel, AECOM will recommend that the employer discipline the employee. If the action continues, AECOM will have the employer remove the employee from the site.

Documentation: Employee warnings and disciplinary actions will be documented using AECOM's Corporate Memorandum format in a manner consistent with the requirements of this policy.

4.6 Manager and Supervisor Accountability

Managers and supervisors are responsible for enforcing safety and health as part of their job descriptions. They are ultimately responsible for protecting the welfare of the employees, as well as minimizing the potential liability associated with on-the-job accidents. Annual performance reviews and incentive plans for managers and supervisors include the assessment of both the individual's safety performance as well as their project safety performance.

5 Subcontractors and Suppliers

Various subcontractors and suppliers will be used to execute the project, subcontractors selection will be based on their safety compliance history with OSHA, prior experience with AECOM, the USACE, and their Experience Modification Rating (EMR). AECOM will use subcontractor and suppliers with an EMR of less than or equal to one.

Subcontractors and suppliers are required to provide a safe and healthful working environment for employees that are free from recognized hazards that are causing or likely to cause harm to their employees and other project personnel.

Subcontractors and suppliers are responsible for compliance with the safety and health requirements found in EM 385-1-1 (3 November 2008), In addition, subcontractors and suppliers are responsible for compliance with the safety and health requirements set forth in the APP.

Subcontractors working on the project site are required to designate a competent person –who can identify existing and predicable hazards in the working environment or working conditions that are, dangerous to personnel and who has authorization to take prompt corrective measures to eliminate them.

The subcontractor shall immediately correct any unsafe conditions that are brought to its attention. When unsafe conditions are not corrected to the satisfaction of AECOM work will be stopped. The work stoppage will be in place until the corrective steps to eliminate the unsafe conditions are taken.

Where the subcontractor fails to correct the unsafe conditions and/or repeatedly fails to comply with the safety and health requirements as found in EM 385-1-1, or the requirements of this AAP and specific safety plans, AECOM will take the following action:

- Stop work until the conditions are corrected to the satisfaction of AECOM.
- Meet with the subcontractors management team
- Send a written notice of non-compliance to the subcontractor, AECOM Procurement and Project Managers.
- Initiate contract termination procedures.

Personnel refusing or repeatedly failing to comply with AECOM job safety requirements, or supervisors failing to enforce compliance with these and referenced standards shall be, promptly disciplined by their employer, which at AECOM's discretion, and may include removal from the project.

5.1 List of Subcontractors

The following subcontractors will be utilized for the ANG2013NEASTCRP field activities:

- Driller for concrete coring/soil boring/sampling/well installation;
- Geophysics to locate potential leach fields/underground storage tanks/utilities
- Land Surveyor to locate soil borings and monitoring wells;
- Waste transportation and disposal subcontractor for removal and disposal of investigation-derived waste (IDW); and
- Various suppliers for field sampling equipment and health and safety supplies.

5.2 Regulatory Requirements

The work performed shall comply with the safety and health requirements as found in EM 385-1-1 and OSHA Construction Industry Standards (29 CFR 1926). Where, the safety requirements of EM 385-1-1 and of this APP very from the 29 CFR 1926, the most stringent requirement shall be followed.

Subcontractors and suppliers are required to provide a safe and healthful working environment for employees that are free from recognized hazards that are causing or likely to cause harm to their employees and other project personnel.

Subcontractors and suppliers are responsible for compliance with the safety and health requirements as found in EM 385-1-1 (3 November 2008), In addition, subcontractors and suppliers are responsible for compliance with the safety and health requirements set forth in the APP.

5.3 Subcontractor and Supplier Identification

The following subcontractors will be utilized for the ANG2013NEASTCRP field activities:

- Driller for concrete coring/soil boring/sampling/well installation;
- Geophysics to locate potential leach fields/underground storage tanks/utilities
- Land Surveyor to locate soil borings and monitoring wells;
- Waste transportation and disposal subcontractor for removal and disposal of investigation-derived waste (IDW); and
- Various suppliers for field sampling equipment and health and safety supplies.

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6 Training

6.1 Indoctrination Training

Prior to the first work shift or visit, all personnel shall receive safety indoctrination given by the SSHO or delegate. The indoctrination shall be relevant to the work being undertaken and pertinent provisions of the AAP and the project health and safety plan. Indoctrination shall include but not be limited to:

- Requirements and responsibilities for accident prevention and maintaining safe and healthful work environments;
- General safety and health policies and procedures and pertinent provisions of this APP;
- Employee and supervisor responsibilities for reporting all accidents;
- Provisions for medical facilities and emergency response and procedures for obtaining medical treatment or emergency assistance;
- Procedures for reporting and correcting unsafe conditions or practices;
- Job hazards and the means to control/eliminate those hazards, including applicable activity hazard analyses; and project specific training

6.2 Mandatory Training and Certifications

AECOM will verify that personnel under their control have received the necessary safety training. Training shall comply with the USACE and OSHA's Safety and Health training requirements. Documentation and certificates of training will be kept on site and available for inspection by Government Designated Authority (GDA). At minimum, depending on the tasks performed and the hazards involved, personnel shall be trained on the following:

- Hazardous Communication/Right to Know
- Control of hazardous energy (lockout)
- 40-hour HazWoper training
- 8-hour HazWoper annual refresher training
- 8-hour HazWoper Supervisor training
- 30 hour Construction Safety Awareness training (supervisors and SSHO)
- First aid and CPR training (at least two) from each employer
- Personal protective equipment

As site condition and hazards change, employees shall be trained on the following:

- Confined space
- Fall prevention/protection
- Respiratory protection
- Lead Hazards
- Asbestos

6.3 Training Schedule

Mandatory training will be conducted off-site by either an in-house training program or by outside instructors. As applicable, training will be conducted on-site by the Supervisors, or by outside resources.

When supervisory personnel has reason to believe that any person who has already been trained does not have the understanding and skill required the person will be retained by the SSHO or supervisory personnel or by an outside trainer.

Circumstances where retraining is required include, but not limited to situations where:

- Changes in the workplace render previous training obsolete
- New products (PPE) or equipment is introduced into the workplace
- Training expires (i.e. lift truck, first aid etc.)

6.4 Emergency Response Training

As part of the emergency response plan personnel will be trained in the following:

- First aid and CPR (two employees per shift)
- Location and use of alarm and communication system
- Location and use of fire extinguishers
- Location of first aid kit, telephone and spill control supplies
- Routes of escape and location of evacuation assembly area

6.5 Periodic Safety and Health Training

Safety meetings will held at the beginning of each job and at least weekly thereafter, according to the various circumstances involved or when necessary to clear working procedures. The safety meetings will be conducted by the site Supervisor. Project personnel shall attend the safety meeting and sign a meeting roster to confirm attendance. Safety Meeting for non- English speaking personnel will be held in the persons native language.

Safety meetings shall be conducted to review past activities, plan for new or changed operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent safety and health training and motivation.

As part of the safety meeting, employee feedback (comments, questions, health or safety concerns) are welcomed. Issues addressed in the safety meetings will be documented and shall include the date, attendees, subjects discussed and names of individual(s) who conducted the meeting.

6.6 Safety Bulletin Board

Projects are anticipated to be short term in nature, using a mobile crew. For long duration projects where a field office is established a safe bulletin board will be erected and maintained.

A safety bulletin board to increase employee's safety awareness and convey the company's safety message will be installed on long term projects. The following items shall be posted on the Bulletin Board:

- Map denoting the route to the nearest emergency care facility.
- Emergency phone numbers.
- Safety and Health promotional posters.
- Date of last lost workday injury.
- Citation and Notice. If a Citation and Notice is received, it must be posted until all violations are abated
- OSHA and/or USACE required postings.

The following will be mounted on or adjacent to the bulletin board or a notice will be posted that states the location of the documents which will be accessible on the site by all workers.

- Copy of current activity hazard analysis/analyses (AHA)
- Copy of the most up-to-date accident prevention plan (APP)
- OSHA Form 300A
- Copy of Safety deficiency tracking log

7 Safety and Health Inspections

7.1 Daily Job Site Safety and Health Inspection

Due to the short duration and limited nature of the PA/SI field work, and multiple locations of the ANG facilities, the ANG2013NEASTCRP project SSHO may designate a qualified and competent person to conduct site specific daily job site health and safety inspections. The site specific SSHO will conduct daily jobsite health and safety inspections/audits to identify new or previously unidentified hazards, verify the effectiveness of hazard control measures, observe workers performing tasks, and provide feedback to workers. Deficiencies noted during the daily inspection will be corrected immediately, or work will be stopped in the affected area until the deficiency is corrected. The daily jobsite health and safety inspection will be documented in the SSHO logbook.

Identified safety and health issues and deficiencies, and the actions, timetable, and responsibility for correcting the deficiencies, will be recorded on an inspection form. Follow-up inspections to ensure correction of any identified deficiencies will also be conducted and documented on an inspection form.

AECOM will establish a safety and occupational health deficiency tracking log that list and monitors the status of safety and health deficiencies in chronological order. The log will be posted on a project safety bulletin board, be updated daily, and will provide the following information:

- Date of deficiency;
- Description of deficiency;
- Name of person responsible for correcting deficiency;
- Projected resolution date; and
- Date actually resolved.

Table 7-1 lists the safety and health inspection requirements for the ANG2013NEASTCRP anticipated field operations.

Table 7-1
Safety and Health Inspection Requirements

What	Who	When	Documentation
General Site Conditions	SSHO	Daily	Log Book
	SSHO	Weekly	Safety Inspection Form
	Project Manager	Monthly	Safety Inspection Form
	SH&E Manager	Quarterly	Safety Inspection Form
Tools and Equipment	Users	Daily	Tag and Remove Defective Items from Service
Personal Protective Equipment	SSHO	Initial/Monitor use Daily	Log Book

7.2 External Inspections and certifications

External inspections are not expected for this project. In the event that an OSHA or other regulatory agency inspection, AECOM will immediately notify and provide USACE the opportunity to accompany AECOM on the inspection. AECOM will provide USACE a copy of any citations or reports issued by the inspector and any corrective action responses to the citation(s) or report(s).

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8 Accident Reporting

All incidents, no matter how minor, are to be reported immediately (within 24 hours) by employees to their immediate supervisor or manager. Supervisors are responsible for ensuring that all incidents are reported immediately, subsequently documented, and investigated so that corrective action can be initiated to prevent a reoccurrence. The Supervisor shall facilitate and personally assist in the investigation of all incidents. Documents pertaining to an incident analysis must be complete and accurate.

AECOM employee is injured and requires medical treatment, the Site Supervisor will contact the Regional SH&E Manager, AECOM's Incident Reporting Line at (800) 348-5046, the PM and CO immediately. The Site Supervisor will initiate a written report, using the Supervisor's Report of Incident form (S3NA-004-PR). The Site Supervisor will complete the first two sections of this form and forward to the PM for completion of Section 3. The report will then be provided to the Regional SH&E Manager before the end of the following shift.

For OSHA recordable injuries and illnesses, high visibility accidents (any mishap which generate publicity and/or high visibility) and property damage accidents resulting in at least $2,000 in damages, AECOM will conduct an accident investigation to establish the root cause(s) of the accident, complete the Contractor Significant Incident Report (CSIR) form, USACE Accident Report Form 3394, and provide the report to the CO within five calendar days of the accident.

8.1 Accident Investigation

All accidents, no matter how minor, are subject to investigation. Reasonably, an accident causing death or serious injury will require a more thorough analysis than one resulting in a first-aid case. Any near-miss incident that might have caused harm and steady reoccurrence of minor injuries (first-aid cases) also requires investigating. Supervisory personnel shall initiate the analysis as soon after the incident as possible.

The primary focus of the investigation is to determine why the incident occurred, what actions should be taken to prevent it from reoccurring, and if employee training or retraining is required. Investigations are not intended to be faultfinding, but should seek to identify any unsafe conditions or acts that must be corrected. Such information serves an important purpose to help management learn from past mistakes in order to prevent and control hazards and potential incidents on future projects.

Questions that should be asked during an incident investigation include the following:

- What happened?

  The investigation should describe what took place to prompt the investigation (injury, damage to property, etc.).

- Why did the incident happen?

  The investigator must obtain all the facts surrounding the incident (who was involved, what caused the incident to occur, were employee(s) qualified to perform the task, etc.).

- What needs to be done to prevent reoccurrence?

  The investigator must determine what aspect of the operation or process needs additional attention. The purpose of this portion of the investigation is not to fix blame, but to give constructive recommendations for improving the work environment by establishing safe work practices or correcting unsafe conditions

8.2 Accident Notification

The CO and the AECOM Project Manager and Regional SH&E Manager shall be notified immediately, but not later than four hours, after any accident meeting the definition of Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than $2,000,or any weight handling equipment accident. Information shall include:

- Contractor name; contract title; type of contract; name of activity,
- Installation, or location where accident occurred;
- Date and time of accident;
- Name(s) of personnel injured; extent of property damage, if any;
- Extent of injury, if known; and
- A brief description of the accident (to include type of construction equipment used, PPE used, etc.).

As necessary preserve the conditions and evidence on the accident site until the Government investigation team arrives on site and Government investigation is conducted.

8.3 Monthly Exposure Report

Monthly exposure reporting to the CO is required to be attached to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both prime and subcontractor. The monthly exposure as prepared by AECOM will also include type of incidents (e.g., first aid, near hits, exposure to hazardous chemicals, OSHA recordables).

8.4 Reports

All incidents noted above with the exception of near miss accidents require the preparation of ENG. 3394, and AECOM Incident Report, which are available electronically from the Corporate Safety Office. ENG 3394 must be provided to the CO and EH&S Manager within five calendar days of the accident

An incident log for: recording daily first-aid treatment, near misses, exposures and other incidents that are not otherwise reportable will be maintained on the project site. The log shall be furnished to the GDA representative upon request. AECOM will maintain a log of work-related injuries and illnesses (OSHA 300-A) in accordance with OSHA requirements.

9 Plans (Programs, Procedures) Required by the Safety Manual

Based on the scope of site investigation activities, all applicable safety plans, programs, and procedures to address risk and compliance requirements were identified and are described below.

9.1 Layout Plans

During the project work plan phase, the site layout will be planned to show the work sites, administrative areas, access and egress routes and parking areas. Staging areas for the temporary storage of equipment and supplies, as well as waste materials, will be sited. Location maps are provided in the Work Plan.

9.2 Hazard Communication (HAZCOM) Program

Included as Attachment D to this Accident Prevention Plan is AECOM' s written hazard communication program (S3NA-507-PR) addressing as a minimum, the following: training (to include potential safety and health effects from exposure), labeling, current inventory of hazardous chemicals on site, and the location and use of Material Safety Data Sheets (MSDSs).

9.3 Emergency Response Plan

An Emergency Response Plan is included in the Site Safety and Health Plan (Attachment J to this Accident Prevention Plan). This Emergency Response Plan includes site-specific emergency procedures to ensure employee safety in case of fire or other emergency, including emergency telephone numbers and reporting instructions for ambulance, physician, hospital, fire, and police. Also a map of directions to the nearest hospital(s). The plan also includes Spill Response Procedures including organizations with telephone numbers of individuals to contact in the event of a spill.

9.4 Firefighting Plan

AECOM personnel will not be engaged in firefighting activities. Regardless of the size and nature of the fire, and AECOM's ability to respond, all fires will be reported immediately to the local fire department

9.5 Respiratory Protection Plan

AECOM's Respiratory Protection Plan (S3NA-519-PR) is included as Attachment E to this Accident Prevention Plan.

9.6 Health Hazard Control Program

Activity Hazard Analyses (AHA's) shall consider all substances, agents and environments that present a hazard and will recommend hazard control measures. Engineering and administrative controls shall be used to control hazards. In cases where engineering or administrative controls are not feasible, PPE may be used. The AHA shall serve as certification that a hazard assessment has been conducted.

9.7 Site Sanitation

AECOM's Sanitation Plan is included as Attachment F to this Accident Prevention Plan.

9.8 Abrasive Blasting

Not applicable

9.9 Confined Space

Not applicable

9.10 Hazardous Energy Control Plan

Not applicable

9.11 Access and Haul Road Plan

Not applicable

9.12 Plan for Prevention of Alcohol and Drug Abuse

AECOM's plan for prevention of Alcohol and Drug Abuse is included as Attachment G to the Accident Prevention Plan. This plan meets the minimum requirements of DFAR 252.223-7004.

9.13 Excavation Plan

Not applicable

9.14 Lead Abatement Plan

Not applicable

9.15 Asbestos Abatement Plan

Not applicable

9.16 Critical Lifts

Not applicable

9.17 Demolition Plan

Not applicable

9.18 Fall Protection Plan

Not applicable

9.19 Steel Erection Plan

Not applicable

9.20 Night Operations

Not applicable

9.21 PCB Plan

Not applicable

9.22 Heat and Cold Stress Plan

The SSHO has the authority to stop work or restrict work when ice, snow, lightening or other weather condition poses a potential risk to site personnel. AECOM's Cold Stress Prevention Plan (S3NA-505-PR) and Heat Stress Prevention Plan(S3NA- 511- PR) are included as Attachment H to this Accident Prevention Plan.

9.23 Wild Land Fire Management Plan

This section is not applicable to the tasks being performed for this project.

9.24 Medical Support

The AECOM's Occupational Medical Program has been established to ensure that the health of all employees is not compromised by potential exposure to hazardous substances and physical agents encountered in the workplace. The program requires that prompt first aid and medical treatment be given to those that are injured on the job.

AECOM personnel performing on-site work that may result in exposure to contaminant-related health and safety hazards are enrolled in the medical surveillance program that complies with OSHA standard 29 CFR 1910.120 (f)/29 CFR 1926.62 (f). They will have successfully completed a pre-placement occupational physical examination and annually thereafter. The medical surveillance program meets the following requirements:

- The physician's opinion concerning the employees' abilities to perform the assigned work shall be provided to the Regional SH&E Manager,
- The required written physician's opinion shall be made available upon request,
- All medical records are maintained in accordance with 29 CFR 1910.1020,
- Examinations are given at least once every 12 months unless the attending physician believes a longer interval (not greater than biennially) is appropriate, and
- Examinations are administered by a licensed physician who is certified by the American Board of Preventive Medicine.

AECOM will certify that all employees have successfully completed a physical examination by a qualified occupational health physician and will supply certification of medical clearance for each on-site employee.

Off Site Medical Support

The off-site consulting physician for AECOM's Occupational Medical Program is Peter Greaney, M.D. Dr. Greaney is a board certified Occupational Physician (American Board of Preventive Medicine). The Doctor can be reached at:

WorkCare
300 South Harbor Blvd
Suite 600
Anaheim, CA 92868
800-455-6155

On-Site Medical Support

On-site medical support will consist of individuals trained in first aid and CPR. As required by EM385-1-1 Section 3 a first aid kit(s) that meet the requirements of ANSI Z308.1-2003 will be maintained on site. At least two employees on each shift will be qualified to administer first aid. The first aid qualified people are as follows:

- Site supervisor
- SSHO

9.25 Process Safety Management Plan

This section is not applicable to the tasks being performed for this project.

9.26 Site Safety and Health Plan for HTRW Work

See the site-specific SSHP, Attachment I to this APP.

10 Risk Management Processes

Detailed site specific hazards and controls will be provided in the activity hazard analysis (AHA) for each phase of the operation (each Major Definable Feature of Work as defined by the Contractor Quality Control Plan). The AHA's will provide information on how the requirements of major sections of EM 385-1-1 will be met. Particular attention shall be paid to:

- Physical Hazards
  - Struck by
  - Caught in or between
  - Electrical shock
  - Falls
  - Noise
  - Fire/explosion
  - Confined Space
- Health Hazards
  - Chemicals
  - Biological (flora and fauna**)**
  - Non-ionizing radiation (intense light)
  - Heat and cold stress
  - Musculoskeletal disorder (MSD)

The control measures that will be employed to manage the risk follow the hierarchy of controls, which are as follows:

- Elimination (design it out) **Most Effective Control**
- Substitution (use something else)
- Engineering controls (isolation, guarding)
- Administrative controls (training, work schedule signage)
- Personal protective equipment **Least Effective Control**

The AHAs will be considered a "living document" with revisions incorporated based on actual work activities being performed. The contents of the AHAs will be communicated to affected personnel before work begins and shall be periodically reviewed with affected personnel thereafter.

The specific AHAs identifying the project-specific task hazards and controls are presented in the SSHP, Attachment J to this APP

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Attachment A

AECOM OSHA 300 Form

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Summary of Work-Related Injuries and Illnesses

Using the Log, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the log. If you had no cases write "0."

Number of Cases

Total number of deaths	Total number of cases with days away from work	Total number of cases with job transfer or restriction	Total number of other recordable cases
0	10	7	37
(G)	(H)	(I)	(J)

Number of Days

Total number of days away from work	Total number of days of job transfer or restriction
399	262
(K)	(L)

Injury and Illness Types

Total number of...
(M)

(1) Injury	47	(4) Poisoning	0
(2) Skin Disorder	0	(5) Hearing Loss	0
(3) Respiratory Condition	0	(6) All Other Illnesses	7

Establishment information

Your establishment name AECOM Technical Services, Inc

US Locations

Industry description (e.g., Manufacture of motor truck trailers)
Engineering and Consulting

Standard Industrial Classification (SIC), if known (e.g., SIC 3715)

OR North American Industrial Classification (NAICS), if known (e.g., 336212)
5 4 1 3 3 0

Employment information

Annual average number of employees 10765

Total hours worked by all employees last year 21,531,000

Sign here

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

Company executive

VP-SH&E
Title

724-695-9353
Phone

1-30-13
Date

Log of Work-Related Injuries and Illnesses

Year 2012

Establishment name

City State

Identify the person		Describe the case				Classify the case											
(A) Case No.	(B) Employees Name	(C) Job Title	(D) Date of injury or onset of illness (mo./day)	(E) Where the event occurred (e.g. Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)	CHECK ONLY ONE box for each case based on the most serious outcome for that case:				Enter the number of days the injured or ill worker was:		Check the "injury" column or choose one type of illness: (M)					
						Death	Days away from work	Remained at work: Job transfer or restriction	Remained at work: Other recordable cases	Days Away From Work (days)	On job transfer or restriction (days)	Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other illnesses
						(G)	(H)	(I)	(J)	(K)	(L)	(1)	(2)	(3)	(4)	(5)	(6)
2012.01.11.18. A7374C0D91E F		Superintendent	1/11/2012	293 Court Street Project, Binghamton, NY	Disconnected a camlock fitting and hose became stuck. Hose snapped back when force was applied striking EE face causing cut lip, 2 broken teeth and 4 cracked teeth				x			x					
2012.01.13.03. 400F36BF0C0D		EnvironmentalPlanner	1/12/2012	Columbus Road in Mansfield, New Jersey	Stepping on a mid rail of a wooden fence in order to climb over to take site photographs, the mid rail broke and the employee fell head first resulting in C-1 vertebrae fracture with lost time		x			180		x					
2012.01.12.14. CDF902C0C0B C		Const Inspector II	1/12/2012	Montgomery outer loop job site, Montgomery, AL	RT elbow contusion, lower back strain, employee struck by excavator counterweight, knocked to the ground. RX - anti-inflammatory/relaxant				x			x					
2012.01.19.13. B8D3FF2D298 D		Construction Foreman	1/19/2012	Pier 6 in Fairfield, MD	Leaving the pier and his foot hit the slight raised asphalt at the end causing him to fall forward causing a fracture LT lower arm (radius)		x			7		x					
2012.01.23.05. F76164F4C886		Project Controls	1/19/2012	1003 Bishop St., Honolulu, HI	Sitting at desk reaching for a trash can EE fell out of chair, striking head on windowsill causing laceration to forehead and 11 stitches.				x			x					
2012.02.13.13. B7D61DEF70B 3		Construction Inspect	2/7/2012	Dumbarton Bridge Area, Newark CA	Unsecured steel plate slipped when sloped on wall and struck employee's right foot resulting in fractured toe (4th/5th) and prescription medication				x			x					
2012.02.28.11. 384541793B1C		Benefits	2/17/2012	515 SFlower St, 10th Fl, Los Angeles, CA	Pain in right wrist while performing office tasks (typing etc) requiring hard brace, physical therapy and RX.				x								x
2012.02.17.14. EE198DFCD9A 9		Laborer	2/17/2012	293 Court Street Project, Binghamton, NY	Dislocation of right ankle when stepped down from waste trailer and rolled right ankle requiring lost time with hard cast.		x			58	36	x					

Identify the person			Describe the case			Classify the case											
(A) Case No.	(B) Employees Name	(C) Job Title	(D) Date of injury or onset of illness (mo./day)	(E) Where the event occurred (e.g. Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)	CHECK ONLY ONE box for each case based on the most serious outcome for that case: Death (G)	Days away from work (H)	Remained at work: Job transfer or restriction (I)	Remained at work: Other recordable cases (J)	Enter the number of days the injured or ill worker was: Days Away From Work (days) (K)	On job transfer or restriction (days) (L)	Check the "injury" column or choose one type of illness: (M) Injury (1)	Skin Disorder (2)	Respiratory Condition (3)	Poisoning (4)	Hearing Loss (5)	All other illnesses (6)
2012.03.01.09.3700ED7D7F8A		Sr Tech	2/28/2012	8400 West Block Ryan Road, Sheybogan, WI	Lifting a density testing machine (weighing 40 lbs) from ground level to just higher than the bed of a his truck resulting in LT shoulder strain with RX for pain and inflammation				x			x					
2012.03.12.11.C89B3C68733C		Designer 1	3/8/2012	1755 Fairway Dr. San Leandro, CA	Mild concussion after hitting head on scaffolding while wearing a hard hat requiring RX for pain and work restrictions			x			14	x					
2012.03.26.07.F96A42E26063		Proposal Speicalist	3/12/2012	AECOM office, Newport Beach CA	Ulnar Nerve irritation from resting elbows (bilateral) on workstation requiring rx for inflammation				x								x
2012.03.21.05.9F6F6660704E		Inspector	3/13/2012	Henry Hudson Pkwy GWB Ramp New York	Neck, RT shoulder, RT arm, RT Elbow and lower back pain from motor vehicle accident requiring physical therapy and restricted duty			x			5	x					
2012.04.12.04.2F377CC7CADD		Scientist-Tech Spc 3	4/11/2012	Culvert at Kivett Dr., Greensboro, NC	Slipped on a downed tree while surveying and fell on left side. Diagnosis of pain in left flank requiring RX treatment.				x			x					
2012.11.29.05.028443CA7048		Env Compliance	4/15/2012	1001 Bishop Street,Suite 1600 ASB Tower, Honolulu,	Ergo request for support due to back and shoulder pain requiring PT				x								x
2012.04.24.10.058F4F514D59		Project Accountant	4/20/2012	Instersection of 13th and I Streets, Sacramento, C	Sprain or strain of cervical spine, strain shoulder, trapezius muscle sprain or strain of lumbar region from motor vehicle accident resulting in lost time		x			2	6	x					
2012.05.01.12.0CE82AC54902		Biller	4/30/2012	AECOM Office workstation, Alexandria VA	Contusion to lower back and Lumbar strain when falling from office chair resulting in RX for pain and physical therapy				x			x					
2012.05.01.13.858C3D4A25A6		Project Accountant	5/1/2012	Atlanta officeOne Midtown Plaza, (workstation), GA	LT forearm pain from repetitive motion causing tendonitis requiring physical therapy				x								x
2012.05.04.02.824E1FF57928		Inspector	5/2/2012	I 95 SRI Interchange, Christiana DE	Minor bruises to the hands and shins plus abrasions to both forearms; received Rx (800 mg Motrin & 10 mg Flexiril) for pain.				x			x					
2012.05.14.07.CAEA13AC9145		Tech III	5/10/2012	Edwards AFB Staging area CA	RT eye irritation when using a grinder to cut a steel drum. Requiring optical exam and flush of eye and RX for vicodin and gentymycin ointment				x			x					
2012.05.15.07.3794EDD8EFF2		Engineer I	5/14/2012	I-95 bridge over Branywine Creek, Wilmington, DE	Walking down a bridge embankment, the EE slipped on the mud, tripped over a tree branch/stump, and rolled/twisted his RT ankle requiring work restrictions and PT			x			9	x					
2012.05.24.10.09817B3A6207		Const. Manager	5/21/2012	Delaware River Project, Wilmington/New Castle, DE	Contusion to the RT shin/leg when he slipped on debris requiring light duty and RX			x			30	x					
2012.05.23.15.F7F33D72B5DA		Archaeological Field	5/21/2012	Solar Genisis field area, Blythe, CA	Rash on both ankles and feet from working outside in heat requiring RX (kenalog shot) for treatment.				x			x					

Identify the person			Describe the case			Classify the case											
						CHECK ONLY ONE box for each case based on the most serious outcome for that case:				Enter the number of days the injured or ill worker was:		Check the "injury" column or choose one type of illness:					
								Remained at work				(M)					
(A) Case No.	(B) Employees Name	(C) Job Title	(D) Date of injury or onset of illness (mo./day)	(E) Where the event occurred (e.g. Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)	Death (G)	Days away from work (H)	Job transfer or restriction (I)	Other recordable cases (J)	Days Away From Work (days) (K)	On job transfer or restriction (days) (L)	Injury (1)	Skin Disorder (2)	Respiratory Condition (3)	Poisoning (4)	Hearing Loss (5)	All other illnesses (6)
2012.06.04.05. F8191232E6C8		Chief Inspector	5/21/2012	Albany and West Street, NY, NY	Twisted LT Ankle in the rain stepping off curb resulting in ankle sprain with - Bruise from heel to arch on LT ankle requiring steriod injections and ankle brace for ankle sprain.				x			x					
2012.05.30.11. D0625A98F4FA		Administrator	5/30/2012	Office trailer; 5000 Overlook Ave., Washington DC	Right foot sprain; on the later aspect of her right mid foot when running downstairs to get supplies requiring RX for Ibuprofen				x			x					
2012.06.01.12. 59938FDF5221		Traffic Incident Mgm	6/1/2012	Broward Turnpike, I-595, Miami FL	RT shoulder impingment and full thickness tear and required surgery resulting from motor vehicle accident		x			52	47	x					
2012.06.18.10. 028F55F07E33		Air Quality Tech	6/1/2012	Freeport McMoran, Claypool, AZ	Chondromacia of left knee from stairs when carrying equipment and received PT and RX for inflammation			x			26	x					
2012.06.14.10. 56B5B38D8631		CAD Operator	6/12/2012	Honolulu AECOM office	Neck sprain, sprain of unspecified site of wrist, thoracic sprain from repetitive motion requiring RX and wrist brace		x			14		x					
2012.07.19.06. DD4CF20600CD		Associate	7/9/2012	AECOM-Flower Street Office	LT Shoulder and elbow tendonitis due to long work hours, employee recieved Rx strength Voltaren Topical 1 %				x			x					
2012.07.13.09. CE43AB3390D0		Project Manager	7/12/2012	4500 Wilma Lane, Arlington, TX	Employee boosting themselves, loosing balance body weight straing elbow causing medial epicondylitis LT elbow. Physical therapy required.				x			x					
2012.07.26.19. 4FA0A2DBBC2E		Wildlife Technician	7/15/2012	Constitution pipeline field area,Richmondville, NY	Bee stings to right ankle and left thigh requiring RX for swelling				x			x					
2012.07.18.10. C2137DFF29D9		Cost Engineer	7/18/2012	7301 World Way West, Los Angeles, CA 90045	Twisted right ankle and back contusion when slipped out of her shoe went getting up at workstation requiring RX				x			x					
2012.08.31.06. EECEB5D773C3		Inspector II, Constr	8/5/2012	Lab Office Famingdale NY	Lower back pain from moving cylinders weighing approx 30lbs each requiring RX for pain and physical therapy				x			x					
2012.08.07.05. F43302198E1E		Inspector IV, Constr	8/6/2012	Cocke County field area, Del Rio, TN	Heel got caught on the edge of the basket and he fell backward onto his RT shoulder resulting in surgery, RX and work restrictions.		x			30	5	x					
2012.10.04.05. 41E9A198C2CA		Toxicologist	8/12/2012	Muskogee Pure Oil field Muskogee, OK	tick bite to lateral chest after field work requiring RX for lymes disease prevention				x								x
2012.08.13.11. F0E98815A4D8		Manager, Constructio	8/13/2012	I75/SR78 Ft Myers Florida	Out in field stepped in hole causing sprain to RT ankle requiring RX				x			x					
2012.08.30.10. 5EFDDB3EF0A6		Mechanical Engineer	8/17/2012	GUS - Richland, WA - 825 Goethals Drive	Moving server rack and hurt RT shoulder when pulling dr ordered theraputic exercises, and may have recomended a cortosone shot.				x			x					

Identify the person		Describe the case				Classify the case											
(A) Case No.	(B) Employees Name	(C) Job Title	(D) Date of injury or onset of illness (mo./day)	(E) Where the event occurred (e.g. Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)	**CHECK ONLY ONE box for each case based on the most serious outcome for that case:**				Enter the number of days the injured or ill worker was:		Check the "injury" column or choose one type of illness:					
						Death	Days away from work	Remained at work		Days Away From Work (days)	On job transfer or restriction (days)	(M)					
								Job transfer or restriction	Other recordable cases			Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other illnesses
						(G)	(H)	(I)	(J)	(K)	(L)	(1)	(2)	(3)	(4)	(5)	(6)
2012.08.24.04. 0DA7998C9E33		Design CADD Operator	8/20/2012	AECOM - Convoy	Back pain from lifting a water bottle onto the water cooler resulting in chiropractic treatment				x			x					
2012.08.27.08. F36002AB27E6		Technician II, Engin	8/27/2012	16595 BROWNVILLE RD. Northport AL	Little finger LT hand cut with saw blade requiring 6 stitches				x			x					
2012.09.04.14. E6FE72B6660D		Engineer III	8/29/2012	430 East River Avenue, Barron, WI 54812	EE with reaction to insect bite to RT arm and subsequent infection requiring RX for inflammation and infection.				x								x
2012.08.30.19. 98B6F5D63161		Fisheries Biologist	8/30/2012	Tule River California	Stumbled and fell on a boulder and a small sharp stick punctured LT thumb upon impact requiring stitches				x			x					
2012.09.28.13. 33DCC626C88 D		Engineer II	9/10/2012	OMF Building, Cleveland Street, St. Paul, MN	Twisted RT knee, slipped going around a parked truck, RX for anti-inflammatory			x			24	x					
2012.09.17.15. 88D172E895A8		Technician	9/13/2012	US Health Works, Folsom Blvd, Sacramento CA	Temporary Loss of Consciousness during blood draw for annual required physical				x			x					
2012.10.15.09. 9D40DE6FAB0 9		Scientist I, Geology	10/15/2012	Augusta, MI; Staging Area E-2, 5140 River Road	Inguinal strain, LT groin, lifting/pulling cinder block from from mud in river			x			5	x					
2012.10.23.14. C82CCD0E559 D		Scientist III	10/22/2012	Constitution Pipeline area, Oneonta, NY	EE's RT eye contacted by twig when bending causing subconjunctiveal hemorrage resulting in RX antibiotics.				x			x					
2012.10.29.19. 5B9A56B59096		Const Inspector	10/25/2012	4th Ave job site, Tucson, AZ	Sprained left elbow, shoulder discomfort requiring therapy exercise				x			x					
2012.10.29.14. 77215D2D470F		Senior ITS Engineer	10/26/2012	I-495 Wilmington, DE	Broken bone in right foot when stepped on a rock and twisted ankle in field.		x			2	40	x					
2012.11.01.12. 2D277A0206CB		Technician III, Engi	11/1/2012	Sheboygan Falls site South Cleveland St, WI	Exiting vehicle on passenger side and caught left foot on seat and fell landing on RT foot and wrenching his LT shoulder resulting in lost time, PT and RX.		x			52	15	x					
2012.11.08.06. 7FDD3B587A0 B		Chemical Engineer	11/7/2012	HWY-101 and I-110 , Los Angeles	Wrist Sprain, bruises, soreness, fractured rib as a result of a Motor Vehicle Accident/air bag deployment. Bone fracture, pain Rx and restricted work days, PT.		x			2		x					
2012.11.15.07. 6EE4141203FC		Project Manager	11/13/2012	JFK Airport Terminal NY	Debris in eye resulting in a scatch to eye; treated with Rx eye drops.				x			x					
2012.12.12.11. 7555E05ABAB8		Wildlife Biologist	12/10/2012	Field Area San Bernadino CA	tick to the middle back area w/ target rash resulting in doxycycline rx				x			x					

Identify the person			Describe the case			Classify the case											
(A) Case No.	(B) Employees Name	(C) Job Title	(D) Date of injury or onset of illness (mo./day)	(E) Where the event occurred (e.g. Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)	**CHECK ONLY ONE box for each case based on the most serious outcome for that case:**				Enter the number of days the injured or ill worker was:		Check the "injury" column or choose one type of illness: (M)					
						Death	Days away from work	Remained at work: Job transfer or restriction	Remained at work: Other recordable cases	Days Away From Work (days)	On job transfer or restriction (days)	Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other illnesses
						(G)	(H)	(I)	(J)	(K)	(L)	(1)	(2)	(3)	(4)	(5)	(6)
2012.12.18.13.7CCC1DAF2B3B		Wildlife Biologist	12/10/2012	Field Areal San Bernadino CA	Rash Associated with Poison Oak Exposure, Rx				x								x
2012.12.17.05.84ACC4252FF3		Resident Eng I	12/15/2012	Ala Wai Blvd at Niu St Honolulu HI	rear ended while stopped in traffic by another vehicle resulting in lumbar sprain, neck sprain, pain thoracic spine resulting in RX and PT				x			x					
2012.12.26.09.2CE24C3C7894		SVP Market Segment	12/18/2012	Denver CO airport taxi	struck head on taxi door latch resulting in stitches				x			x					
2012.12.18.11.0592C439DDB2		Project Billing Spec	12/18/2012	I-5 No, Mission Viejo, CA	complaints of discomfort to mid-upper back and neck resulting in RX and therapy				x			x					
						0	***10***	***7***	***37***	***399***	***262***	***47***	***0***	***0***	***0***	***0***	***7***

					1	
	Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other illnesses
Page 1 of 1	(1)	(2)	(3)	(4)	(5)	(6)

Attachment B

AECOM Safety and Health Policy Statement

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Safety, Health and Environment Policy Statement

AECOM

PURPOSE

The purpose of this policy is to:

- Establish and maintain a framework for a safe and healthy workplace for all AECOM employees and minimize our impact on the environment.
- Outline expectations relative to compliance with governing occupational safety, health and environmental legislation.

COMMITMENT

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. We will actively seek to conserve energy, water and natural resources and to recycle and reduce waste where appropriate during the execution of our business activities. We will be good corporate citizens by striving to ensure that our facilities and operations do not pose unreasonable safety or environmental risks, and by participating in community-related activities that promote excellence in safety, health and environmental practices. In all of our activities, we will develop and implement appropriate systems and procedures designed to comply with applicable laws, legislation, licensing requirements and stakeholder expectations. AECOM will plan and design its processes, facilities and projects in a manner that reduces risks and impacts during their entire life cycle, consistent with the direction and objectives of our clients.

OBJECTIVES

Our ultimate goals are simple and are derived from AECOM's Core Values:

- Prevent work-related injuries or illnesses.
- Prevent damage to property and/or equipment from our activities.
- Prevent adverse impacts to the environment from our ongoing projects or operations.

IMPLEMENTATION

In order to guide the implementation efforts required by this policy, the Geography and Business Line Chief Executives and their respective safety teams, will collaborate to establish Safety, Health and Environment (SH&E) programs that:

- Embrace the AECOM SH&E Life Preserving Principles and this policy statement.
- Comply with all applicable safety, health and environmental rules and regulations at the local, state, provincial and national levels.
- Meet client requirements.
- Where no specific regulation exists, comply with AECOM standards and appropriate industry practices.
- Report on performance relative to short- and long-term SH&E metrics designed to help achieve established goals.
- Consult with, listen to, and respond to employees, customers and partners in order to continuously improve their SH&E performance. The establishment of formal SH&E committees, with documented charters, is recognized as an effective tool for this purpose.
- Recognize those who contribute to their improved SH&E Performance.

AECOM EMPLOYEE RESPONSIBILITIES

All employees will be responsible for:

- Conducting themselves in accordance with directives, standards and procedures established by the applicable SH&E program.
- Temporarily suspending their personal work activities and requesting guidance from their supervisor before continuing a task when they identify a condition or practice that creates a serious safety, health or environmental risk.
- Immediately reporting safety, health and/or environmental incidents to their supervisor.

POLICY REVIEW

This policy will be formally reviewed annually. However, if substantial changes occur in legislation, organization and/or other business drivers, changes may be made on an interim basis.

COMMUNICATION

This policy is to be displayed prominently in all permanent and temporary offices of AECOM where employee information is normally communicated. An electronic version will also be posted on the AECOM intranet.

A copy of this policy will be provided to entities working for, or on behalf of, AECOM and will also be made available to other stakeholders upon request.

Signature: John M. Dionisio   Date: 10-1-2013

John M. Dionisio
Chairman and CEO

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Attachment C

AECOM SH&E Standard Operating Procedures Table of Contents

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TABLE OF CONTENTS

NO.	TITLE	REVISION DATE
300 SERIES – FIELD (COMMON)		
301	Confined Spaces	December 2010
302	Electrical, General	December 2010
303	Excavation and Trenching	March 2011
304	Fall Protection	March 2011
305	Hand and Power Tools	March 2011
306	Highway and Road Work	December 2010
307	Housekeeping, Worksite	December 2010
308	Manual Lifting, Field	December 2010
309	Mobile or Heavy Equipment	March 2011
310	Rigging, Hoisting, Cranes and Lifting Devices	December 2010
311	Scaffolding	March 2011
312	Stairways and Ladders	March 2011
313	Wildlife, Plants and Insects	March 2011
314	Working Alone & Remote Travel	March 2011
315	Water, Working Around	March 2011
400 SERIES – FIELD (UNCOMMON)		
401	Aircraft Charters	October 2011
402	All Terrain Vehicles (ATVs)	March 2011
403	Avalanches	March 2011
404	Commercial Motor Vehicles	March 2011
405	Drilling and Boring	March 2011
406	Electrical Lines, Overhead	March 2011
407	Electrofishing	March 2011
408	Elevated Work Platforms and Aerial Lifts	March 2011
409	Forklifts (operation of)	March 2011
410	Hazardous Energy Control	March 2011
411	Machine Guarding	March 2011
412	Powder-Actuated Tools	March 2011
413	Process Safety Management	October 2010
414	Railway Sites	June 2012
415	RCRA Regulated Facilities	October 2011
416	Tunnel and Underground Work	March 2011
417	Utilities, Underground	March 2011

NO.	TITLE	REVISION DATE
418	Welding, Cutting and Other Hot Work	March 2011
419	Water, Marine Operations, Boating	March 2011
420	Water, Underwater Diving	October 2011
	500 SERIES – INDUSTRIAL HYGIENE (CHEMICAL, BIOLOGICAL, RADIOLOGICAL)	
501	Asbestos	March 2011
502	Benzene	March 2011
503	Bloodborne Pathogen Program	March 2013
504	Cadmium	March 2011
505	Cold Stress Prevention	October 2011
506	Compressed Gases	March 2011
507	Hazardous Materials Communication / WHMIS	October 2011
508	Hazardous Materials Handling, Shipping, and Manifesting	June 2012
509	Hazardous Waste Operations and Emergency Response	December 2010
510	Hearing Conservation Program	December 2010
511	Heat Stress Prevention	March 2011
512	Laboratory Safety	March 2011
513	Lead	March 2011
514	Munitions and Explosives of Concern/Unexploded Ordnance	March 2011
515	Nanotechnology	March 2011
516	Radiation Safety Programs	March 2011
517	Radiation, Non-ionizing	March 2011
518	Radiation, Gauge Source Program	March 2011
519	Respiratory Protection Program	December 2010
520	Spill Response, Incidental	December 2010
521	Decontamination	October 2011
522	Hydrogen Sulfide	October 2011
	600 SERIES – INCIDENT & MEDICAL MANAGEMENT	
601	Recordkeeping	October 2011
602	Exposure Monitoring	October 2011
603	Incident Investigation and Review	March 2013
604	Medical Records	October 2011
605	Medical Surveillance Program	November 2012
606	Modified Duty Program	October 2011
607	Post Incident Medical Management	October 2011

NO.	TITLE	REVISION DATE
700 SERIES – SH&E PROGRAM MANAGEMENT		
701	Rules and Regulatory Review	October 2010
702	SH&E Organizational Reporting Structure & Supporting Roles	October 2011
703	SH&E Manual and Procedures Review	October 2010
704	SH&E Program Auditing	March 2011
705	SH&E Program Monitoring and Reporting	October 2010

Attachment D

Hazard Communication Program

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S3NA-507-PR Hazardous Materials Communication / WHMIS

1.0 Purpose and Scope

1.1 Provides a Hazard Communication Program so that AECOM employees are informed of the hazards of the chemicals to which they may be exposed in the course of their work by way of container labeling and other forms of warning, material safety data sheets (MSDS), and employee training.

1.2 This procedure applies to all AECOM North America based employees and operations.

1.3 The program applies to the use of any hazardous substances which are known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency.

2.0 Terms and Definitions

Additional definitions can be found in the Hazardous Material Regulations (HMR), the Transportation of Dangerous Goods (TDG) Regulations, and the International Air Transport Association (IATA) Dangerous Goods Regulation (DGR).

2.1 **Acute Effect:** An adverse effect on the human body with immediate onset of symptoms.

2.2 **Article:** A manufactured item: (1) which is formed to a specific shape or design during manufacture; (2) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and, (3) which does not release or otherwise result in exposure to, a hazardous chemical, under normal conditions of use.

2.3 **Carcinogen:** Those chemicals appearing in any of the following reference sources are established as carcinogens for hazard communication purposes:

- National Toxicology Program (NTP) Annual Report on Carcinogens.
- International Agency for Research on Cancer (IARC) Monographs, Volumes 1-34. Note: The Registry of Toxic Effects of Chemical Substances published by NIOSH indicates whether a substance has been found by NTP or IARC to be a potential carcinogen.

2.4 **Chemical Name:** The scientific designation of a substance in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry or the system developed by the Chemical Abstracts Service.

2.5 **Chronic Effect:** An adverse effect on the human body with symptoms which develop slowly over a long period of time or which frequently recur.

2.6 **Combustible Liquid:** Any liquid having a flash point at or above 100°F (37.8°C) but below 200°F (93.3°C), except any mixture having components with flash points of 200°F (93.3°C), or higher, the total volume of which makes up 99% or more of the total volume of the mixture.

2.7 **Common Name:** Any designation or identification such as code name, code number, trade name or brand name used to identify a substance other than by its chemical name.

2.8 **Container:** Any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank or the like that contains a hazardous chemical. For purposes of this Safety Operating Procedure (SOP) and Occupational Safety and Health Administration (OSHA) standard, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle are not considered to be containers.

2.9 **Establishment:** Any separate and distinct AECOM office, laboratory or other company facility.

2.10 **Exposure:** Any situation arising from work operations where an employee may ingest, inhale, absorb through the skin or eyes or otherwise come into contact with a hazardous substance.

2.11 **Flammable:** A substance that falls into one of the following categories:

- **Flammable Aerosol**: An aerosol that when tested by the method described in 16 CFR 1500.45, yields a flame projection exceeding 18 inches at full valve opening or flashback (a flame extending back to the valve) at any degree of valve opening;
- **Flammable Gas**: A gas that at ambient temperature and pressure:
  - Forms a flammable mixture with air at a concentration of 13% of volume or less; or
  - Forms a range of flammable mixtures with air wider than 12% by volume, regardless of the lower limit.
- **Flammable Liquid**: Any liquid having a flash point below 100°F (37.8°C), except any mixture having components with flash points of 100°F (37.8°C) or higher, the total of which make up 99% or more of the total volume of the mixture.
- **Flammable Solid**: A solid, other than a blasting agent or explosive as defined in 8 CCR 5237(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change or retained heat from manufacturing or processing or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard.
  - A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

2.12 **Flash Point:** Minimum temperature of a liquid at which it gives off sufficient vapors to form an ignitable mixture with the air near the surface of the liquid or within the container used.

2.13 **Hazardous Chemical:** Those chemicals appearing in any of the following reference sources are established as hazardous chemicals for hazard communication purposes.

- 29 CFR Part 1910, Subpart Z, Toxic and Hazardous Substances, OSHA.
- Hazardous Products Act, R.C.S. 1985, c. H-3, section 2, Canada
- For operations within the state of California, the list of hazardous substances prepared by the California Director of Industrial Relations pursuant to Labor Code Section 6382. The concentrations and footnotes, which are applicable to the list, shall be understood to modify the same substance on all other source lists or hazard determinations set forth in § 8 CCR 5194(d)(3)(B) and (d)(5)(D).

2.14 **Hazardous Substance:** A hazardous chemical or carcinogen, or a product or mixture containing a hazardous chemical or carcinogen provided that:

- The hazardous chemical is 1% or more of the mixture or product or 2% if the hazardous chemical exists as an impurity in the mixture; or
- The carcinogen is 0.1%or more of the mixture or product.
- Manufacturers, importers and distributors will be relied upon to perform the appropriate hazard determination for the substances they produce or sell.

2.15 The following materials are not covered by the Hazard Communication Standard:

- Any hazardous waste as defined by the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 USC 6901 et seq.) when subject to regulations issued under that act by the Environmental Protection Agency.
- Tobacco or tobacco products
- Wood or wood products. Note: Wood dust is not exempt since the hazards of wood dust are not “self-evident” as are the hazards of wood or wood products
- Consumer products (including pens, pencils, adhesive tape) used in the work place under typical consumer usage
- Articles (i.e. plastic chairs)
- Foods, drugs, or cosmetics intended for personal consumption by employees while in the work place

Foods, drugs, cosmetics in retail store packaged for retail sale

- Any drug in solid form used for direct administration to the patient (i.e., tablets or pills)

2.16 **Hazardous Substance Inventory (HSI) / WHMIS Log:** A listing of all chemicals stored or used at an office or project site. Note that the list may be imbedded in a project Health and Safety Plan.

2.17 **Immediate Use:** Means that the hazardous chemical will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.

2.18 **MSDS:** A Material Safety Data Sheet prepared pursuant to state and federal regulations, OSHA Form 174 and Canada regulations (Controlled Products regulations, schedule 1).

2.19 **MSDS Administrator:** The individual or group designated by the Office Manager to maintain the establishment-specific inventory list or log and the MSDS binder required if that establishment uses or stores hazardous substances.

2.20 **NFPA:** A system of categories, colors and numbers was created to provide basic hazard information. It enables firefighters and other emergency personnel to easily decide whether or not to evacuate an area or proceed with emergency control operations. The three principal categories of identification are Health, Flammability and Instability. A numerical range of “0 to 4” indicates the severity of the hazard. A “4” indicates the most severe and a “0” indicates a minimal hazard.

2.21 **Mixture:** Any solution or intimate admixture of two or more substances which do not react chemically with each other**.**

2.22 **Reactivity:** A measure of the tendency of a substance to undergo chemical reaction with the release of energy.

2.23 **Solubility:** The ability of substance to blend and mix uniformly with another.

2.24 **Specific Gravity (density):** Ratio of the weight of a substance to the weight of the same volume of another substance. As used in this directive, specific gravity or density refers to the weight of substance as compared to the weight of an equal volume of water.

2.25 **Vapor Density:** The weight of a vapor-air mixture resulting from the vaporization of a volatile liquid at equilibrium temperature and pressure conditions, as compared with the weight of an equal volume of air under the same conditions.

2.26 **WHMIS:** The Workplace Hazardous Materials Information System (WHMIS) is Canada's national hazard communication standard. The key elements of the system are cautionary labeling of containers of WHMIS "controlled products", the provision of material safety data sheets (MSDSs) and worker education and training programs.

3.0 Attachments

3.1 None

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Region SH&E Managers** will:

- Audit their regional offices to assure that they maintain an establishment-specific Hazardous Substance Inventory (HSI).
- Audit their regional offices to assure that if an establishment-specific HSI is required, that MSDSs are available for each substance listed on the HSI.
- Provide interpretation of MSDSs and hazard information for WHMIS labels/NFPA labels and other information to assist in training employees.
- Provide hazard communication training to AECOM employees and file documents of this training in the Corporate SH&E office.

Review MSDS for adequacy of completion to meet the OSHA and Canadian standard and returning them to supplier, if necessary.

4.1.2 **Office Managers** will:

- Have an operations-specific, written hazard communication program which at least describes how the requirements of this Procedure and the US OSHA and Canadian Hazard Communication requirements for labels and other forms of warning, material safety data sheets, and employee information and training will be met.
- Appoint an MSDS administrator for their establishment if they store or use hazardous substances.
- Confirm, if required, that the MSDS Administrator maintains an HSI for their establishment.
- Confirm that MSDS are available for all substances listed on their establishment's HSI.
- Confirm that a copy of this Procedure and the site-specific MSDS are available to all employees. Employees shall be instructed in the location of this Procedure and the MSDS.
- Confirm that all employees in their office affected by the HAZCOM standard are provided with the appropriate training, including new employees.

4.1.3 **Project Managers (field task managers, supervisors)** will:

- Confirm that all employees under their supervision have received the initial and periodic training required by this SOP prior to assigning employees to tasks involve the use of, or potential exposure to, hazardous substances.
- Notify employees of hazardous substances covered by this SOP that are used in their work area.
- Determine the potential fire, toxic, or reactivity hazards which are likely to be encountered in the handling or utilization of a hazardous substance and will communicate this information to their affected employees, before any are permitted to work with it.
- Confirm that an MSDS is available for each hazardous substance used, or potentially encountered, in the work areas or on the projects that are under their supervision.
- Notify subcontractors (working for AECOM) of any hazardous substances that are used or stored by AECOM to which the subcontractor's employees may be exposed.
- Notify clients or property owner/operators of chemicals brought onto their property by AECOM or AECOM's subcontractors.
- Request MSDSs from all subcontractor organization for the relevant chemicals they bring onto an AECOM controlled site.

4.1.4 **Employees** will:

- Confirm that they have received appropriate hazard communication training prior to working with materials that fall under the standard.
- Only work with materials for which they have been instructed on how to find an MSDS and how to work with that material safely.
- Provide a copy of all MSDSs received to the MSDS Administrator at their facility.
- Verify that an MSDS is available in their work area for each hazardous substance that they use.
- Confirm that containers of hazardous substances that they use are properly labelled.

4.2 All employees have a right to, and should, know the properties and potential hazards of substances to which they may be exposed.

4.3 Should AECOM assign employees that do not read and speak English to tasks with chemical exposures, communications will be provided in the language understood by that employee.

4.4 Hazardous Waste Exemption

4.4.1 In the U.S., hazardous wastes are excluded from the state and federal Hazard Communication standards. However, AECOM employees who handle or are otherwise exposed to hazardous wastes are covered by the requirements of the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard at 29 CFR 1910.120 – Hazardous Waste Operations And Emergency Response. This standard requires that:

- Employees receive 40-hour initial and 8-hour annual SH&E training; and that
- Information on the hazards of hazardous wastes be documented in a site-specific Health and Safety Plan (HASP) and communicated to all employees in site-specific briefing on-site training required by the standard.

4.4.2 Therefore, AECOM HAZWOPER projects are not required to comply with the requirements of this SOP as they relate to the hazardous wastes that are present at those project sites.

4.4.3 AECOM's Health And Safety Plan (HASP) requirements are specified in *S3NA-509-PR Hazardous Waste Operations and Emergency Response.*

4.5 Hazardous Substance Inventory

4.5.1 Establishment-Specific Hazardous Substance Inventory or WHMIS Log

- If an AECOM establishment uses or stores additional hazardous substances, an establishment-specific HSI must be maintained at that establishment.
- If it is determined that an office-specific HSI is needed, the AECOM **Office Manager** shall assure that one is developed and maintained by someone appointed as the establishment's MSDS Administrator.
- The content of the office-specific written inventory shall be updated as new hazardous substances are procured for, or removed from, the establishment and shall be verified by the **Region SH&E Manager** through regular inspections of the establishment.
- In order to meet the 30-years-after-employment-termination record retention requirement, the office-specific HSIs shall be treated as a permanent record.

4.6 Material Safety Data Sheets

4.6.1 Establishment-Specific MSDS Inventory

- If it is determined that an AECOM establishment is required to maintain an establishment-specific inventory ,MSDSs for the specific hazardous substances must be maintained on file at that establishment.
- The **Region SH&E Manager** shall audit the local office program for MSDS request and maintenance and report deficiencies to the appropriate management level, as necessary, to assure compliance with this SOP.

4.6.2 Field Project Sites and Client Facilities

- The **Project Manager** and/or the **Site Safety Officer** shall access or obtain, and maintain copies of MSDS from:
  - All AECOM subcontractors bringing chemicals onto the project site; and
  - The client, for all of the client's chemicals to which AECOM or AECOM subcontract employees are potentially exposed.

4.6.3 Employee Access to MSDSs

- MSDSs should be maintained at the local establishment that uses that hazardous substance. Copies of the MSDS should be made available to the employee upon request to the office's MSDS Administrator.

4.6.4 Field Access to MSDSs

- When hazardous substances are brought into the field, the user must assure that a copy of the MSDS for that substance accompanies it and is available at the field location where it is to be used.

4.6.5 MSDSs for AECOM Products

- It is unlikely that AECOM activities would create a chemical for which a new MSDS were needed. If such a chemical were created, the Corporate SH&E Department shall work with the appropriate operations groups to draft, review, and publish the new MSDS.

4.6.6 Content of the Material Safety Data Sheet

- As a minimum, the MSDS must contain the following information:
  - The name, address, and telephone number of the source of the product or material, preferably those of the manufacturer
  - The trade name and synonyms of the product or material
  - Chemical names of hazardous ingredients, including, but not limited to, those in mixtures
  - An indication of the percentage, by weight or volume, which each ingredient of a mixture bears to the whole mixture
  - Physical data pertaining to the product or material, including boiling point (in °F); vapor pressure (in mm of mercury); vapour density of gas or vapour (air = 1); solubility in water (in percent by weight); specific gravity of material (water = 1); percentage volatile by volume (at 70 °F); evaporation rate for liquids (either butyl acetate or ether may be taken as 1); and appearance and odour
  - Fire and explosion hazard data pertaining to the product or material, including flash point (in °F); flammable limits (in percent by volume in air); suitable extinguishing media or agents; special fire fighting procedures; and unusual fire and explosion hazard information
  - Health hazard data pertaining to the product or material, including exposure limits, effects of overexposure and medical conditions aggravated by exposure, and emergency and first-aid procedures
  - Reactivity data, including stability, incompatibility, hazardous decomposition products, and hazardous polymerization
  - Procedures to be followed and precautions to be taken in cleaning up and disposing of materials leaked or spilled
  - Special protection information, including use of personal protective equipment, such as respirators, eye protection, and protective clothing, and ventilation or other control measures
  - Special precautionary information about handling and strong
  - Any other general precautionary information
- MSDSs that do not contain this information shall be returned to the distributor or manufacturer to be updated.

4.6.7 Trade Secrets

- Some hazardous substance suppliers may claim the information requested on MSDSs is proprietary and not provide the information to AECOM.
- When MSDSs supplied to the AECOM Regional SH&E Manager indicate that proprietary information has been withheld, the Regional SH&E Manager will either obtain the necessary information to make a hazard assessment or reject the material for use within AECOM.

4.7 Labeling

4.7.1 Containers of hazardous substances used or stored in each AECOM establishment must be labeled, tagged or marked with the following information:

- Identification of the hazardous substance(s)

Appropriate hazard warnings

- Name and address of the manufacturer, importer or other responsible parties
- Safe Handling Instructions
- Statement that an MSDS is available for the product

4.7.2 Labels on containers shall not be removed or defaced. Labels or other forms of warning shall be legible, in English and French (Canada), and prominently displayed on the container.

4.7.3 Any failure to have the appropriate labeling information on a container at any time will be cause to suspend use of the product until the container is properly labeled.

4.7.4 Carcinogen Labeling

- Chemicals which have been indicated as positive or suspect carcinogens by either OSHA, ACGIH, the International Agency for Research on Cancer (IARC) (World Health Organization), or the National Toxicology Program (NTP) will be considered to be carcinogenic for purpose of the HCS. Those chemicals identified as being “known to be carcinogenic” by NTP must have carcinogen warnings on the label and information on the MSDSs.

4.7.5 Stationary Process Containers

- If there is stationary process equipment within a work area, signs, placards, process sheets, batch tickets, operating procedures, or other such written materials may be used in lieu of fixed labels on the containers, as long as the alternative method conveys the appropriate hazard information. The written materials shall be readily accessible to the employees in the work area.

4.7.6 Portable Containers

- Portable containers of hazardous substances need not be labelled when the substance is transferred from labelled containers and is intended for immediate use of the employee who performs the transfer.
- Containers of hazardous substances transferred from labelled containers and not intended for the immediate use of the employee performing the transfer shall be labelled with the chemical name and a hazard warning label in accordance with the National Fire Protection Association’s (NFPA) 704M Hazard Identification System shall be attached.

4.8 Chemical Storage

4.8.1 Hazardous chemicals are to be stored in their original, labeled containers with the lids securely closed and taped if possible. Flammable and combustible materials must be stored in fire impervious cabinets in designated stockroom areas. Chemicals must be stored in compliance with instructions provided on their labels, MSDS, or the manufacturer’s specifications.

4.8.2 All hazardous chemicals must be stored in a manner that prevents spillage and leakage from exposing people or the environment to the chemical.

4.8.3 Hazardous chemicals shall not be stored with foods or beverages. Food and beverages shall not be consumed in areas where hazardous chemicals are used or stored.

4.9 Chemical Use in Offices

4.9.1 In general, hazardous substances should not be taken into office areas, conference rooms, or break areas. If this general requirement is infeasible, contact the SH&E Department for guidance.

4.9.2 General exceptions to this rule are the following:

- Liquid paper
- Toner
- Cleaners
- Isobutylene calibration gas
- pH calibration solutions for instruments

4.10 **Employee Information and Training**

4.10.1 Each AECOM **employee** who handles or is exposed to hazardous substances must be provided information and training on hazardous substances in their work area.

- At the time of their initial assignment
- Whenever a new hazard is introduced into their work area

4.10.2 As a minimum, the training requirements apply to AECOM personnel in the following job categories:

- All personnel who perform field work that involves the use of, or potential exposure to, hazardous substances
- Laboratory Employees

4.11 **Initial Training Content**

4.11.1 The Initial Training will provide instruction in the following:

- Methods and observations that may be used to detect the presence or release of a hazardous substance in the work area (such as personal monitoring, visual appearance or odor of hazardous substances being released, etc.);
- The physical and health hazards of substances in the work area and measures and procedures AECOM has implemented to protect employees; and
- The details of this hazard communication program (SOP), including an explanation of the labeling system and the MSDS, and how he/she can obtain and use appropriate hazard information.

4.11.2 The Initial Training will also inform the employee of the following:

- Any operations in their work area in which hazardous substances are present
- Location and availability of this written hazard communications program (SOP)
- Their right to personally receive information regarding hazardous substances to which they may be exposed
- Their right to have their physician receive information regarding hazardous substances to which they may be exposed
- Their right against discharge or other discrimination (in California) due to the employee's exercise of rights afforded pursuant to provisions of the California Hazardous Substances Information and Training Act

4.12 **Periodic Training and Training for Non-Routine Tasks**

4.12.1 Additional training will be provided to employees who have received initial training whenever:

- A new hazardous substance is introduced into their work area
- A new or revised MSDS is received, which indicates significantly increased risks to employee health as compared to those stated on the previous MSDS
- Non-routine tasks are performed, which will potentially result in exposure to hazardous substances, or exposure under circumstances, which were not addressed during initial training

4.12.2 Supervisors, in coordination with their **Region SH&E Manager**, shall provide such training through an explanation of the information on the contents of the MSDS for that substance.

4.12.3 When training their employees, supervisors shall explain:

- Any health hazards associated with use of the substance or mixture
- Proper precautions for handling
- Necessary personal protective equipment or other safety precautions to prevent or minimize exposure

Emergency procedures for spills, fire, disposal, and first aid

4.12.4 For most projects involving field work, this periodic training requirement will be facilitated through the implementation of the site specific HASP that has been developed for the project.

4.13 Documentation of Initial and Periodic Training

4.13.1 All training required by this SOP shall be documented at the time it is performed by having the employee sign a copy of a training attendance sheet.

4.14 Chemical Usage

4.14.1 Prior to using any chemical, a Task Hazard Analysis (THA) shall be completed by the employees assigned to use the chemical. The analysis will identify the hazards associated with the tasks to be performed and prescribe the Personal Protective Equipment (PPE) to be used.

4.15 Office Specific Written Program

4.15.1 Each office or location using or storing hazardous materials will develop a written office/ location-specific Hazard Communication/WHMIS Program. If the local office decides to implement the requirements of the standard in any way that differs from this procedure, they shall verify the changes with the SH&E department, document the changes, and communicate the differences to all affected employees.

4.15.2 For Canadian operations, all relevant MSDS must be current (no more than 3 years old) and readily available (in French and English) for all hazardous materials.

4.16 Canada-specific

4.16.1 Consumer products are exempt from supplier labels and MSDS requirements. Some cleaning solvents may be packaged as consumer products and these must be labeled in accordance with the Consumer Product Act requirements.

4.16.2 In addition to the labelling of storage containers in the workplace, the contents of process piping (including valves), process vessels and reaction vessels are required to be identified through the use of colour coding, labels, placards or other modes of identifications that must be communicated to workers through training programs. It is very important for employees to be aware of and understand Client labelling requirements for these types of process systems.

5.0 Records

5.1 None

6.0 References

6.1 None

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Attachment E

Respiratory Protection Plan

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S3NA-519-PR Respiratory Protection Program

1.0 Purpose and Scope

1.1 This procedure establishes methods that AECOM will use to prevent employee exposure to hazardous concentrations of airborne contaminants or to supply breathing-quality air to employees working in oxygen-deficient atmospheres.

1.2 This procedure applies to all AECOM North America-based employees and operations.

2.0 Terms and Definitions

2.1 **Air-purifying respirator:** A respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

2.2 **Approved:** Equipment tested and listed by the Bureau of Mines, jointly by the Mining Enforcement and Safety Administration (MESA), and the National Institute for Occupational Safety and Health (NIOSH), or jointly by the Mine Safety and Health Administration (MSHA) and NIOSH.

2.3 **Assigned protection factor (APF):** The ratio of the ambient concentration of an airborne substance (outside the respirator) to the concentration of the substance inside the respirator. NIOSH defines this as 10 for an approved half-face respirator and 50 for an approved full-face respirator.

2.4 **Atmosphere-supplying respirator:** A respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

2.5 **Breakthrough:** The first perception of an odor, taste or irritation experienced while wearing an air-purifying respirator. Breakthrough is generally an indication that the cartridges are saturated and are no longer filtering out the contaminant. Breakthrough can also be an indication of an improperly functioning respirator.

2.6 **Confined space:** An enclosure, such as a storage tank, process vessel, boiler, silo, tank car, pipeline, tube, duct, sewer, underground utility vault, tunnel, or pit, that has limited means of egress and poor natural ventilation and that may contain hazardous contaminants or be oxygen deficient.

2.7 **Canister or cartridge:** A container that has a filter, sorbent, or catalyst, or a combination of these items and that removes specific contaminants from the air passed through the container.

2.8 **Demand respirator:** An atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

2.9 **Emergency situation:** Any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant.

2.10 **Employee exposure:** Exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.

2.11 **End-of-service-life indicator (ESLI):** A system that warns the respirator user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective.

2.12 **Escape-only respirator:** A respirator intended to be used only for emergency exit.

2.13 **Filter or air purifying element:** A component used in respirators to remove solid or liquid aerosols from the inspired air.

2.14 **Filtering facepiece (dust mask):** A negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

2.15 **Fit factor:** A quantitative estimate of the fit of a particular respirator to a specific individual, typically estimating the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

2.16 **Fit test:** The use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual. (See also Qualitative fit test QLFT and Quantitative fit test QNFT.)

2.17 **Helmet:** A rigid respiratory inlet covering that also provides head protection against impact and penetration.

2.18 **HASP:** Health and Safety Plan

2.19 **Hazardous atmosphere:** Any atmosphere, either immediately or not immediately dangerous to life or health, that is oxygen-deficient or that contains a toxic or disease-producing contaminant exceeding the legally established permissible exposure limit (PEL) or, where applicable, the Threshold Limit Value (TLV) established by the American Conference of Governmental Industrial Hygienists (ACGIH).

2.20 **High efficiency particulate air (HEPA) filter:** A filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters.

2.21 **Hood:** A respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

2.22 **Immediately dangerous to life or health (IDLH):** An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

2.23 **Loose-fitting facepiece:** A respiratory inlet covering that is designed to form a partial seal with the face.

2.24 **Maximum use concentration (MUC):** The protection factor (PF) of an approved respirator assembly times the permissible exposure limit (PEL). MUC = PF x PEL

2.25 **Negative pressure respirator (tight fitting):** A respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

2.26 **Oxygen deficient atmosphere:** An atmosphere with oxygen content below 19.5% by volume.

2.27 **Powered air-purifying respirator (PAPR):** A respirator that contains a blower that passes ambient air through an air-purifying component. Air-purifying respirators may be half-face (covering the nose and mouth) or full-face (covering the eyes, nose, and mouth).

2.28 **Physician or other licensed health care professional (PLHCP):** An individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide or be delegated the responsibility to provide some or all of the health care services required by paragraph (e) of this section.

2.29 **Positive pressure respirator:** A respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

2.30 **Powered air-purifying respirator (PAPR):** An air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

2.31 **Program administrator:** The individual that has the responsibility to verify full compliance with this SOP and determines the need for medical evaluations or any other additional medical attention in regards to the use of a respirator.

2.32 **Pressure demand respirator:** A positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

2.33 **Qualitative fit test (QLFT):** A pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

2.34 **Quantitative fit test (QNFT):** An assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

2.35 **Respiratory inlet covering:** That portion of a respirator that forms the protective barrier between the user's respiratory tract and an air-purifying device or breathing air source, or both. It may be a facepiece, helmet, hood, suit, or a mouthpiece respirator with nose clamp.

2.36 **Self-contained breathing apparatus (SCBA):** An atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

2.37 **Service life:** The period of time that a respirator, filter or sorbent, or other respiratory equipment provides adequate protection to the wearer.

2.38 **Supplied-air respirator (SAR) or airline respirator:** An atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

2.39 **Tight-fitting facepiece:** A respiratory inlet covering that forms a complete seal with the face.

2.40 **User seal check:** An action conducted by the respirator user to determine if the respirator is properly sealed to the face.

3.0 Attachments

3.1 S3NA-519-FM1 Respiratory Equipment Fit Test

3.2 S3NA-519-FM2 Respiratory Equipment Maintenance Log

3.3 S3NA-519-FM3 Respiratory Equipment Inspection

3.4 S3NA-519-WI1 Fit Testing Protocol

3.5 S3NA-519-WI2 User Seal Check Procedures

3.6 S3NA-519-WI3 Respirator Cleaning Procedures

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Program Administrator.** The AECOM Americas **SH&E Director** is the Respiratory Protection Program Administrator. The **Program Administrator** shall:

- Verify full compliance with this SOP.
- Determine the need for medical evaluations or any other additional medical attention related to the use of a respirator.
- Perform the program evaluations described in this SOP.

4.1.2 **District/office manager** and **project manager (including Operations Field Manager, supervisors, etc)** shall**:**

- Verify compliance with the respiratory protection program set forth in this procedure.
- Verify that only those employees who are medically qualified, properly trained, and fit tested are assigned to respirator work.
- Verify that respirators are provided, repaired, or replaced as may be required due to wear and deterioration.

4.1.3 **Region SH&E Manager** shall**:**

- Monitor compliance with the various aspects of this program.
- Provide technical assistance regarding respirator selection and use, evaluate the effectiveness of this program, and support respirator training and fit testing.
- Audit company compliance with this procedure.

4.1.4 **Employees** shall**:**

- Will use the provided respiratory protection in accordance with instructions and training received.
- Will guard against damage to the respirator.
- Will report immediately any malfunction of the respirator to the supervisor or other responsible person.

4.2 **Medical Surveillance**

> No employee shall be assigned to a task that requires the use of a respirator unless it has been determined that he/she is physically able to perform the work while using the required respirator.

4.2.1 Prior to wearing a respirator, **employees** will complete an initial baseline medical surveillance examination performed by a PLHCP in accordance with the requirements of the Medical Surveillance Program (*S3NA-605- PR Medical Surveillance Program).*

4.2.2 **Employees** who continue to use respiratory protection will receive an annual medical surveillance examination.

4.2.3 Additional medical examinations will be provided to employees who wear respirators if/when:

- An **employee** reports medical signs or symptoms that are related to ability to use a respirator;
- A PLHCP, supervisor, or the respirator program administrator determines that an employee needs to be reevaluated;
- Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation; or
- A change occurs in workplace conditions (e.g., physical work effort, protective clothing, temperature, etc.) that may result in a substantial increase in the physiological burden placed on an employee.

4.2.4 All medical surveillance examinations shall occur during normal working hours; shall be convenient, understandable, and confidential; and the employee will be given chance to discuss results with examining physician.

4.3 Training

4.3.1 Project staff that may be exposed to the hazard will be oriented to the hazard and the controls prior to beginning work.

4.3.2 Atmospheric testing will be carried out by someone trained in the use, calibration, and interpretation of the test equipment.

4.3.3 **Employees** who may be required to use a breathing apparatus shall be properly trained in the operation, maintenance, cleaning and storage of the apparatus.

4.3.4 All staff will receive an orientation to the hazards on the job site as well as initial Field Safety training which outlines appropriate PPE requirements.

4.3.5 **Employees** who wear respiratory protection must receive training before they are assigned to a task that requires the use of respiratory protection.

4.3.6 Retraining shall be administered annually, and when the following situations occur:

- Changes in the workplace or the type of respirator render previous training obsolete;
- Inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill; or
- Any other situation arises in which retraining appears necessary to verify safe respirator use.

4.3.7 Frequency of Training

- All employees who may have the need to wear respiratory protection are required to participate in AECOM's internal SH&E training program.
- In addition, AECOM's SH&E Department will conduct respirator training classes, as necessary, for those who may need to wear respiratory protection but did not participate in AECOM's HAZWOPER training classes.

4.3.8 Basic Respirator Training Program

Respirator training classes will include, at a minimum, the following:

- Instruction in the nature of the respiratory hazards, whether acute, chronic, or both, and a description of potential health effects if the respirators are not used.

Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator.

- The limitations and capabilities of the respirator.
- Proper fitting, including demonstrations and practice in wearing, adjusting, determining the fit of, and performing a user seal check (in accordance with *S3NA-519-WI1 Fit Testing Protocol)* each time respirator is donned.
- How to inspect, put on, use and remove the respirator.
- How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions.
- The procedures for maintenance and storage of the respirator.
- How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators.
- The general requirements of the OSHA and OH&S Respiratory Protection Standard.

4.4 Respirator Selection

4.4.1 AECOM will maintain air purifying respirators and cartridges from at least two providers (i.e. MSA and North).

4.4.2 Prior to fit testing, the employee shall be allowed to pick the most comfortable respirator from the brands offered.

4.4.3 The type of respirator most commonly used by AECOM staff is a cartridge type air purifying respirator (APR). Many different types of APRs exist, and field staff should always fit test an APR prior to use.

4.5 Fit Testing Procedures

4.5.1 A respirator that doesn't fit properly will not provide adequate protection.

4.5.2 Four types of tests can be used:

- Positive Pressure Sealing Check: Close off the exhalation valve and exhale gently. The fit is satisfactory if a slight positive pressure can be built up inside the face piece for a full 10 seconds without detecting any outward leakage of air between the sealing surface of the face piece and the wearer's face.
- Negative Pressure Sealing Check: Close off the inlet opening of the cartridges by covering them with the palm of the hands. Inhale gently and hold breath for at least 10 seconds. The face piece should collapse slightly with no detection of inward leakage of air into the face piece.
- Isoamyl Acetate Test (banana oil test): A tube or bottle of banana oil is held in front of and around the mask. The fit is adequate if the wearer does not detect the odour of bananas. During the test, the wearer should be demonstrating movements that approximate a normal working situation, including deep breathing, side-to-side and up-and-down head movements, and talking.
- Irritant Smoke Test (Stannic Chloride Test): The procedure is similar to that of the banana oil test except that an irritant smoke is used. The wearer of the mask will cough (involuntary reaction) if he/she detects the irritant smoke in the mask.

4.5.3 Fit Testing Frequency

Additional fit tests will be performed:

- Whenever there is an indication that changes in the **employee's** physical condition might have an effect on respirator fit. (Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.)
- Whenever there is an indication that changes in the **employee's** physical condition might have an effect on respirator fit. (Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.)
- If the **employee** notifies his/her supervisor or Regional SH&E Manager that the fit of his/her respirator is unacceptable.

4.5.4 Fit Testing Records

A written record of each fit test performed must be maintained in the **employee's** health and safety records. *S3NA-519-FM1 Respiratory Equipment Fit Test* will be used to document each fit test.

4.6 Interference with Gas-Tight Seal

Respiratory protection can only be worn when it can be determined that there is no obstruction of contact between the wearer's skin and the sealing surfaces of the mask whatsoever. Such obstruction can include facial hair, head hair, and the temple bars of eye glasses.

4.6.1 Respirator wearers cannot be afforded protection from hazardous airborne contaminants when conditions prevent a complete gas-tight face seal.

4.6.2 Although eyeglass temple bars will interfere with the formation of a gas-tight face seal in the case of full-face respirators, this problem is correctable by use of internally mounted spectacle kits. Management and supervisors shall verify that **employees** under their supervision who regularly wear eyeglasses, and who will require the use of a full-face respirator, are provided with appropriate spectacle kits at company expense.

The use of contact lenses in hazardous atmospheres or in operations involving intense heat, molten metals or the potential for chemical splash shall be prohibited.

4.6.3 Because facial hair (even beard stubble) will interfere with a gas-tight seal, employees shall be required to be clean- shaven whenever the use of respiratory protection is specified.

4.6.4 Respiratory Protection will only be assigned to those **employees** without physical obstructions to a gas-tight face seal to jobs that may require the use of respiratory protection. Candidates for employment shall be made aware that their versatility may be limited if they cannot wear a respirator and that this can affect their job assignments.

4.7 Specification of Proper Level of Respiratory Protection

4.7.1 The **Region SH&E Manager** or his/her designated and qualified representative is responsible for specifying the proper selection and use of all respiratory protective devices, including half-face and full-face air purifying respirators, airline respirators, and self-contained breathing apparatus. This information is generally specified as part of the written site-specific Health and Safety Plan (HASP).

4.7.2 **Employees** engaged in activities not covered by a HASP must consult with the **Region SH&E Manager** or his/her designated representative to determine the proper equipment prior to use. Whenever appropriate, exposure levels will be measured to verify that the actual use conditions are within the limitations of the approvals specified by NIOSH/MSHA for the selected respirator.

4.7.3 Conditions Required for Air-Purifying Respirator (APR) Use

Air-purifying respirators (APR) shall only be specified for use when it can be determined that the following conditions exist:

- The oxygen concentration is greater than 19.5%.
- The contaminant is known and its concentration can be quantified.
- The airborne contaminant concentration is below its IDLH.
- A canister or cartridge is available which is approved for the contaminant.
- The contaminant concentration is below the concentration for which the canister is approved.
- The contaminant concentration is below the Maximum Use Concentration (MUC) of the respirator.

In all cases where OSHA has specified that a particular respirator be used (asbestos, formaldehyde, benzene, arsenic, lead, etc.), that respirator, or one providing equal or better protection, shall be specified.

4.7.4 APR Filter and Chemical Cartridges

An adequate supply of the following cartridges shall be maintained in stock at each office location where respiratory protective equipment:

- High efficiency particulate air (HEPA) filter cartridges;
- Organic vapor cartridges; and
- Combination HEPA/acid gas/organic vapor cartridges

4.7.5 Change Out Schedule

Filter cartridges shall be changed out whenever an increase in breathing resistance is detected by the user.

When available, chemical cartridges that are equipped with end-of-service life indicators (ESLI) shall be utilized. In those cases, cartridges should be changed when indicated by the ESLI.

In the absence of cartridges equipped with an ESLI, employees shall change chemical cartridges on the following schedule:

- Immediately if breakthrough is perceived;
- In accordance with the change out schedule developed by the Regional SH&E Manager in the site-specific Health and Safety Plan (HASP); and
- After each day's use.

The change out schedule will be based upon the anticipated contaminant concentration, environmental conditions, employee work rate, and the specific data provided by manufacturer

When powered air-purifying respirators **(**PAPRs) are worn, the same rules apply with the exception that filter cartridges should be changed when airflow through the filter elements decreases to an unacceptable level, as indicated by the manufacturer's test device.

4.8 Air-Supplying Respirator Use

4.8.1 Conditions Requiring Use of Air-Supplying Respirators

Air-supplying respirators will be specified for use when it has been determined that any of the following conditions exist:

- The oxygen concentration is less than 19.5%;
- The contaminant is unknown or its concentration cannot be quantified;
- The airborne contaminant concentration is above its IDLH;
- An air-purifying respirator canister or cartridge that removes the contaminant is not available;
- The contaminant concentration is above the concentration for which an air-purifying canister or cartridge is approved; or
- The contaminant concentration is above the Maximum Use Concentration (MUC) of a full-face air-purifying respirator.

No employee may engage in an operation requiring the use of an air-supplied respirator unless a representative of the SH&E Department has reviewed the operation and approved its use.

The determination of the type of air-supplying respirator (i.e., SCBA, air-line, demand, pressure demand, etc.) which is appropriate for the job, outside standby persons, communication, proper training and equipment, notification procedures, and necessary action all require planning. Mandatory equipment including SCBA or SAR with auxiliary air supply & emergency appropriate retrieval equipment or equivalent rescue means will be made by the **Region SH&E Manager** or his/her designated representative at the time of review. The need for any additional precautions (i.e., equipment specific training, on-site H&S support, etc.) will also be determined by the **Region SH&E Manager**.

4.9 Minimum Procedures for IDLH atmospheres

4.9.1 One **employee** or, when needed, more than one employee shall be located outside the IDLH atmosphere. This employee shall be responsible for communicating with the **employees** in the IDLH atmosphere, alerting rescue services if needed, and restricting entrance to the IDLH area by untrained and unapproved persons.

4.9.2 Visual, voice, or signal line communication shall be maintained between the **employee**(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere.

4.9.3 The **employee**(s) located outside the IDLH atmosphere shall be trained and equipped to provide effective emergency rescue or to initiate onsite rescue services.

4.9.4 If on-site rescue services are to be used, the **Site Safety Officer** shall confirm that the service is available to respond prior to any employees entering the IDLH area.

4.9.5 **Employee**(s) located outside the IDLH area and/or on-site rescue services shall be equipped with:

- Pressure demand or other positive pressure SCBAs, or a pressure demand or other positive pressure supplied-air respirator with auxiliary SCBA; and either
- Appropriate retrieval equipment for removing the employee(s) who enter(s) these hazardous atmospheres where retrieval equipment would contribute to the rescue of the employee(s) and would not increase the overall risk resulting from entry; or
- Equivalent means for rescue where retrieval equipment would create a hazard to the workers in the IDLH area.

4.10 Breathing Air Quality

Compressed air used for respiration shall be of high purity and shall meet, as a minimum, the requirements of the specification for Grade D breathing air as described in Compressed Gas Association Specification G-7.1 (ANSI Z86.1).

Oxygen shall NOT be used as a source of breathing air at any time in open-circuit SCBAs or air-line respirators.

4.10.1 Compressor Supplied Breathing Air

All compressors used for filling SCBA air cylinders or for supplying air-line respirators shall be equipped with the following safety and standby devices:

- The compressor intake shall be located to verify that only respirable (uncontaminated) air is admitted. This requires attention to the location of the compressor intake with respect to compressor engine exhaust, chemical storage or use areas, and suitable intake screening or filtration.
- Alarms to indicate compressor failure (such as low-pressure air horns, etc.) shall be installed in the system.
- A receiver of sufficient capacity to enable the respirator wearer to exit from a contaminated atmosphere shall be provided.

If an oil-lubricated compressor is used to supply breathing air, it shall be equipped with both of the following devices:

- A continuous reading carbon monoxide monitoring system set to alarm should the carbon monoxide concentration exceed 10 ppm; and,
- A high temperature alarm which will activate when the discharge air exceeds 110% of the normal operating temperature in degrees Fahrenheit.

An in-line purifying filter assembly to remove oil, condensed water, particulates, odors, and organic vapors shall be used in conjunction with the air compressor.

Routine inspection and maintenance of air compressor shall be performed.

4.10.2 Compressed Air Cylinders

Breathing air cylinders shall be legibly identified with the word AIR by means of stenciling, stamping, or labeling as near to the valve end as practical.

Cylinders shall be stored and handled to prevent damage to the cylinder or valve.

> Cylinders shall be stored upright with the protective valve cover in place and, in such a way (e.g. supported with substantial rope or chain in the upper one third of the cylinder, or in racks designed for this purpose) as to prevent the cylinder from falling.

Cylinders shall not be dropped, dragged, rolled, or allowed to strike each other or to be struck violently. Cylinders shall never be exposed to temperatures exceeding 125^0 F. Cylinders with visible external damage, evidence of corrosion damage, or exposure to fire shall not be accepted or used.

Only cylinders within current hydrostatic test periods shall be used. Steel cylinders must be hydrostatically tested every five years and fiberglass wrapped aluminum cylinders must be tested every three years.

4.10.3 Compressed Air Cylinder Systems for Air-Line Respirators

Compressed air cylinder systems used to supply air-line respirators shall be equipped with low pressure warning bells (e.g., Scott Pak-Alarm) or similar warning devices to indicate air pressure in the manifold below 500 psi. When such systems are used, one employee shall be assigned as safety standby within audible range of the low pressure alarm.

Air-line hose couplings shall be incompatible with outlets for other gas systems to prevent inadvertently supplying air-line respirators with nonrespirable gases or oxygen.

The air pressure at the hose connection to air-line respiratory equipment shall be within the range specified in the approval of the equipment by the manufacturer.

4.10.4 Compressed Air Cylinder Systems for Recharging SCBAs

When a cascade system is used to recharge SCBA air cylinders, it shall be equipped with a high-pressure supply hose and coupling rated at a capacity of at least 3000 psi.

4.10.5 Escape/Egress Units

Escape/egress unit respirators are intended for use in areas where escape with a short-term (5 minutes) air supply is necessary.

They may be used as adjuncts to airline pressure demand respirators as a backup air supply or as independent emergency devices in areas where respiratory protection is not normally required.

Appropriate training shall be conducted and documented prior to assigning employees to tasks or locations subject to the use of these respirators.

> Escape/egress units (5 minutes) shall never be used to enter a hazardous atmosphere or as primary standby respirators for confined space entry.

4.10.6 Respirator Inspection, Cleaning, Maintenance, and Storage

When respirator use is required, only properly cleaned and maintained NIOSH/MSHA approved respirators shall be used.

4.10.7 Inspection

- Respirators should be inspected before and after use. Those for emergency use should be inspected once per month.
- All connections, including gaskets, o-rings should be checked for damage and tightness.
- The face piece should be inspected for cracks and rubber or elastomer parts should be checked for deterioration and pliability.
- All respirators shall be inspected routinely by the user before, during, and after each use. Defects shall be reported to supervision. No defective respirator shall be issued or worn.

Routinely used respiratory equipment shall be inspected by an individual qualified by experience or training to do the work.

4.10.8 Cleaning and Maintenance

- Respirator facepiece assemblies shall be cleaned and sanitized minimally after each day of use in accordance with the requirements specified in *S3NA-519-WI3 Respirator Cleaning Procedures*.
- Respiratory equipment shall not be passed from one person to another until it has been cleaned and sanitized.
- Respiratory equipment shall be maintained according to manufacturer's instructions.
- Where respirators are assigned to individual employees, management shall verify compliance with cleaning and maintenance requirements by periodic inspection and field audits of respiratory equipment.
- Respirators must be cleaned after each use and then placed into a clean bag for storage.
- Prior to cleaning, the filters, cartridges, or canisters must be removed and discarded.
- The respirator should then be inspected for any damaged parts (repair should only be done by trained personnel with the proper tools) and cleaned with a hot water/mild detergent solution.
- In field situations, a premoistened towelette (e.g., baby wipes) can be used. The mask should then be rinsed with clean warm water and dried.
- Alcohol should never be used to clean masks as it can damage the face pieces and rubber parts.

4.10.9 Storage

- Store clean respirators so that they are protected from dust, excessive moisture, damaging chemicals, temperature extremes and direct sunlight. They should be placed in a sealed plastic bag and stored in the original box.

When not in use, respirator facepieces shall be placed in clean Ziploc-style bags and stored to protect against dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals.

4.11 Hygiene

Employees must leave the work area to wash, change cartridges, or if they detect breakthrough or resistance.

4.12 Program Evaluation

4.12.1 The **Region SH&E Manager** will conduct evaluations of the workplace as necessary to verify that the provisions of the current written program are being effectively implemented and that it continues to be effective.

4.12.2 The **Region SH&E Manager** will regularly (i.e., during annual training) consult employees required to use respirators to assess their views on program effectiveness and to identify any problems. Any problems that are identified during this assessment shall be corrected. Factors to be assessed include but are not limited to:

- Respirator fit (including the ability to use the respirator without interfering with effective workplace performance);
- Appropriate respirator selection for the hazards to which the employee is exposed;
- Proper respirator use under the workplace conditions the employee encounters; and
- Proper respirator maintenance.

4.13 **Costs**

4.13.1 The costs for training, medical examinations, fit testing, respirators, and cleaning materials should be considered as operational costs for the respective AECOM business lines.

5.0 Records

5.1 Medical Records

Medical records under this section will be maintained at a minimum in accordance with 29 CFR 1910.1020 **–** Access to Employee Exposure and Medical Records (*S3NA-604 Medical Records*).

5.2 Fit Test Records

Fit test records will include the name of the employee tested; the type of fit test performed; the specific style, make, model, and size of the respirator tested; the date of the test; and the pass/fail results for QLFTs or QNFT test documentation (i.e., strip charts).

5.3 Training Records

- Respiratory protection training records will be maintained by the employee with copies provided to their SH&E Coordinators or Administrators.
- On-site records of training and fit testing will be maintained as necessary.
- For situations where training is required by and provided by clients, copies of SH&E Records shall be maintained by AECOM.

6.0 References

6.1 The following standards apply to respiratory equipment:

Association	Standard
Canadian Standards Association (CSA)	Z180.1-00, Compressed Breathing Air and Systems Z94.4-02, Selection, Use and Care of Respirators
Department of Labor - Occupational Safety and Health Administration	29 Code of Federal Regulation 1910. 134 29 Code of Federal Regulation 1926.103

S3NA-519-FM1 Respiratory Equipment Fit Test

Date of Testing:		**Respirator Type(s):**	
Employee Name:		**Location:**	
Method & Testing Agent:			
Test Exercise	**Pass / Fail**	**Test Exercise**	**Pass / Fail**
Sensitivity Check		Normal Breathing	
Deep Breathing		Turning Head (side to side)	
Moving Head (up/down)		Rainbow Passage*	
Bending Over		Normal Breathing	

Successful Respirator Fit Determined: ☐ **Yes** ☐ **No**

I certify that I have been tested with the respirator(s) listed above. I have also had the opportunity to ask questions and those questions have been answered to my satisfaction. I also understand that the above fit test is voided if respirator limitations are not followed or the respirator is not worn or if conditions (e.g., facial hair) prevent a good face seal.

Employee Signature:	Date:
Signature of Tester:	Date:

***Rainbow Passage.** "When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch with its path high above and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow."*

Date: Tester:	MSA Comfo II HM S ☐ M ☐ L ☐	MSA Ultra Twin FM S ☐ M ☐ L ☐	North 7700 HM S ☐ M ☐ L ☐	North 7600 FM S ☐ M/L ☐	HM S ☐ M ☐ L ☐	FM S ☐ M ☐ L ☐
Qualitative Test Agent(s): IAA ☐ Smoke ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
Quantitative Test Device	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor
Date: Tester:	MSA Comfo II HM S ☐ M ☐ L ☐	MSA Ultra Twin FM S ☐ M ☐ L ☐	North 7700 HM S ☐ M ☐ L ☐	North 7600 FM S ☐ M/L ☐	HM S ☐ M ☐ L ☐	FM S ☐ M ☐ L ☐
Qualitative Test Agent(s): IAA ☐ Smoke ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
Quantitative Test Device	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor
Date: Tester:	MSA Comfo II HM S ☐ M ☐ L ☐	MSA Ultra Twin FM S ☐ M ☐ L ☐	North 7700 HM S ☐ M ☐ L ☐	North 7600 FM S ☐ M/L ☐	HM S ☐ M ☐ L ☐	FM S ☐ M ☐ L ☐
Qualitative Test Agent(s): IAA ☐ Smoke ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
Quantitative Test Device	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor

Instructions

1. Complete the employee information at the top of the record (one record per employee).
2. Enter the date of the test and the name of the person conducting the fit test.
3. Circle the brand and model of respirator tested (e.g., MSA Comfo II, North 7700, etc.) or enter another brand and model in one of the last two columns.
4. Circle the size of the respirator tested.
5. For qualitative fit tests, circle the test agent used - IAA = Isoamyl Acetate, Smoke = Irritant Smoke (Stannic Chloride) and the outcome of the test (i.e., Pass or Fail).
6. For quantitative fit tests, enter the name of the instrument used and the overall fit factor measured by the test.
7. Keep a copy in the employee's training files and enter subsequent (e.g., annual) tests until the record is filled.

S3NA-519-FM2 Respiratory Equipment Maintenance Log

Unit No.	Respirator Type	Cleaned	Sterilized	Date	Performed by

S3NA-519-FM3 Respiratory Equipment Inspection

Date:		**Inspected by:**	
Air Purifier Unit #:			

	N/A	Pass	Fail
Examine Face Piece for:			
Excessive dirt	☐	☐	☐
Cracks, tears, holes, or distortion from improper storage	☐	☐	☐
Inflexibility (stretch and massage to restore flexibility)	☐	☐	☐
Cracked or badly scratched lenses in full face pieces	☐	☐	☐
Incorrectly mounted full-face piece lens or broken or missing mounting clips	☐	☐	☐
Lens sealed properly in receptacle, retaining clamp secured	☐	☐	☐
Cracked or broken air-purifying element holder(s), badly worn threads or missing gasket(s) (if appropriate)	☐	☐	☐
Examine the Head Straps or Head Harness for:			
Breaks	☐	☐	☐
Loss of elasticity	☐	☐	☐
Broken or malfunctioning buckles and attachments	☐	☐	☐
Excessively worn serrations on the head harness that might permit slippage (full face pieces only)	☐	☐	☐
Tears in headband at cradle attachment	☐	☐	☐
Examine the Inhalation and Exhalation Valves for:			
Foreign material, such as detergent residue, dust particles, or human hair under the valve seat	☐	☐	☐
Cracks, tears, or distortion in the valve material	☐	☐	☐
Improper insertion of the valve body in the face piece	☐	☐	☐
Cracks, breaks, or chips in the valve body, particularly in the sealing surface	☐	☐	☐
Missing or defective valve cover	☐	☐	☐
Examine the Air Purifying Elements for:			
Incorrect cartridge, canister, or filter for the hazard	☐	☐	☐
Incorrect installation, loose connection, missing or worn gaskets, or cross-threading in the holder	☐	☐	☐
Expired shelf life date on cartridge or canister	☐	☐	☐
Defects Noted:			
Unit Deemed Suitable for Use	☐ Yes		☐ No

S3NA-519-WI1 Fit Testing Protocol

1.0 Selection

1.1 The test subject shall be allowed to pick the most acceptable respirator from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

1.2 Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension, and how to determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, because it is only a review.

1.3 The test subject shall be informed that he/she is being asked to select the respirator that provides the most acceptable fit. Each respirator represents a different size and shape and if fitted and used properly will provide adequate protection.

2.0 Comfort

2.1 The test subject shall be instructed to hold each chosen face piece up to the face and to eliminate those that obviously do not give an acceptable fit.

2.2 The more acceptable face pieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort.

2.3 If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

2.4 Assessment of comfort shall include a review of the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

- Position of the mask on the nose
- Room for eye protection
- Room to talk
- Position of mask on face and cheeks

3.0 Fit Test Criteria

3.1 The following criteria shall be used to help determine the adequacy of the respirator fit:

- Chin properly placed;
- Adequate strap tension, not overly tightened;
- Fit across nose bridge;
- Respirator of proper size to span distance from nose to chin;
- Tendency of respirator to slip;
- Self-observation in mirror to evaluate fit and respirator position.

3.2 The test subject shall conduct a user seal check, either the negative and positive pressure seal checks described in *S3NA-519-WI2 User Seal Check Procedures* or those recommended by the respirator manufacturer that provide equivalent protection to the procedures in *S3NA-519-WI2 User Seal Check Procedures.*

3.3 Before conducting the negative and positive pressure checks, the subject shall be told to seat the mask on the face by moving the head from side to side and up and down slowly while taking in a few slow deep breaths. Another face piece shall be selected and retested if the test subject fails the user seal check tests.

3.4 The test shall not be conducted if there is any hair growth between the skin and the face piece sealing surface, such as stubble beard growth, beard, mustache, or sideburns that cross the respirator sealing surface. Any type of apparel that interferes with a satisfactory fit shall be altered or removed.

3.5 If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician or other licensed health care professional, as appropriate, to determine whether the test subject can wear a respirator while performing her or his duties.

3.6 If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.

4.0 Exercise Regimen

4.1 Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.

4.2 The fit test shall be performed while the test subject is wearing any applicable safety equipment that may be worn during actual respirator use and that could interfere with respirator fit.

5.0 General Test Exercises

5.1 The following test exercises are to be performed for all fit testing methods prescribed in this appendix, except for the CNP method. A separate fit testing exercise regimen is contained in the CNP protocol. The test subject shall perform exercises, in the test environment, in the following manner:

5.1.1 **Normal breathing**. In a normal standing position, without talking, the subject shall breathe normally.

5.1.2 **Deep breathing.** In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as not to hyperventilate.

5.1.3 **Turning head side to side.** Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.

5.1.4 **Moving head up and down.** Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

5.1.5 **Talking.** The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song.

5.1.6 **Rainbow Passage.** "When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch with its path high above and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow."

5.1.7 **Grimace.** The test subject shall grimace by smiling or frowning. (This applies only to QNFT testing; it is not performed for QLFT.)

5.1.8 **Bending over.** The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT or QLFT units that do not permit bending over at the waist.

5.1.9 **Normal breathing**. In a normal standing position, without talking, the subject shall breathe normally (this is the same as the first test).

5.2 Each test exercise shall be performed for one minute except for the grimace exercise, which shall be performed for 15 seconds.

5.3 The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried.

5.4 The respirator shall not be adjusted once the fit test exercises begin. Any adjustment voids the test and the fit test must be repeated.

6.0 Qualitative Fit Test (QLFT) Protocols

6.1 General

6.1.1 AECOM will ensure that persons administering QLFT are able to calibrate equipment and perform tests properly, recognize invalid tests, and ensure that test equipment is in proper working order.

6.1.2 AECOM will ensure that that QLFT equipment is kept clean and well maintained so as to operate within the parameters for which it was designed.

6.2 Irritant Smoke (Stannic Chloride) Protocol

6.2.1 This qualitative fit test uses a person's response to the irritating chemicals released in the "smoke" produced by a stannic chloride ventilation smoke tube to detect leakage into the respirator.

6.2.2 **General Requirements and Precautions:**

- The respirator to be tested shall be equipped with high efficiency particulate air (HEPA) or P100 series filter(s).
- Only stannic chloride smoke tubes shall be used for this protocol.
- No form of test enclosure or hood for the test subject shall be used.
- The smoke can be irritating to the eyes, lungs, and nasal passages. The test conductor shall take precautions to minimize the test subject's exposure to irritant smoke. Sensitivity varies, and certain individuals may respond to a greater degree to irritant smoke. Care shall be taken when performing the sensitivity screening checks that determine whether the test subject can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the test subject.
- The fit test shall be performed in an area with adequate ventilation to prevent exposure of the person conducting the fit test or the build-up of irritant smoke in the general atmosphere.

6.2.3 **Sensitivity Screening Check**

The person to be tested must demonstrate his or her ability to detect a weak concentration of the irritant smoke.

- The test operator shall break both ends of a ventilation smoke tube containing stannic chloride and attach one end of the smoke tube to a low flow air pump set to deliver 200 milliliters per minute or to an aspirator squeeze bulb. The test operator shall cover the other end of the smoke tube with a short piece of tubing to prevent potential injury from the jagged end of the smoke tube.
- The test operator shall advise the test subject that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the subject to keep his/her eyes closed while the test is performed.
- The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties and to determine if he/she can detect the irritating properties of the smoke. The test operator shall carefully direct a small amount of the irritant smoke in the test subject's direction to determine that he/she can detect it.

6.2.4 **Irritant Smoke Fit Test Procedure**

- The person being fit tested shall don the respirator without assistance, and perform the required user seal check(s).
- The test subject shall be instructed to keep his/her eyes closed.
- The test operator shall direct the stream of irritant smoke from the smoke tube toward the face seal area of the test subject, using the low flow pump or the squeeze bulb. The test operator shall begin at least 12 inches from the face piece and move the smoke stream around the whole perimeter of the mask. The operator shall gradually make two more passes around the perimeter of the mask, moving to within six inches of the respirator.

If the person being tested has not had an involuntary response and/or has not detected the irritant smoke, proceed with the test exercises.

- The General Test Excercises (Section 5.0) shall be performed by the test subject while the respirator seal is being continually challenged by the smoke, directed around the perimeter of the respirator at a distance of six inches.
- If the person being fit tested reports detecting the irritant smoke at any time, the test is failed. The person being retested must repeat the entire sensitivity check and fit test procedure.
- Each test subject passing the irritant smoke test without evidence of a response (involuntary cough, irritation) shall be given a second sensitivity screening check, with the smoke from the same smoke tube used during the fit test, once the respirator has been removed, to determine whether he/she still reacts to the smoke. Failure to evoke a response shall void the fit test.
- If a response is produced during this second sensitivity check, then the fit test is passed.

7.0 Quantitative Fit Test (QNFT) Protocols

7.1 General

- AECOM will confirm that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly, and ensure that test equipment is in proper working order.
- AECOM will ensure that QNFT equipment is kept clean and is maintained and calibrated according to the manufacturer's instructions so as to operate at the parameters for which it was designed.

7.2 Ambient Aerosol Condensation Nuclei Counter (CNC) Quantitative Fit Testing Protocol

7.2.1 The ambient aerosol condensation nuclei counter (CNC) quantitative fit testing (Portacount TM) protocol quantitatively fit tests respirators with the use of a probe. The probed respirator is only used for quantitative fit tests. A probed respirator has a special sampling device installed on the respirator to allow the probe to sample the air from inside the mask. A probed respirator is required for each make, style, model, and size that the employer uses and can be obtained from the respirator manufacturer or distributor. The CNC instrument manufacturer, TSI Inc., also provides probe attachments (TSI sampling adapters) that permit fit testing in an employee's own respirator. A minimum fit factor pass level of at least 100 is necessary for a half-mask respirator, and a minimum fit factor pass level of at least 500 is required for a full face piece negative pressure respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

7.2.2 Portacount Fit Test Requirements

- Check the respirator to make sure the sampling probe and line are properly attached to the face piece and that the respirator is fitted with a particulate filter capable of preventing significant penetration by the ambient particles used for the fit test (e.g., NIOSH 42 CFR 84 series 100, series 99, or series 95 particulate filter) according to the manufacturer's instructions.
- Instruct the person to be tested to don the respirator for five minutes before the fit test starts. This purges the ambient particles trapped inside the respirator and permits the wearer to make certain the respirator is comfortable. This individual shall already have been trained on how to wear the respirator properly.
- Check the following conditions for the adequacy of the respirator fit: chin properly placed; adequate strap tension, not overly tightened; fit across nose bridge; respirator of proper size to span distance from nose to chin; tendency of the respirator to slip; self-observation in a mirror to evaluate fit and respirator position.
- Have the person wearing the respirator do a user seal check. If leakage is detected, determine the cause. If leakage is from a poorly fitting face piece, try another size of the same model respirator, or another model of respirator.
- Follow the manufacturer's instructions for operating the Portacount and proceed with the test.
- The test subject shall be instructed to perform the exercises in General Test Excercises (Section 5.0).

- After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried.

7.2.3 **Portacount Test Instrument**

- The Portacount will automatically stop and calculate the overall fit factor for the entire set of exercises. The overall fit factor is what counts. The Pass or Fail message will indicate whether or not the test was successful. If the test was a Pass, the fit test is over.
- Since the pass or fail criterion of the Portacount is user programmable, the test operator shall confirm that the pass or fail criterion meet the requirements for minimum respirator performance.
- A record of the test needs to be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style, and size of respirator used; and date tested.

S3NA-519-WI2 User Seal Check Procedures

1.0 Requirements

1.1 The individual who uses a tight-fitting respirator is to perform a user seal check to confirm that an adequate seal is achieved each time the respirator is put on.

1.2 Either the positive and negative pressure checks listed here or the respirator manufacturer's recommended user seal check method shall be used.

1.3 User seal checks are not substitutes for qualitative or quantitative fit tests.

2.0 Facepiece Positive and/or Negative Pressure Checks

2.1 **Positive pressure check**

2.1.1 Close off the exhalation valve and exhale gently into the facepiece.

2.1.2 The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal.

2.1.3 For most respirators, this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.

2.2 **Negative pressure check**

2.2.1 Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s), inhale gently so that the facepiece collapses slightly, and hold your breath for 10 seconds.

2.2.2 The design of the inlet opening of some cartridges cannot be effectively covered with the palm of the hand.

2.2.3 The test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove.

2.2.4 If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

3.0 Manufacturer's Recommended User Seal Check Procedures

3.1 The respirator manufacturer's recommended procedures for performing a user seal check may be used instead of the positive and/or negative pressure check procedures, provided that the employer demonstrates that the manufacturer's procedures are equally effective.

S3NA-519-WI3 Respirator Cleaning Procedures

1.0 Requirements

1.1 These procedures are general in nature. The cleaning recommendations provided by the manufacturer may be used for the respirators used by their employees, provided such procedures are as effective as those listed here.

1.2 Equivalent effectiveness simply means that the procedures used must accomplish the objectives set forth (i.e., confirm that the respirator is properly cleaned and disinfected in a manner that prevents damage to the respirator and does not cause harm to the user).

2.0 Procedures for Cleaning Respirators

2.1 Remove filters, cartridges, or canisters. Disassemble facepieces by removing speaking diaphragms, demand and pressure-demand valve assemblies, hoses, or any components recommended by the manufacturer. Discard or repair any defective parts.

2.2 Wash components in warm (43^{o}C [110^{o}F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.

2.3 Rinse components thoroughly in clean, warm (43^{o}C [110^{o}F] maximum), preferably running water. Drain.

2.4 When the cleaner used does not contain a disinfecting agent, respirator components should be immersed for two minutes in one of the following:

- Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 43^{o}C (110^{o}F); or,
- Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine (6-8 grams ammonium and/or potassium iodide/100 cc of 45% alcohol) to one liter of water at 43oC (110oF); or,
- Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.

2.5 Rinse components thoroughly in clean, warm (43^{o}C [110^{o}F] maximum), preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.

2.6 Components should be hand dried with a clean, lint-free cloth or air-dried.

2.7 Reassemble facepiece, replacing filters, cartridges, and canisters where necessary.

2.8 Test the respirator to ensure that all components work properly.

2.9 After the fit test, wipe down the respirator with a sanitary swab.

Attachment F

Sanitation Plan

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SANITATION PLAN

INTRODUCTION

AECOM personnel will strive to maintain the workplace in sanitary condition to eliminate the health hazard posed by unsanitary conditions.

DRINKING WATER

AECOM shall provide an adequate supply of potable drinking water for their personnel. Portable containers used to dispense drinking water shall be capable of being tightly closed and equipped with a drain faucet. Water shall not be dipped from containers. The water container shall be labeled “Drinking Water”. A common drinking cup is prohibited. Where disposable cups are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups will be provided.

Nonpotable Water

Outlets dispensing nonpotable water will be conspicuously posted "CAUTION - WATER UNSAFE FOR DRINKING, WASHING, OR COOKING."

Cross-connection - open or potential - between a system furnishing potable water and a system furnishing nonpotable water is prohibited.

TOILETS

AECOM shall provide toilet facilities for their personnel. The minimal number of toilets and urinals shall comply with EM 385-1-1 Section 2.E. AECOM will make arrangements to have the facilities pumped and cleaned weekly or more frequently based on usage. Toilet facility will be designated for both male and female personnel and label as such.

Enclosed temporary/ portable toilet facilities which contain a toilet seat and urinal will be provided on the project site. The facilities are constructed to protect personnel from the weather and falling objects and are equipped a self closing door capable of being latched.

Exceptions to this requirement will apply to mobile crews where work activities and locations permit transportation to nearby toilet facilities.

WASHING FACILITIES

Hand washing facilities such as a portable sink or hand sanitizer will be provided at toilet facilities. Where hand washing facilities are provided they will be maintained in sanitary condition and provided with water, soap and means of drying. The washing facilities at nearby buildings will be used for persons to wash where harmful substances are used.

FOOD SERVICE OPERATIONS

As part of the project no food service operations will be conducted. Personnel who obtain food from an off-site location (home) will be provided with a clean and safe place to consume their meal/take a break. No food or beverage will be consumed or stored in a toilet room or in any area where hazardous materials may be present.

WASTE DISPOSAL

An adequate number of waste receptacles will be provided in the break area for food scrapes and litter. These receptacles will have a tight-fitting cover and emptied at least daily.

VERMIN CONTROL

Vermin control on this project is the responsibility of the bases. If vermin control is need the facility will be contacted.

Attachment G

Alcohol and Drug Abuse Policy

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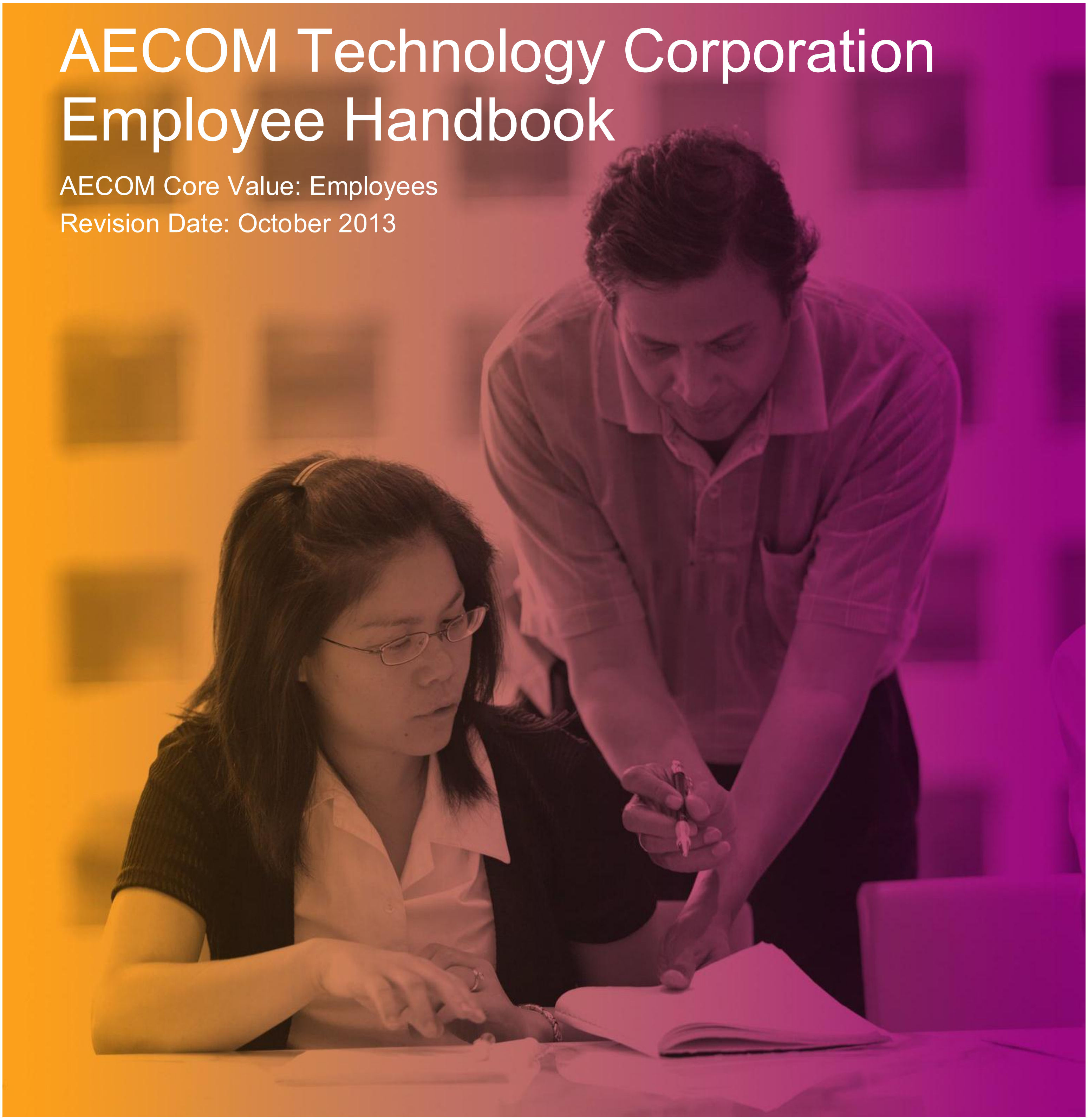
AECOM Technology Corporation Employee Handbook

AECOM Core Value: Employees

Revision Date: October 2013



Drug-Free Workplace

AECOM is committed to providing a safe and healthy workplace for all employees. Consistent with this commitment and in keeping with the federal Drug-Free Workplace Act of 1988, it is the policy of AECOM to maintain a drug-free workplace.

Key provisions
AECOM policy prohibits employees from being under the influence of alcohol or drugs or improperly using medication in any way that could diminish, or raise questions concerning, an employee's ability to perform at his or her best while performing services for or on behalf of AECOM. Employees who are under the influence of alcohol or any controlled substance have the potential for interfering with their own and their coworkers' safe and efficient job performance. Compliance with this policy is considered a condition of employment.

This policy also prohibits the sale, possession, manufacturing and/or distribution of illegal drugs, and/or other controlled substances in the workplace or while on company business off premises. Violations of this policy will be considered to be gross and willful misconduct and will result in disciplinary action, up to and including termination. Any illegal substances discovered in the workplace will be turned over to the appropriate law enforcement agency and may result in criminal prosecution.

Company-sponsored events
It is understood that employees may at times attend company-sponsored events where alcohol is served. While consuming alcohol on such occasions is not prohibited, employees are expected to exercise proper judgment and must observe professional, legal and common-sense guidelines at all times.

Prior approval from management and Human Resources is required for any on-site AECOM-sponsored event where alcohol is served. In addition, such events must comply with the following conditions:

- Employees should not be expected to return to work after attending the event.
- Transportation arrangements will be provided for employees who need such assistance.

Testing for drugs and alcohol
Drug and/or alcohol screening may be required:

- Of any applicant to whom a job offer has been made.
- Of any employee where there is reason to believe that he or she may be using illegal or non-prescribed drugs or may be under the influence of drugs and alcohol. "Reason to believe" includes an injury or accident at work where there is reason to believe that employee impairment may have been a factor. "Reason to believe" may be based on objective symptoms such as the employee's appearance, behavior or speech.
- As part of occasional follow-up testing if the employee is found to have breached these policies but has been permitted to remain employed.
- As required by client contract, project, or if an employee is employed in a safety-sensitive position. Under these limited circumstances, employees may also be subjected to pre-employment and random drug screening.

An employee’s cooperation with such drug or alcohol screening tests is required as a condition of employment. The employee’s refusal to cooperate with such a request and to provide a specimen may result in termination where there is reason to believe that the employee has violated this policy and the employee’s refusal to cooperate has prevented a medical determination of his or her condition. Any violation of this policy may result in immediate termination.

Employees who take the initiative of advising their supervisor or Human Resources in advance that they have a medical problem with regard to alcohol or drug use, and who demonstrate a commitment to take the necessary remedial action, may be eligible for a medical leave of absence for such purpose and may not be subjected to disciplinary action.

As part of the disciplinary process and, at its sole discretion, AECOM may require employees who violate this policy to successfully complete a drug abuse assistance or rehabilitation program as a condition of continued employment.

Persons whose positions with AECOM require driving as part of their work may be removed from such positions and/or subject to termination if found to have been driving under the influence of alcohol or controlled substances whether on or off-duty.

Drug conviction
An employee who has been convicted of a felony under a criminal drug statute for a violation occurring on company property or during the employee's working hours must notify Human Resources no later than five (5) calendar days after the felony conviction becomes final under the law.

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Attachment H

Cold Stress Prevention Plan and Heat Stress Prevention Plan

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S3NA-511-PR Heat Stress

1.0 Purpose and Scope

1.1 Establishes a heat stress prevention program to help ensure that employees know and recognize the symptoms of heat stress-related illnesses and are prepared to take appropriate corrective action.

1.2 This procedure applies to all AECOM North America-based employees and operations.

2.0 Terms and Definitions

2.1 **Acclimated**: Workers who have developed physiological adaptation to hot environments characterized by increased sweating efficiency, circulation stability, and tolerance of high temperatures without stress. Acclimatization occurs after 7 to 10 consecutive days of exposure to heat and much of its benefit may be lost if exposure to hot environments is discontinued for a week.

2.2 **Chemical Protective Clothing (CPC):** Apparel that is constructed of relatively impermeable materials intended to act as a barrier to physical contact of the worker with potentially hazardous materials in the workplace. Such materials include: Tyvek® coveralls (all types) and polyvinyl chloride (PVC) coveralls and rain suits.

2.3 **Unacclimated**: Workers who have not been exposed to hot work conditions for one week or more or who have become heat-intolerant due to illness or other reasons.

2.4 **Heat Cramps**: A form of heat stress brought on by profuse sweating and the resultant loss of salt from the body.

2.5 **Heat Exhaustion**: A form of heat stress brought about by the pooling of blood in the vessels of the skin and in the extremities.

2.6 **Heat Rash**: A heat-induced condition characterized by a red, bumpy rash with severe itching.

2.7 **Heat Stress.** The combination of environmental and physical work factors that constitute the total heat load imposed on the body.

2.8 **Heat Stroke**: The most serious form of heat stress, which involves a profound disturbance of the body's heat-regulating mechanism.

2.9 **Sunburn**: Is caused by unprotected exposure to ultraviolet light that is damaging to the skin. The injury is characterized by red painful skin, blisters, and/or peeling.

3.0 Attachments

3.1 S3NA-511-FM Heat Stress Monitoring Log

3.2 S3NA-511-WI1 Temperature Thresholds

3.3 S3NA-511-WI2 Symptoms and Treatment

3.4 S3NA-511-ST Heat Exposure

4.0 Procedures

4.1 Restrictions

4.1.1 Staff working in extreme heat or sun for extended periods of time away from a shelter or vehicle must not work alone.

4.1.2 Staff shall not be exposed to levels that exceed those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard.

4.1.3 Clothing corrections shall be applied in accordance with the heat stress and strain section of the ACGIH Standard.

4.2 Roles and Responsibilities

4.2.1 **Project Managers'/field task managers'** responsibilities:

- Evaluate the need for heat stress prevention measures and incorporate as appropriate into the Health and Safety Plan.
- Implement heat stress prevention measures, as applicable, at each work site.
- Develop/coordinate a work-rest schedule, as applicable.
- Ensure heat stress hazard assessments/evaluations were completed for the planned activities.
- Assign personnel physically capable of performing the assigned tasks.
- Ensure that personnel are properly trained in the recognition of heat stress-related symptoms.

4.2.2 **Region SH&E Managers'** responsibilities**:**

- Provide heat stress awareness training.
- Assist project teams develop appropriate work-rest schedules.
- Conduct/support incident investigations related to potential heat stress-related illnesses.

4.2.3 **Site Supervisors'** responsibilities**:**

- Identify those tasks that may be most impacted by heat stress and communicate the hazard to the assigned employees.
- Ensure that employees have been trained on the recognition of heat stress-related illness.
- Ensure that adequate supplies of appropriate fluids are readily available to employees.
- Ensure that a proper rest area is available.
- Conduct heat stress monitoring, as applicable.
- Implement the work-rest schedule.
- Ensure that first aid measures are implemented once heat stress symptoms are identified.
- Ensure personnel are physically capable of performing the assigned tasks and are not in a physically compromised condition.
- Report all suspected heat stress-related illnesses.

4.2.4 **Employees'** responsibilities:

- Observe each other for the early symptoms of heat stress-related illnesses.
- Maintain an adequate intake of available fluids.
- Be familiar with heat stress hazards, predisposing factors, and preventative measures.
- Report to work in a properly rested and hydrated condition.
- Report all suspected heat stress-related illnesses.

4.3 Controls

4.3.1 If staff are or may be exposed, the supervisor shall:

- Conduct a heat stress assessment to determine the potential for hazardous exposure of workers, and
- Develop and implement a heat stress exposure control plan.

4.3.2 If staff are or may be exposed, the supervisor shall implement engineering controls (e.g., shelters, cooling devises, etc.) to reduce the exposure of staff to levels below those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard.

4.3.3 If engineering controls are not practicable, the supervisor shall reduce the exposure of workers to levels below those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard by providing administrative controls, including a work-rest cycle or personal protective equipment, if the equipment provides protection equally effective as administrative controls.

4.3.4 If staff are or may be exposed, the supervisor shall provide and maintain an adequate supply of cool, potable water close to the work area for the use of a heat exposed worker.

4.3.5 If a staff person shows signs or reports symptoms of heat stress or strain, they shall be removed from the hot environment and treated by an appropriate first aid attendant, if available, or by a physician.

4.3.6 Heat stress can be a significant field site hazard, especially for workers wearing CPC. The workforce will gradually work up to a full workload under potentially stressful conditions to allow for proper acclimation.

4.3.7 Site personnel shall be instructed in the recognition of heat stress symptoms, the first aid treatment procedures for severe heat stress, and the prevention of heat stress injuries. Workers must be encouraged to immediately report any heat stress that they may experience or observe in fellow workers. Supervisors must use such information to adjust the work-rest schedule to accommodate such problems.

4.3.8 Wherever possible, a designated break area should be established in an air conditioned space, or in shaded areas where air conditioning is impractical. The break area should be equipped to allow workers to loosen or remove protective clothing, and sufficient seating should be available for all personnel. During breaks, workers must be encouraged to drink plenty of water or other liquids, even if not thirsty, to replace lost fluids and to help cool off. Cool water should be available at all times in the break area, and in the work area itself unless hygiene/chemical exposure issues prevent it.

4.4 Symptoms and Treatment

4.4.1 Workers who exhibit ANY signs of significant heat stress (e.g., profuse sweating, confusion and irritability, pale, clammy skin), shall be relieved of all duties at once, made to rest in a cool location, and provided with large amounts of cool water.

4.4.2 Anyone exhibiting symptoms of heat stroke (red, dry skin, or unconsciousness) must be taken immediately to the nearest medical facility, taking steps to cool the person during transportation (clothing removal, wet the skin, air conditioning, etc.).

4.4.3 Severe heat stress (heat stroke) is a life-threatening condition that must be treated by a competent medical authority.

4.5 Prevention

4.5.1 All staff working in extreme heat or sun should understand the following guidelines for preventing and detecting heat exhaustion and heat stroke.

- If you experience heat exhaustion or heat stroke you must immediately seek shelter and water.
- Take frequent short breaks in areas sheltered from direct sunlight; eat and drink small amounts frequently.
- Try to schedule work for the coolest part of the day, early morning and evening.

4.5.2 Prevention of heat-related illnesses:

- Avoid strenuous physical activity outdoors during the hottest part of the day.
- Wear a hat and light-colored, loose-fitting clothing to reflect the sun.
- Avoid sudden changes of temperature. Air out a hot vehicle before getting into it.
- If you take diuretics, ask your doctor about taking a lower dose during hot weather.
- Drink 8 to 10 glasses of water per day. Drink even more if you are working or exercising in hot weather.
- Avoid caffeine and alcohol as they increase dehydration.
- If you exercise strenuously in hot weather, drink more liquid than your thirst seems to require.

4.6 Personal Protective Equipment

- Wear a hat and light-colored, loose-fitting clothing to reflect the sun.
- Apply sunscreen to exposed skin (SPF 30 or greater, follow directions on label).
- Wear sunglasses with UV protection.
- Pack extra water to avoid dehydration (try freezing water in bottles overnight to help keep the water cooler for longer during the day).

4.7 Work-Rest Schedule Practices

- Intake of fluid will be increased beyond that which satisfies thirst, and it is important to avoid "fluid debt," which will not be made up as long as the individual is sweating.
- Two 8-ounce glasses of water should be taken prior to beginning work, then up to 32 oz. per hour during the work shift; fluid replacement at frequent intervals is most effective.

The best fluid to drink is water; liquids like coffee or soda do not provide efficient hydration and may increase loss of water.

- If commercial electrolyte drinks (e.g., Gatorade) are used, the drink should be diluted with water, or 8 ounces of water should be taken with each 8 ounces of electrolyte beverage.
- Additional salt is usually not needed and salt tablets should not be taken.
- Replacement fluids should be cool, but not cold.
- Breaks will be taken in a cool, shaded location, and any impermeable clothing should be opened or removed.
- Dry clothing or towels will be available to minimize chills when taking breaks.
- Manual labor will not be performed during breaks, other than paperwork or similar light tasks.
- Other controls that may be used include:
  - Scheduling work at night or during the cooler parts of the day (6 am–10 am, 3 pm–7 pm).
  - Erecting a cover or partition to shade the work area.
  - Wearing cooling devices such as vortex tubes or cooling vests beneath protective garments. If cooling devices are worn, only physiological monitoring will be used to determine work activity.

4.8 Evaluating the Work-Rest Schedule's Effectiveness

4.8.1 Once a work-rest schedule is established, the work supervisor must continually evaluate its effectiveness through observation of workers for signs/symptoms of heart stress. Measurement of each worker's vitals (e.g., pulse, blood pressure, and temperature) can provide additional information in determining if the schedule is adequate, and is accomplished as follows:

4.8.2 At the start of the workday each worker's baseline pulse rate (in beats per minute – bpm) is determined by taking a pulse count for 15 seconds and multiplying the result by four or an automated pulse count device may be utilized. Worker pulse rates can then be measured at the beginning and end of each break period to determine if the rest period allows adequate cooling by applying the following criteria:

- Each worker's maximum heart rate at the start of any break should be less than [180 minus worker's age] bpm. If this value is exceeded for any worker, the duration of the following work period will be decreased by at least 10 minutes.
- At the end of each work period all workers' heart rates must have returned to within +10% of the baseline pulse rate. If any worker's pulse rate exceeds this value the break period will be extended for at least 5 minutes, at the end of which pulse rates will be remeasured and the end-of-break criteria again applied.

4.8.3 Use a clinical thermometer or similar device to measure the oral/ear temperature at the beginning (before drinking liquids) and end of each break period and apply the following criteria:

- If the oral temperature exceeds 99.6^{o}F, shorten the next work cycle by one-third without changing the rest period.
- If the oral temperature still exceeds 99.6^{o}F (36.6^{o}C) at the beginning of the next rest period, shorten the following work cycle by one-third.

4.8.4 Use of an automated or similar blood pressure device will be used to assess each employee's blood pressure at the beginning and end of each break period to determine if the rest period allows adequate cooling by applying the following criteria:

- If the blood pressure of an employee is outside of 90/60 to 150/90, then the employee will not be allowed to begin or resume work; extend the break period by at least five minutes, at the end of which blood pressure rates will be remeasured and the end-of-break criteria again applied.

4.8.5 All physiological monitoring of heat stress will be documented using *S3NA-511-FM Heat/Cold Stress Monitoring Log*.

4.9 Training

4.9.1 Project staff and their supervisors that may be exposed to the hazard will be oriented to the hazard and the controls prior to work commencing.

4.9.2 Those personnel potentially exposed to heat stress will receive training including, but not limited to

- Sources of heat stress, influence of protective clothing, and importance of acclimatization.

- How the body handles heat.
- Recognition of heat-related illness symptoms.
- Preventative/corrective measures.
    - Employees will be informed of the harmful effects of excessive alcohol consumption in the prevention of heat stress.
    - All employees will be informed of the importance of adequate rest and proper diet in the prevention of heat stress.
- First aid procedures for heat stress-related illnesses.

5.0 Records

5.1 None

6.0 References

6.1 S3NA-003-PR SH&E Training

6.2 S3NA-208-PR Personal Protective Equipment

6.3 S3NA-314-PR Working Alone and Remote Travel

AECOM

[redacted]-511-FM Heat Stress Monitoring Log

The purpose of this form is to track entry into hot zones wearing chemically protective clothing and monitor employees for heat stress-related illness. It is the responsibility of the foreman or supervisor-in-charge to ensure that each person entering the hot zone completes the required information. Vital signs must be taken by a competent person.

Project Name:			**Foreman/Supervisor:**							**Work/Rest Schedule1:**		IN *(min)*		OUT *(min)*		
Date:	**Water Provided**[2]		**Acclimated**[3]		**Initial Vitals**[3]	**Vital Signs and Time In/Out**[4]										
Employee Name	Yes	No	Yes	No	**Vitals**	In	Out	**Vitals**	In	Out	**Vitals**	In	Out	**Vitals**	In	Out
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		

1. Please refer to S3NA-511-PR, Heat Stress. Section 6.3 provides specific details on how to develop a work-rest schedule.
2. Each employee should be provided a sufficient amount of water or sports drink before entering the hot zone. Drinks such as coffee and cola should be discouraged.
3. A worker is "acclimated" if he/she has worked in a hot environment for at least 7 to 10 consecutive days. If a worker is acclimated, check "Yes." If a worker is not acclimated, check "No" and reduce the "Min In" by 50 percent for that employee until the 7- to 10-day period is reached.
4. "Vitals" refers to employee vital signs (e.g., pulse [P], blood pressure [BP], body temperature [Temp], etc.). Initial vitals must be taken and recorded before the start of work operations in the hot zone. Each time the employee exits the hot zone, vitals must be taken and evaluated for heat stress criteria. Section 6.4 of S3NA-511-PR *Heat Stress* provides specific instructions for taking and evaluating employee vital signs.
5. Body temperature vital signs will be recorded in °F.

S3NA-511-WI1 Temperature Thresholds

1.0 Work-Rest Schedule

The prevention of heat stress is best performed through supervisor observation of employees and routine heat stress awareness training activities. However, it is also necessary to implement a work routine that incorporates adequate rest periods to allow workers to remove protective clothing, drink fluids (vital when extreme sweating is occurring), rest and recover. The frequency and length of work breaks must be determined by the work supervisor based upon the ambient temperature, amount of sunshine, humidity, the amount of physical labor being performed, the physical condition of the workers (e.g., acclimated/not), and protective clothing being used.

1.1 Establishing a Work-Rest Schedule

1.1.1 AECOM permits the use of either of two techniques to initially determine an appropriate daily work-rest schedule. These methods are:

- Wet Bulb Globe Thermometer (WBGT) Method: This method is preferred, if a WBGT meter is available.
- Adjusted Temperature Method:This method should be used only if WBGT data is not available.

1.1.2 Either procedure will provide the work supervisor with a recommended routine; however, adjustments to this routine may be required to accommodate the specific daily conditions at the work site.

1.2 WBGT Work-Rest Schedule Guidelines

1.2.1 Table 1, the Non-CPC Activities WBGT Chart, is intended for use where personnel are not utilizing CPC. Where workers are required to utilize CPC, Table 2, the CPC Activities WBGT Chart, will be used.

1.2.2 WBGT readings are compared directly with the values the applicable WBGT Chart for the applicable work rate (where light work corresponds to minimal physical activity besides standing/watching; very heavy work corresponds to significant, continuous physical labor) to determine the work-rest frequency.

Table 1. Non-CPC Activities WBGT Chart

Work-Rest Regimen	WBGT			
	Light Work	Moderate Work	Heavy Work	Very Heavy Work
Continuous Work	85°F (29.4°C)	81°F (27.2°C)	78°F (25.6°C)	
75% Work – 25% Rest	86°F (30°C)	83°F (28.3°C)	81°F (27.2°C)	
50% Work – 50% Rest	88°F (31.1°C)	85°F (29.4°C)	83°F (28.3°C)	81°F (27.2°C)
25% Work – 75% Rest	90°F (32.2°C)	87°F (30.6°C)	86°F (30°C)	85°F (29.4°C)

Modified from ACGIH's 2002 *Threshold Limit Values for Chemical Substances and Physical Agents*, for acclimatized workers

Table 2. CPC Activities WBGT chart

Work-Rest Regimen	WBGT			
	Light Work	Moderate Work	Heavy Work	Very Heavy Work
Continuous Work	74°F (23.3°C)	70°F (21.1°C)	67°F (19.4°C)	
75% Work – 25% Rest	75°F (23.9°C)	72°F (22.2°C)	70°F (21.1°C)	

50% Work – 50% Rest	77°F (25°C)	74°F (23.3°C)	72°F (22.2°C)	70°F (21.1°C)
25% Work – 75% Rest	79°F (26.1°C)	76°F (24.4°C)	75°F (23.9°C)	74°F (23.3°C)

Modified from ACGIH's 2002 *Threshold Limit Values for Chemical Substances and Physical Agents*, for acclimatized workers

1.3 Adjusted Temperature Work-Rest Schedule Guidelines

This method can be utilized where WBGT data is not available, and requires only that the ambient temperature be known. Adjustment factors are applied to the ambient temperature to account for departures from ideal conditions (sunny conditions, light winds, moderate humidity and a fully acclimated work force). The adjustments will be made by addition or subtraction to the ambient temperature reading, or changes in table position, as indicated in Table 3. Adjustments are independent and cumulative, all applicable adjustments should be applied. The result is the Adjusted Temperature, which can be compared with the values in Table 4 for the applicable work rate (where light work corresponds to minimal physical activity besides standing/watching; very heavy work corresponds to significant, continuous physical labor) to determine the work-rest schedule.

Table 3. Temperature Adjustment Factors

Time of Day	
Before daily temperature peak[1]	+2°F (+1.11°C)
10 am – 2 pm (peak sunshine)	+2°F (+1.11°C)
Sunshine	
No clouds	+1°F (+0.56°C)
Partly Cloudy (3/8 – 5/8 cloud cover)	-3°F (-1.67°C)
Mostly Cloudy (5/8 – 7/8 cloud cover)	-5°F (-2.78°C)
Cloudy (>7/8 cloud cover)	-7°F (-3.89°C)
Indoor or nighttime work	-7°F (-3.89°C)
Wind (*ignore if indoors or wearing CPC*)	
Gusts greater than 5 miles per hour at least once per minute	-1°F (-0.56°C)
Gusts greater than 10 miles per hour at least once per minute	+2°F (+1.11°C)
Sustained greater than 5 miles per hour	-3°F (-1.67°C)
Sustained greater than 10 miles per hour	-5°F (-2.78°C)
Humidity (*ignore if wearing CPC*)	
Relative Humidity greater than 90%	+5°F (+2.78°C)
Relative Humidity greater than 80%	+2°F (+1.11°C)
Relative Humidity less than 50%	-4°F (-2.23°C)
Chemical Protective Clothing (CPC)	
Modified Level D (coveralls, no respirator)	+5°F (+2.78°C)
Level C (coveralls w/o hood, full-face respirator)	+8°F (+4.45°C)
Level C (coveralls with hood, full-face respirator)	+10°F (+5°C)
Level B with airline system	+9°F (+5.56°C)
Level B with SCBA	+9°F (+5.56°C) and right one column[2]
Level A	+14°F (+7.78°C) and right one column[2]
Other	Specified in the HASP
Miscellaneous	

[1] This adjustment accounts for temperature rise during the day. If the temperature has already reached its daytime peak it can be ignored.

[2] Locate the proper column based on work rate, then move one column to the right (next higher work rate) before locating the corresponding adjusted temperature.

Unacclimated work force	+5°F (+2.78°C)
Partially acclimated work force	+2°F (+1.11°C)
Working in shade	-3°F (-1.67°C)
Breaks taken in air conditioned space	-3°F (-1.67°C)

Table 4. Work-Rest Schedule Based on Adjusted Temperature

Work-Rest Regimen	Adjusted Temperature			
	Light Work	Moderate Work	Heavy Work	Very Heavy Work
No specified requirements	< 80°F (22.67°C)	< 75 (23.88°C)	< 70 (21.11°C)	< 65 (18.33°C)
15 minute break every 90 minutes of work	80°F – 90°F (22.67°C) - (32.22°C)	75 – 85 (23.88°C) - (29.44°C)	70 – 80 (21.11°C) - (22.67°C)	65 – 75 (37.77°C) - (23.88°C)
15 minute break every 60 minutes of work	>90 – 100 (32.22°C) - (37.77°C)	> 85 – 95 (23.88°C) - (35°C)	>80 – 85 (22.67°C) - (23.88°C)	>75 – 80 (23.88°C) - (22.67°C)
15 minute break every 45 minutes of work	>100 – 110 (37.77°C) - (43.33°C)	>95 – 100 (35°C) - (37.77°C)	>85 – 90 (23.88°C) - (32.22°C)	>80 – 85 (22.67°C) - (23.88°C)
15 minute break every 30 minutes of work	>110 – 115 (43.33°C) - (46.11°C)	>100 – 105 (37.77°C) – (40.55°C)	>90 – 95 (32.22°C) - (35°C)	>85 – 90 (23.88°C) - (32.22°C)
15 minute break every 15 minutes of work	>115 – 120 (46.11°C) - (48.88°C)	>105 – 110 (40.55°C) - (43.33°C)	>95 -100 (35°C) - (37.77°C)	>90 – 95 (32.22°C) - (35°C)
Stop Work	**>120** (48.88°C)	**>110** (43.33°C)	**>100** (37.77°C)	**>95** (35°C)

Note: Time spent performing decontamination or donning/doffing CPC should not be included in calculating work or break time lengths.

S3NA-511-WI2 Symptoms and Treatment

1.0 Heat Stress-related Illness Symptoms

1.1 There are three stages of heat-related illness:

1.1.1 Heat Cramps

- Heat cramps are painful muscle cramps caused by over-exertion in extreme heat.
  - Muscle spasms, and
  - Pain in the hands, feet, and abdomen

1.1.2 Heat Exhaustion

- Heat exhaustion is the next stage. Symptoms include:
  - Cool, moist, pale, flushed or red skin
  - Heavy sweating
  - Headache
  - Nausea or vomiting
  - Dizziness, and
  - Exhaustion.
- Mood changes (irritable, or confused/can't think straight)
- Pale, cool, moist skin
- Heavy sweating
- Dizziness
- Nausea
- Fainting

1.1.3 Heat Stroke

- Heat stroke. Heat exhaustion can sometimes lead to heat stroke, which can be fatal and requires emergency treatment. Heat stroke happens when you stop sweating and your body temperature continues to rise, often to 105° F (40.5° C) or higher. Symptoms of heat stroke:
  - Vomiting
  - Decreased alertness level or complete loss of consciousness
  - High body temperature (sometimes as high as 105° F (40.5° C))
  - Skin may still be moist or the victim may stop sweating and the skin may be red, hot, and dry
  - Rapid, weak pulse, and
  - Rapid, shallow breathing.
- Red, hot, usually dry skin
- Lack of or reduced perspiration
- Nausea
- Dizziness and confusion
- Strong rapid pulse
- Coma

2.0 Recommended Treatment for Heat Stress-related Illnesses

2.1 Heat Cramps

2.1.1 Treatment:

- Gently stretch the cramped muscle and hold the stretch for about 20 seconds, then gently massage the muscle. Repeat these steps if necessary.
- Take more frequent breaks and drink more water.
- Move victim to a cool place.
- Administer drinks of cool water.

Apply manual pressure to cramped muscles.
- Seek medical attention if symptoms are not alleviated or if more serious problems are indicated.

2.1.2 Heat Exhaustion

- Treatment of heat exhaustion:
  - Get out of the sun to a cool location and drink lots of water, a little at a time.
  - Remove or loosen tight clothing.
  - If you are nauseated or dizzy, lie down.
- Move the victim to a cool place.
- Remove as much clothing as possible and elevate the feet.
- Administer drinks of cool water and fan to cool.
- Seek medical attention immediately.

2.1.3 Heat Stroke

- Treatment of heat stroke, or if a person's temperature exceeds 102° F (38.9 ° C) :
- Call for immediate medical help and then try to lower the temperature as quickly as possible:
  - Apply cool (not cold) water the person's whole body, then fan the person.
  - Stop cooling once the person's temperature appears to be down; be careful not to overcool.
  - Do not give aspirin or acetaminophen to reduce the temperature.
- Treat as a true medical emergency. Seek medical help immediately
- Reduce body temperature quickly
- Douse with cool water (not cold water)
- Wrap in wet sheet
- If available, use cold packs under arms, neck, and ankles
- Protect from injury during convulsion
- Ensure that the person's airway is open.
- Transfer to a medical facility immediately.

S3NA-511-ST Heat Exposure

The following Occupational Health and Safety regulations apply directly to heat stress hazards:

Jurisdiction	Regulation
United States	
OSHA	1910.132
Canada	
Alberta	n/a
British Columbia	OHS Regulation (1997) Sect 7.28 – 7.32, 8.21, 12.72, 12.73
Manitoba	Workplace Health and Safety Regulation (217/2006) Sect 4.12, 4.13
New Brunswick	OHS Regulation (91-191) Sect 44
Newfoundland/Labrador	OHS Regulation (C.N.L.R. 1165/96) Sect 10
Nova Scotia	n/a
NWT/NU Territories	n/a
Ontario	O. Reg. 213/91 Sect 112 O. Reg. 851 Sect 129 Heat Stress (Health and Safety Guidelines) (April 2003)
Prince Edward Island	OHS Regulations (EC180/87) Sect 42.1
Quebec	OHS Regulation (R.R.Q., c. S-2.1, r.19.01 O.C. 885-2001) Sect 121 – 124, Schedule 4, Schedule 5
Saskatchewan	OHS Regulation (R.R.S., c. O-1, r. 1) Sect 70
Yukon Territory	Occupational Health Regulations (O.I.C. 1986/164) Sect 9, 12

S3NA-505-PR Cold Stress Prevention

1.0 Purpose and Scope

1.1 To protect workers from the severest effects of cold stress (hypothermia) and cold injury and to identify exposures to cold working conditions under which it is believed nearly all workers can be repeatedly exposed without adverse health effects.

1.2 This procedure applies to all AECOM North America-based employees and operations.

2.0 Terms and Definitions

2.1 **Cold Stress:** The production of physiological effects due to cold temperatures and\or wind chill.

2.2 **Equivalent Chill Temperature (ECT):** Also known as Wind Chill (see below)

2.3 **Frostnip:** Superficial cooling of tissues without cellular destruction.

2.4 **Frostbite:** Freezing of tissue, resulting in tissue destruction.

2.5 **Hypothermia:** Condition of reduced core body temperature to 95^{o}F (35^{o}C) resulting in loss of dexterity, loss of mental alertness, collapse, and possible death.

2.6 **Wind Chill:** The combined effect of air temperature and wind. Also expressed as "equivalent chill temperature" (ECT), wind chill is defined as heat loss resulting from the effects of air temperature and wind velocity upon exposed skin.

3.0 Attachments

3.1 S3NA-505-WI1 Temperature Thresholds

3.2 S3NA-505-WI2 Symptoms and Treatment

3.3 S3NA-505-ST Cold Exposure

4.0 Procedure

4.1 Restrictions

4.1.1 Staff working in extreme cold (wind chill or ECT below 10^{o}F or -12^{o}C) shall not work alone.

4.1.2 All staff working in extreme cold or snow conditions should understand the following guidelines for preventing and detecting hypothermia and frost bite.

- If you experience frost bite or hypothermia, find shelter and warmth and contact a medical practitioner if symptoms persist.
- Take frequent short breaks in warm dry shelters to allow your body to warm up. Limit time of exposure.
- Schedule work for the warmest part of the day or when the wind is most calm.
- Avoid exhaustion or fatigue because energy is needed to keep muscles warm.
- Because prolonged exposure to cold air or to immersion in cold water at temperatures even well above freezing can lead to dangerous hypothermia, whole-body protection shall be used.

4.2 Roles and Responsibilities

4.2.1 **Project Managers/field task managers**

- Implement cold stress prevention measures as applicable at each work site.
- Develop/coordinate a work-warning regimen, as applicable.
- Confirm cold stress hazard assessments/evaluations were completed for the planned activities.
- Assign personnel physically capable of performing the assigned tasks. Consider acclimation to cold weather when evaluating worker capability.
- Confirm personnel are properly trained to recognize the symptoms of cold stress.

4.2.2 **Region SH&E Managers**

- Conduct/support cold stress assessments/evaluations.
- Conduct/support incident investigations related to potential cold stress-related illnesses.
- Assist project teams develop appropriate work-warming regimens.
- Provide cold stress awareness training.

4.2.3 **Supervisors**

- Identify the tasks that may be most impacted by cold stress and communicate the hazard to the assigned employees.
- Confirm that employees have been trained on the recognition of cold stress-related illnesses.
- Confirm that adequate supplies of warm fluids/drinks are readily available to employees.
- Confirm that a warm/sheltered rest area is available, as applicable.
- Conduct cold stress monitoring, as applicable.
- Implement the work-warming regimen.
- Confirm that first aid measures are implemented once cold stress symptoms are identified.
- Confirm that personnel are physically capable of performing the assigned tasks and are not in a physically compromised condition.

4.2.4 **Employees**

- Observe each other for the early symptoms of cold stress-related illnesses.
- Maintain an adequate intake of available fluids.
- Report to work in a properly vested condition.
- Report all suspected cold stress-related illnesses.

4.3 Training

4.3.1 Before they begin work in a cold environment, project staff who might be exposed to cold stress will be informed of the potential for cold stress and how to prevent cold stress. Workers that have not had the training within the twelve prior months shall repeat the training before exposure to cold stress.

4.3.2 Personnel potentially exposed to cold stress will receive training including, but not limited to:

- Sources of cold stress, the influence of protective clothing, and the importance of acclimatization
- How the body loses heat.
- Recognition of cold-related illness symptoms
- Cold stress preventative/corrective measures
- Tthe harmful effects of excessive alcohol consumption in a cold stress environment
- The hazards associated with unstable snow or ice build ups
- First aid procedures for symptoms related to cold stress

4.4 Personal Protective Equipment

4.4.1 Wear multiple layers of loose fitting clothing to maintain immobile layers of warm air next to the body.

4.4.2 Avoid cotton, especially blue jeans.

4.4.3 Wear proper clothing, including head coverings and gloves or mittens for cold, wet, and windy conditions.

4.4.4 Use insulated footwear with adequate traction to prevent slips and falls.

4.4.5 Confirm extra blankets or sleeping bags are on-site.

4.4.6 Sunglasses and sunscreen should be used when there is a persistent combination of snow and direct sun.

4.4.7 If shelter is not readily available, consider supplying temporary shelters

4.4.8 Confirm that staff carry fire starter materials ifworking in remote areas..

4.4.9 Pack warm, sweet drinks, and high calorie food for snacks.

4.5 General Cold Stress Prevention Measures

4.5.1 In order to prevent hypothermia:

- Wear multiple layers of clothing to maintain immobile layers of warm air next to the body. Avoid cotton, especially blue jeans.
- When active, ventilate excess heat by opening or removing outer layers of clothing to avoid sweating.
  - Start with the mitten or gloves, unless protection from ice, snow, or cold metal surfaces is needed.
  - Next remove head gear and neck wrappings.
  - Then coats/parkas should be opened at the waist and sleeves.
  - Finally, layers of clothing should be taken off.
  - When resting or tired, or colder conditions are encountered, add additional layers of clothing/ close outer layers in the reverse of the above order, or get out of the cold. Have a sweet drink but do not indulge in heavy eating.
- Garments worn to keep out rain and spray should also allow water vapor to escape.
- Take advantage of heat from the sun and stay out of the wind as much as possible.
- Have available emergency shelter providing protection from wind and rain and insulation from the ground.
- Replace wet clothing. If wet clothing cannot be replaced, then cover it with a layer of non-breathing material to prevent evaporation. Place an insulation layer over this non-breathing material.
- Get adequate rest; conserve energy.
- Get adequate nutrition to replenish energy stores; rest after meals.
- Drink adequate fluids to avoid dehydration.
- If any project staff member shows signs of hypothermia, stop and treat him/her.

4.5.2 In order to prevent frost bite:

- Dress to prevent hypothermia and protect the feet and hands.
- Avoid obstruction of circulation by, for example, tight boots or tightly fitting clothing.
- Avoid nicotine, particularly cigarettes, and alcohol.
- Keep ears and nose covered and out of the wind.
- Frostbite of the corneas of the eyes can be prevented by protective goggles.
- Adopt a "buddy system" of constantly watching the faces of others in the party for white skin tissue, which is evidence of frostbite (frostnip).
- Practice constant personal vigilance for signs of trouble in one's own fingers and toes; when in doubt, investigate thoroughly before it is too late.

4.5.3 Adequate, insulating dry clothing that will help maintain core temperatures above 96.8^{o}F (37^{o}C) shall be provided to workers if work is performed in air temperatures below 40^{o}F (5^{o}C). Wind chill cooling rate and the cooling power of air are critical factors. The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.

4.5.4 An Equivalent Chill Temperature (ECT) chart relating the actual dry bulb air temperature and the wind velocity is presented in *S3NA-505-WI1 Temperature Thresholds.* Unless unusual or extenuating circumstances exist, cold injury to other than hands, feet, and head is not likely to occur without the development of the initial signs of hypothermia. Superficial or deep local tissue freezing will occur only at temperatures below 32^{o}F (0^{o} C) regardless of wind speed. However, older workers or workers with circulatory problems require special precautionary protection against cold injury. The use of extra insulating clothing and/or a reduction in the duration of the exposure period are among the special precautions that should be considered.

4.5.5 Continuous exposure of skin should not be permitted when the air speed and temperature results in an ECT of –25^{o}F (-32^{o} C) or below.

4.5.6 At air temperatures of 40^{o}F (5^{o}C) or less, it is imperative that workers who become immersed in water or whose clothing becomes wet be immediately removed from the cold environment, provided a change of clothing, and be treated for hypothermia.

4.5.7 If the air velocity at the job site is increased by wind, draft, or artificial ventilating equipment, the cooling effect of the wind should be reduced by shielding the work area or by wearing an easily removable windbreak garment.

4.5.8 Adequate protection, such as general ventilation, shall be incorporated into any warming shelter design to prevent carbon monoxide poisoning.

4.5.9 Operation of internal combustion or similar devices within warming shelters is prohibited.

4.5.10 If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work should be modified or suspended until adequate clothing is made available or until weather conditions improve.

4.5.11 Walking and working surfaces shall be cleared of ice and snow to prevent slips and falls.

4.5.12 Supplies such as PPE, fuels, enclosures, de-icing, traction aids, warm drinks, and batteries will be specified by the SH&E Manager and/or the Project Manager. These supplies will be inspected at least weekly during cold weather projects and replaced when necessary.

4.6 Cold Stress Prevention Measures for the Hands

4.6.1 Special protection of the hands is required to maintain manual dexterity for the prevention of accidents including, but not limited to the following:

- If fine work is to be performed with bare hands for more than 10 to 20 minutes in an environment below 60°F (15° C), special provisions should be established for keeping the workers' hands warm. For this purpose, warm air jets, radiant heaters (fuel burner or electric radiator), or contact warm plates may be utilized. Metal handles of tools and control bars should be covered by thermal insulating material at temperatures below 30°F (-1° C).
- If the air temperature falls below 60°F (15° C) for sedentary work, 40°F (5° C) for light work, or 20°F (-6° C) for moderate work, and fine manual dexterity is not required, workers should use gloves.

4.6.2 To prevent contact frostbite, workers should wear anti-contact gloves:

- When cold surfaces below 20°F (-6° C) are within reach, each worker should be warned to prevent inadvertent contact by bare skin.
- If the air temperature is 0°F (-18° C) or less, workers should protect their hands with mittens. Machine controls and tools for use in cold conditions should be designed so that they can be handled without removing the mittens.

4.6.3 Provisions for additional total body protection are required if work is performed in an environment at or below 40°F (5° C). The workers should wear cold protective clothing appropriate for the level of cold and physical activity.

4.6.4 Additional Cold Stress Prevention Measures For work practices at or below 10°F (-12° C) ECT, the following will apply:

- The worker should be under constant protective observation (buddy system or supervision).
- The work rate should not be so high as to cause heavy sweating that will result in wet clothing. If heavy work is being performed, rest periods should be taken in heated shelters and opportunities to change into dry clothing should be provided.
- New employees should not be required to work full time in the cold during the first days of employment until they become acclimated to the working conditions and required protective clothing.
- The weight and bulkiness of clothing should be included in estimating the required work performance and weights to be lifted by the worker.
- The work should be arranged in such a way that sitting still or standing still for long periods is minimized. Unprotected metal chair seats should not be used. The worker should be protected from drafts to the greatest extent possible.
- Workers should be instructed in safety and health procedures, which should address:
    - Proper rewarming procedures and appropriate first aid treatment.
    - Proper clothing practices.
    - Proper eating and drinking habits.
    - Recognition of impending frostbite.

- o Recognition of signs and symptoms of impending hypothermia or excessive cooling of the body even when shivering does not occur.
- o Safe work practices.

4.6.5 Eye protection for workers employed outdoors in a snow and/or ice-covered terrain should be supplied. Special safety goggles to protect against blowing ice crystals and ultraviolet light and glare (which can produce temporary conjunctivitis and/or temporary loss of vision) should be required when there is an expanse of snow coverage causing a potential eye exposure hazard.

4.6.6 Workers handling evaporative liquid (gasoline, alcohol, or cleaning fluids) at air temperatures below 40^{o}F should take special precautions to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling. Special note should be taken of the particularly acute effects of splashes of "cryogenic fluids" or those liquids with a boiling point that is just above ambient temperature.

4.6.7 Trauma sustained in freezing or subzero conditions requires special attention, because an injured worker is predisposed to cold injury. Special provisions should be made to prevent hypothermia and freezing of damaged tissue in addition to providing for first aid treatment.

4.7 **Work-Warming Regimen**

4.7.1 If work is performed continuously in the cold at an equivalent chill temperature (ECT) at or below -15^{o}F (–26^{o}C), heated warming shelters (tents, cabins, rest rooms, etc.) should be made available nearby. The workers should be encouraged to use these shelters at regular intervals; the frequency will depend on the severity of the environmental exposure.

4.7.2 The onset of heavy shivering, minor frostbite (frostnip), the feeling of excessive fatigue, drowsiness, irritability, or euphoria are indications for immediate return to the shelter.

4.7.3 When entering the heated shelter, the outer layer of clothing should be removed and the remainder of the clothing should be loosened to permit sweat evaporation or a change of dry work clothing provided.

4.7.4 A change of dry work clothing should be provided as necessary to prevent workers from returning to the cold environment with wet clothing.

5.0 Records

5.1 Training records will be maintained by the SH&E Department

5.2 Exposure assessments will be documented in the project files.

6.0 References

6.1 See attachment S3NA-505-WI1 Temperature Thresholds.

S3NA-505-WI1 Temperature Thresholds

1.0 Purpose and Scope

1.1 The following table gives apparent temperatures (wind chill) for various combinations of wind and air temperature, as well as guidelines to the danger of skin exposure.

Table 1. Wind Chill Chart (C)

Actual Temp (°C)	Wind Speed in km/hour									
	8	**16**	**24**	**32**	**40**	**48**	**56**	**64**	**72**	**80**
	Ambient Temperature (°C)									
0	-2	-8	-11	-14	-16	-17	-18	-19	-19	-20
-5	-7	-14	-18	-21	-23	-25	-26	-27	-28	-28
-10	-12	-20	-25	-28	-31	-33	-34	-35	-36	-36
-15	-18	-26	-32	-35	-38	-40	-42	-43	-43	-44
-20	-23	-32	-38	-43	-46	-48	-50	-51	-52	-52
-25	-28	-38	-45	-50	-53	-56	-57	-59	-59	-60
-30	-33	-45	-52	-57	-61	-63	-65	-67	-67	-68
-35	-39	-51	-59	-64	-68	-71	-73	-75	-75	-76
-40	-44	-57	-65	-71	-75	-79	-81	-83	-83	-84
-45	-49	-63	-72	-78	-83	-86	-89	-90	-91	-92
-50	-54	-69	-79	-85	-90	-94	-96	-98	-99	-100

Note: *A. Little Danger: if less than one hour of exposure to dry skin.*
B. Danger: Exposed flesh freezes within one minute.
C. Great Danger: Flesh may freeze with in 30 seconds.

*Source: *Threshold Limit Values (TLV™) and Biological Exposure Indices (BEI™) booklet; published by ACGIH, Cincinnati, Ohio.*

Table 2. Equivalent Chill Temperature Chart (F)

Estimated Wind Speed (mph)	Actual Temperature Reading (°F)									
	50	**40**	**30**	**20**	**10**	**0**	**-10**	**-20**	**-30**	**-40**
	Equivalent Chill Temperature (°F)									
Calm	50	40	30	20	10	0	-10	-20	-30	-20
5	48	37	27	16	6	-5	-15	-26	-36	-47
10	40	28	16	4	-9	-24	-33	-46	-58	-70
15	36	22	9	-5	18	-32	-45	-58	-72	-85
20	32	18	4	-10	-25	-39	-53	-67	-82	-96
25	30	16	0	-15	-29	-44	-59	-75	-88	-104
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109
35	27	11	-4	-20	35	-51	-67	-82	-98	-113
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116
Wind speeds >40 mph have little additional effect	**LITTLE DANGER**				**INCREASING DANGER**			**GREAT DANGER**		
	Trenchfoot and immersion foot may occur at any point on this chart.									

Table 3. Work-Warming Schedule Guidelines

<table>
<tr><th rowspan="2">Air Temp. (Sunny Sky) °F</th><th colspan="2">No Noticeable Wind</th><th colspan="2">5 mph Wind</th><th colspan="2">10 mph Wind</th><th colspan="2">15 mph Wind</th><th colspan="2">20 mph Wind</th><th colspan="2">25 mph Wind</th><th rowspan="2">Air Temp. (Sunny Sky) °C</th></tr>
<tr><th>Max. Work Period</th><th>Breaks</th><th>Max. Work Period</th><th>Breaks</th><th>Max. Work Period</th><th>Breaks</th><th>Max. Work Period</th><th>Breaks</th><th>Max. Work Period</th><th>Breaks</th><th>Max. Work Period</th><th>Breaks</th></tr>
<tr><td>above 5°</td><td colspan="2" rowspan="6">Normal Work Schedule</td><td colspan="2" rowspan="5">Normal Work Schedule</td><td colspan="2" rowspan="4">Normal Work Schedule</td><td colspan="2" rowspan="3">Normal Work Schedule</td><td colspan="2" rowspan="2">Normal Work Schedule</td><td colspan="2">Normal Work Schedule</td><td>above -15°</td></tr>
<tr><td>5° to –1°</td><td>100 min</td><td>2</td><td>-15° to -17°</td></tr>
<tr><td>0° to –4°</td><td>100 min</td><td>2</td><td>75 min</td><td>2</td><td>-18° to -20°</td></tr>
<tr><td>-5° to –9°</td><td>100 min</td><td>2</td><td>75 min</td><td>2</td><td>55 min</td><td>3</td><td>-21° to -22°</td></tr>
<tr><td>-10° to –14°</td><td>100 min</td><td>2</td><td>75 min</td><td>2</td><td>55 min</td><td>3</td><td>40 min</td><td>4</td><td>-23° to -25°</td></tr>
<tr><td>-15° to –19°</td><td>100 min</td><td>2</td><td>75 min</td><td>2</td><td>55 min</td><td>3</td><td>40 min</td><td>4</td><td>30 min</td><td>5</td><td>-26° to -28°</td></tr>
<tr><td>-20° to –24°</td><td>100 min</td><td>2</td><td>75 min</td><td>2</td><td>55 min</td><td>3</td><td>40 min</td><td>4</td><td>30 min</td><td>5</td><td colspan="2" rowspan="6">Cease Work</td><td>-29° to -31°</td></tr>
<tr><td>-25° to –29°</td><td>75 min</td><td>2</td><td>55 min</td><td>3</td><td>40 min</td><td>4</td><td>30 min</td><td>5</td><td colspan="2" rowspan="5">Cease Work</td><td>-32° to -34°</td></tr>
<tr><td>-30° to –34°</td><td>55 min</td><td>3</td><td>40 min</td><td>4</td><td>30 min</td><td>5</td><td colspan="2" rowspan="4">Cease Work</td><td>-35° to -37°</td></tr>
<tr><td>-35° to –39°</td><td>40 min</td><td>4</td><td>30 min</td><td>5</td><td colspan="2" rowspan="3">Cease Work</td><td>-38° to -39°</td></tr>
<tr><td>-40° to –44°</td><td>30 min</td><td>5</td><td colspan="2" rowspan="2">Cease Work</td><td>-40° to -42°</td></tr>
<tr><td>-44° & below</td><td colspan="2">Cease Work</td><td>-43° & below</td></tr>
</table>

Modified from ACGIH 2002 Threshold Limit Values for Chemical Substances and Physical Agents.

Note 1: Schedule describes the maximum continuous duration of work and number of 10-15 minute breaks to be observed during any 4-hour work period and assumes that period will be followed by an extended warm-up period (e.g., lunch). Allowed breaks should be taken in a warm environment.

Note 2: Schedule applies to moderate to heavy work performed by acclimated workers wearing appropriate layered clothing. For light to moderate work apply the schedule for conditions one step lower. For unacclimated workers apply the schedule for conditions two steps lower. These modifications are additive.

Note 3: For work under 25%–50% overcast/clouds, apply the schedule for conditions one step lower. For work at night or under greater then 50% overcast/clouds, apply the schedule for conditions two steps lower. These modifications are additive with any applicable modifications from Note 2.

Note 4: For wind speeds in excess of 25 mph, cease all nonemergency work when temperatures fall below 5°F.

S3NA-505-WI2 Symptoms and Treatment

1.0 Cold Stress-related Illnesses

1.1 Frostbite

1.1.1 Frostbite is a localized cold injury characterized by freezing of the tissues with ice crystal formation.

1.1.2 This injury is almost always limited to the upper and lower extremities or to such appendages as the ears or nose.

1.1.3 Conditions conducive to frostbite include sub-zero temperatures, hypothermia (most important predisposing factor), dehydration, obstruction of the blood supply to the extremities (by constricting clothing, especially on the feet or at the wrists or ankles), contact with cold metal, contact with organic liquids (such as gasoline or solvents that have been left outdoors in sub-zero temperatures), use of substances that cause vasoconstriction (such as smoking tobacco), or other injury or shock.

1.1.4 Symptoms of frostbite include:

- Pain in the involved tissue is the earliest symptom.
- Sudden and complete cessation of cold or discomfort in affected fingers or toes, often followed by a pleasant feeling of warmth.
- Subsequently the only symptom may be the absence of any sensation in the frozen part.
- Paleness in the affected tissues.
- Firm or hard tissues.
- Purple tissue, if a large area, such as an entire hand or food, is frostbitten.

1.1.5 If exposure occurs in temperatures that are below freezing (32ºF or below), frostbite or trench foot (immersion foot) may accompany or complicate the symptoms of hypothermia. Frostbite is the freezing of living tissues with a resultant breakdown of cell structure. Symptoms due to frostbite may include, but is not limited to:

- Superficial redness of the skin
- Slight numbness
- Blisters
- Obstruction of blood flow (ischemia)
- Blood clots (thrombosis)
- Skin discoloration due to insufficient oxygen in the blood (cyanosis)

1.1.6 Frostbite may occur if the skin comes into contact with objects with a surface temperature below freezing, such as metal tool handles. Trench foot is caused by continuous exposure to cold combined with persistent dampness or immersion in water. Injuries in this case include permanent tissue damage due to oxygen deficiency, damage to capillary walls, severe pain, blistering, tissue death, and ulceration.

1.1.7 Additionally, cold exposures may either induce or intensify vascular abnormalities. These include chilblain (a swelling or sore), Raynaud's disease, acrocyanosis (blueness of hands and feet) and thromboangiitis (inflammation of the innermost walls of blood vessels with accompanying clot formation). Workers suffering from these ailments should take particular precautions to avoid chilling.

1.2 Hypothermia

1.2.1 Hypothermia is a lower than normal body temperature that occurs when outer cold cools the body faster than the body can produce heat to stay warm.

1.2.2 Hypothermia can be caused by exposure to wind, cold, and/or moisture. The combination of wind, cold, and moisture can be deadly.

1.2.3 Early warning signs of hypothermia:

- Feeling of being cold and tired.
- Heavier breathing and increased pulse rate.
- Tendency to keep moving (e.g., stamping feet, rubbing hands, continued walking/pacing).
- Goose bumps, holding arms tightly wrapped around the body, hunching of shoulders.

Shivering.

1.2.4 Hypothermia damages both the body's internal temperature mechanisms (hypothalamus) and the peripheral mechanisms to prevent heat loss (vasoconstriction and perspiration.) These effects may last up to three years after the initial hypothermia episode. Symptoms of hypothermia may include, but are not limited to:

- Pain in the extremities.
- Severe shivering and numbness.
- Low core body temperature.
- Drowsiness and muscular weakness.
- Apathy.
- Mental confusion.
- Loss of consciousness.
- Shock.
- Decreasing pulse and breathing rate.

2.0 Recommended Treatment for Cold Stress-related Illnesses

2.1 Frostbite

2.1.1 Wrap the victim in woolen blanket and keep dry until he or she can be brought inside.

2.1.2 Remove the victim from the cold environment.

2.1.3 Do not rub, chafe, or manipulate frozen parts.

2.1.4 Place the victim in warm water (102ºF to 105ºF) and make sure the water remains warm. Test the water by pouring it on the inner surface of your forearm. Never thaw affected body parts if the victim has to go back out into the cold; refreezing can cause significant tissue damage.

2.1.5 Do not use hot water bottles or a heat lamp, and do not place the victim near a hot stove.

2.1.6 Do not allow the victim to walk if his or her feet are affected.

2.1.7 Have the victim gently exercise the affected parts once they are thawed.

2.1.8 Seek immediate medical attention for thawing of serious frostbite.

2.2 Hypothermia

2.2.1 Bring the victim into a warm room or shelter as quickly as possible.

2.2.2 Give artificial respiration and stop any bleeding, if necessary.

2.2.3 If the victim cannot be moved (spinal injury, etc.), carefully place newspapers, blankets, or some other insulation between the victim and the ground.

2.2.4 Remove all wet clothing.

2.2.5 Provide an external heat source, because the body cannot generate its own heat. Wrap the victim in prewarmed blankets, place him or her in the liner of a portable hypothermia treatment unit, put the torso (not the extremities) into a tub of warm water, or use body-to-body contact to rewarm the body core. These measures will slowly reopen the peripheral circulation, minimizing the possibility of after-shock or after-drop (the flowing of cooled, stagnated blood from the limbs to the heart), which may cause ventricular fibrillation, cardiac arrest, or death.

2.2.6 Do not allow the victim to sleep.

2.2.7 Give warm, sweet drinks. Do not give alcohol or pain relievers.

2.2.8 Keep the victim still. Do not try to walk.

2.2.9 Do not rub numb skin.

2.2.10 Get medical attention as soon as possible.

S3NA-505-ST Cold Exposure

The following Occupational Health and Safety regulations apply directly to cold and snow hazards:

Jurisdiction	Regulation
United States	
OSHA	Title 29, Code of Federal Regulations, Sections 1910.1027 and 1926.1127
Canada	
Alberta	n/a
British Columbia	OHS Regulation (1997) Sect 7.33 – 7.38
Manitoba	Workplace Health and Safety Regulation (217/2006) Sect 4.12, 4.14
New Brunswick	OHS Regulation (91-191) Sect 44
Newfoundland/Labrador	OHS Regulation (C.N.L.R. 1165/96) Sect 10
Nova Scotia	n/a
NWT/NU Territories	n/a
Ontario	O. Reg. 851 Sect 39, 129
Prince Edward Island	OHS Regulations (EC180/87) Sect 42.1
Quebec	OHS Regulation (R.R.Q., c. S-2.1, r.19.01 O.C. 885-2001) Schedule 4
Saskatchewan	OHS Regulation (R.R.S., c. O-1, r. 1) Sect 70 Cold Conditions Guidelines for Outside Workers
Yukon Territory	Occupational Health Regulations (O.I.C. 1986/164) Sect 9

Attachment I

Site Safety and Health Plan

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US Army Corps of Engineers, Baltimore District
Contract No. W912DR-12-D-0014
Task/Delivery Order No. 0001

SITE SAFETY AND HEALTH PLAN

Regional Compliance Restoration Program
Preliminary Assessment/Site Investigation
at Multiple Air National Guard Installations
Northeast

Stewart Air National Guard Base
Newburgh, New York

Prepared for:

US Army Corps of Engineers
10 South Howard Street
Room 10000-S
Baltimore, MD 21201-2505

Prepared by:

AECOM
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Alexandria, VA 22314

Project No: 60308608

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List of Acronyms and Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
APP	Accident Prevention Plan
BCT	BRAC Cleanup Team
BRAC	Base Realignment and Closure
CDC	Centers for Disease Control
cDCE	cis-1,2-dichloroethene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CO	Contracting Officer
COC	Contaminant of Concern
COPT	Corporate Office Properties Trust
CPR	Cardiopulmonary Resuscitation
CRZ	Contamination Reduction Zone
DCE	Dichloroethene
DIUF	Deionized Ultra-Filtered
EC	Emergency Coordinator
EEE	Eastern Equine Encephalitis
EM	Engineering Manual
EZ	Exclusion Zone
FFRAG	Former Fort Ritchie Army Garrison
FOST	Finding of Suitability to Transfer
GPS	Global Positioning System
HSA	Hollow-Stem Auger
IAW	In Accordance With
ICP	Inductively Coupled Plasma
ICS	Interference Check Sample
IDW	Investigation-Derived Waste
ISCO	In Situ Chemical Oxidation
LCS	Laboratory Control Sample
LOC	Level of Concern
LOD	Limit of Detection
LTGM	Long-Term Groundwater Monitoring
LTGMP	Long-Term Groundwater Monitoring Plan
LTM	Long-Term Monitoring
LUC	Land Use Control
LUCRD	Land Use Control Remedial Design

MCL	Maximum Contaminant Level
MDE	Maryland Department of the Environment
MDL	Method Detection Limit
mg/L	milligrams per liter
MRL	Method Reporting Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSDS	Material Safety Data Sheets
NEC	National Electric Code
NIOSH	National Institute of Occupational Safety and Health
OPS	Operating Properly and Successfully
OSHA	Occupational Safety and Health Administration
OU4	Operable Unit 4
PCE	Tetrachloroethene
PEL	Permissible Exposure Limit
PM	Project Manager
POV	Privately Owned Vehicle
PPE	Personal Protective Equipment
QC	Quality Control
RBC	Risk-Based Concentration
RI	Remedial Investigation
ROD	Record of Decision
SH&E	Safety, Health & Environmental
SI	Site Investigation
SOPs	Standard Operating Procedures
SOW	Statement of Work
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SZ	Support Zone
TCE	Trichloroethene
TCL	Target Compound List
TLV	Threshold Limit Value
U.S.	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VC	Vinyl Chloride
VOC(s)	Volatile Organic Compound(s)
WP	Work Plan
μg/L	micrograms per liter

1 Introduction

AECOM is collecting data to support PA/SI reports at multiple Air National Guard Installations. The Installations included in this task order include:

Camp Pendleton ANGB, VA	Pease ANGB, NH
Martin State ANGB, MD	Bangor IAP, ME
Fort Indiantown Gap, PA	South Portland, ME
Harrisburg ANGB, PA	Gabreski ANGB, NY
Pittsburg ANGB, PA	Hancock Field ANGB, NY
Martinsburg ANGB, WV	Niagara Falls ANGB, NY
Charleston-Yeager ANGB, WV	Schenectady ANGB, NY
Barnes ANGB, MA	Stewart ANGB, NY
Quonset ANGB, RI	Burlington ANGB, VT
Bradley IAP, CT	

ANG2013NEASTCRP PA/SI activities are being performed under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). The state and regional federal environmental agencies in which the respective site resides is the regulatory lead for this project. The field investigation tasks planned as part of the field operations at the various installations include:

- Mobilization/Demobilization;
- Geophysical Survey
- Concrete Coring;
- Soil Borings and Soil Sample Collection; and
- Monitoring Well Installation
- Groundwater Measurement and Sampling

AHAs for the above investigation tasks are included in this SSHP. Work will be conducted in accordance with the following documents:

- United States Army Corps of Engineers (USACE) Scope of Work;
- Engineering Manual (EM) 385-1-1 [United States Army Corps of Engineers, (USACE), 2008];
- Air National Guard Investigation Guidance, 2009;
- ANG2013NEASTCRP Quality Assurance and Safety Plan;

This SSHP identifies and addresses all occupational safety and health hazards known to be associated with planned investigations at the project sites. All work completed by AECOM and its subcontractors will be performed in compliance with the Accident Prevention Plan (APP) and this SSHP.

The provisions of this SSHP are mandatory for all AECOM personnel engaged in fieldwork associated with the PA/SI activities for all sites. A copy of this SSHP, any applicable SSHP supplements, the APP, and the AECOM U.S. Operations Safety, Health, and Environmental (SH&E) Manual shall be maintained on site and available for review at all times. Record keeping will be maintained in accordance with this SSHP and the applicable Standard Operating Procedures (SOPs). In the event of a conflict between this SSHP, the SOPs, and federal, state, and local regulations, workers shall follow the most stringent/protective requirements.

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

- Title 29, Part 1910 of the Code of Federal Regulations(CFR) (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)/Occupational Safety and Health Administration (OSHA)/United States Coast Guard/U.S. Environmental Protection Agency (USEPA), *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, Publication No. 85-115, 1985;
- Department of the Army, United States Army Corps of Engineers EM 385-1-1, *Safety and Health Requirements Manual* (15 September 2008); and
- AECOM's Corporate SH&E Program requirements as specified in the U.S. Operations SH&E Manual, a copy of which will be maintained onsite at all times.

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

All proposed changes/modifications to this SSHP will be in writing and will be reviewed and approved by the Regional SH&E Manager and USACE before such modifications are implemented in the field.

2 Site Description and Contamination Characterization

AECOM will conduct environmental services at multiple ANG facilities under ANG2013NEASTCRP. The work will be performed in accordance with the applicable Statement of Work (SOW) and associated Work Plan developed for project site. Deviations from the listed SOW will require that a Safety Professional review and changes made to this SSHP, 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.

2.1 Site Information

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

2.1.1 General Description

See the AECOM Work Plan for a description of each of the ANG installations.

2.1.2 Site Background/History

See the AECOM Work Plan for a description of the site background for each of the ANG installations

2.1.3 Suspected Contamination at PA/SI Sites

See the AECOM Work Plan for a description of the site background and suspected contamination for each of the ANG installations.

2.1.4 Previous Investigations

See the AECOM Work Plan for a description of previous investigations for each of the ANG installations.

2.2 Site Assessment Program

The primary objective of the Task Order is to collect data at each installation to support a PA/SI. The site assessment activities will be completed in two Phases:

PA: The PA will include review of existing information about each respective site; reconnaissance of the site and environs; information about potential receptors; and recommended sample locations and analyses for the SI.

SI: The SI objective is to gather information to support a site decision regarding the need for further CERCLA action. SI sample locations will be focused to determine whether hazardous substances are or have been released to the environment, impacted media, and whether receptors may have been impacted from a release. The tasks required to complete this objective may include:

- Mobilization/Demobilization;
- Geophysical Survey
- Concrete Coring;
- Soil Borings and Soil Sample Collection; and
- Monitoring Well Installation
- Groundwater Measurement and Sampling

AHAs for the above investigation tasks are included in this SSHP.

2.2.1 Mobilization/Demobilization

Mobilization and demobilization represent limited pre- and post-task activities. These activities include driving personnel to and from the site, and transporting or shipping equipment to and from the site. This activity does not include any site preparation or intrusive activities.

2.2.2 Site Preparation

Site preparation includes site orientation and training of the field team, utility mark-out and clearance, testing and cleaning of equipment as needed, and the set-up of other work support-related items. It is assumed that the Government will provide applicable maps for on-site utility locations, if available. The public utility marking service (i.e. Miss Utility) will be contacted prior to drilling to perform utility mark-outs. The utilities at ANG Installations in areas with proposed soil borings will also be located and cleared by the ANGB installation or private utlity location services. Concrete coring of paved surfaces will be required at some installations. Soft digging techniques using a hand auger for the clearing of unknown utilities to a depth of three feet below ground surface (ft bgs), will be conducted, if possible. Additional information on locating underground power lines can be found in SH&E SOP 417, *Underground Utilities*.

2.2.3 Soil Borings and Soil Sample Collection

A geologist will perform oversight of the soil borings installed by the drilling subcontractor. Drilling and sampling equipment will be utilized to collect soil samples. Tables presented in the Site Work Plans detail the boring depth and samples to be collected at each installation. Soil samples collected will be logged with lithologic descriptions and screened with a photo-ionization detector (PID). The PID screening results and visual observations will be used to select samples for analytical testing. If elevated levels are detected during the intrusive activities, the work area will be ventilated before other protective measures are employed.

During sampling activities, appropriate air monitoring will be conducted and the appropriate chemical resistant personal protective equipment (PPE) will be worn to protect against exposure. The major activities involved with the soil borings are as follows:

- Monitor air quality in the workers breathing zone;
- Drill soil cores;
- Log soils and screen with a PID;
- Laboratory sample collection;
- Decontamination of equipment; and
- Sample prep and shipping.

2.2.4 Groundwater Sampling

The field sampling team will collect groundwater samples from temporary DPT points and/or monitoring wells. Groundwater samples will be collected using low-flow sampling techniques. 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 groundwater sampling are as follows:

- Pre-sampling event notifications and approval;
- Setup for sampling activities;
- Purge and sample monitoring wells;

- Monitor air quality in the workers breathing zone;
- Decontamination of equipment; and
- Sample prep and shipping.

2.2.5 Investigative-Derived Waste Management

Investigation-derived waste (IDW) will be collected and categorized as non-hazardous or hazardous. IDW including purge water, decontamination fluids, and soil cuttings will be tested and disposed of within 90 calendar days of completing the field activities in accordance with federal, state, and local regulations.

2.2.6 Equipment Decontamination

Field personnel will perform decontamination of equipment used to conduct environmental investigation and sampling activities. Before any drilling has 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 tooling. Soil sampling equipment will be decontaminated between each use using a phosphate-free detergent and potable water. The drilling subcontractor shall construct a temporary decontamination pad to contain all decontamination water generated during decontamination of drill rigs and tools.

2.2.7 Site Restoration

Site restoration will involve the backfill of borings with a bentonite-grout slurry, repair/replacement of surface cover (concrete), removal of temporary materials, and the disposal of IDW.

2.2.8 Additional Work Operations

Operations at an installation may require additional tasks not identified in this section or addressed in Attachment A, Activity Hazard Analyses (AHAs). Before performing any task not covered in this SSHP, a modification to the SSHP must be prepared, and approved by the Regional SH&E Manager or designee.

3 Hazard / Risk Analysis

Hazards that cannot be eliminated by project design during hazard identification or the hazard assessment processes will be considered residual hazards. If unable to eliminate the hazard through design change, risk will be reduced through engineering controls or administrative controls.

Each distinct task or operation will have an AHA developed to define the activity to be performed. The AHA will identify the work sequences, site conditions, anticipated hazards (classic safety, chemical, physical, biological, ionizing radiation), control methods, equipment requirements, and training to be implemented to eliminate or reduce the hazards.

Table 3-1 identifies the hazards that are anticipated to be encountered during this project.

Table 3-1
Hazards Table

Type of Hazard	Hazard	Yes	No
Physical	Confined space entry		✓
	Drowning		✓
	Electrical Shock	✓	
	Equipment and Machinery	✓	
	Trench entry		✓
	Lacerations and skin punctures	✓	
	Lifting and Moving (excess of 25 lbs individual and 50 lbs 2 person lift)	✓	
	Slips, trips and falls	✓	
	Heavy Equipment Operations	✓	
	Traffic/Vehicle Exposure	✓	
	Hand & Power Tool Usage	✓	
	Hazardous Noise Levels	✓	
Chemical	VOC, SVOC,TPH, PAHs, Metals	✓	
Environmental	Heat and Cold Stress	✓	
	Hazardous Noise Levels	✓	
Radiological	Non-Ionizing Radiation	✓	
	Ionization Radiation		✓
Biological	Spiders	✓	
	Ticks	✓	
	Hazardous Plants	✓	
	Animals	✓	
	Poisonous Snakes	✓	

Operations at the site may require additional tasks not identified in Section 2.3 or addressed in Attachment A, AHA. Before performing any task not covered in this SSHP, an AHA must be prepared and approved by the Regional SH&E Manager or designee.

3.1 Physical Hazard Recognition and Controls

The following physical safety hazards may be encountered during this project:

- Slips, Trips, Falls and Protruding Objects;
- Electrical hazards;
- Hand and Power Tool Usage;
- Motor Vehicle Operation;
- Mechanized Machinery;
- Manual Lifting;
- Drilling Operations; and
- Traffic Exposure/Control.

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. 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 SH&E SOP 307, *Worksite Housekeeping*.

3.1.3 Electrical Hazards

The following guidance is provided to ensure electricity safety at the site:

- Personnel may set up temporary circuits up to 220 volts. Maintenance or installation of circuits over 220 volts will require qualified and trained personnel.
- Lockout devices will be used to prevent the operation/energizing of equipment or circuits during maintenance or other work. Tag-out devices will be used only where it is not feasible to use a lockout device. Insulated tools and electrical handling equipment shall be inspected prior to use to ensure the protective properties are not damaged. Damaged equipment will be tagged and removed from service.
- Extension cords and electrical connections on hand-held and other power tools will be inspected prior to use for cuts, kinks, frayed wires, etc. If any deficiency is noted, the equipment will be tagged “DAMAGED” and removed from service. Manufacturer-installed insulated electrical cords will not be repaired or spliced.
- Extension cords are to be kept clean, free of kinks, and protected from oil, hot or sharp surfaces, and chemicals. Extension cords are not to be placed across aisles, through doors, through holes

in a wall, or in areas where the cord may be damaged or create a tripping hazard. Extension cords will be appropriate for the specific task and environment.

- Ground Fault Circuit Interrupter (GFCI) devices will be in place between the equipment and power source for all temporary circuits.

3.1.3.1 Extension Cords

The following applies when extension cords are used during field operations:

- Extension cords for portable electric tools shall be of a 3-wire type;
- Use of extension cords is allowed only for temporary installations not to exceed 90 days;
- Extension cords shall be provided with a plug cap, which is either molded to the cord or equipped with a cord clamp to prevent strain on the terminal screws;
- Extension cords shall not be fastened with staples, or otherwise hung in a manner that could damage the outer jacket or insulation;
- Extension cords shall be inspected prior to each use to ensure that there is no damage or defects. Defective cords shall not be used;
- Extension cords used with grounding-type equipment (e.g., three-prong plug) shall contain a grounding-type conductor (have three plugs to accept the ground plug);
- GFCIs shall be used for all non-permanent wiring needed for construction purposes, or when working in wet or moist areas;
- Extension cords used in highly conductive work locations (e.g., wet areas) shall be of the type approved for such locations;
- Grounding-type equipment (e.g., three-prong plugs) shall not be modified to mate to incompatible outlets (e.g., cut off grounding prong to fit two-prong outlets);
- A temporary light shall not be suspended by the cord, unless the cord and light are designed for suspension;
- Temporary lights shall be equipped with bulb protectors, unless they are installed at least 7 or more feet overhead; and
- Electric lines crossing work areas, personnel, or vehicular traffic areas, shall be either fastened securely overhead (at a height that provides safe clearance for work operations), or protected by a cover capable of withstanding the imposed loads without creating a trip hazard.

3.1.3.2 Portable Electrical Equipment

Double-insulated, portable, industrial-type electrical tools meeting the requirements of the National Electrical Code (NEC) are authorized for use (ground wire not required). Where this type of tool is used, the equipment must be distinctly marked.

Portable electrical tools not provided with special insulating or grounding protection are not for use in damp, wet, or conductive locations (e.g., by persons standing on the ground or on metal floors).

All portable electrical appliances and equipment where the non-current-carrying metal parts are exposed to contact by personnel shall be grounded by a continuous conductor of adequate capacity from the device to a grounded receptacle. The Site Safety Health Officer (SSHO) shall resolve any question of whether or not a particular appliance should be grounded.

Manufacturer-installed guards shall not be tampered with, modified, or removed. These guards will be in place and utilized during operation of equipment.

The dimension of the working space in the direction of access to energized parts in switchboards, control panels, fused switches, circuit breakers, panel boards, motor controllers, and similar equipment that requires examination, adjustment, servicing, or maintenance while energized, shall not be less than 36 inches deep and 30 inches wide or the width of the equipment, whichever is greater.

Energized parts of electrical equipment operating at 50 volts or more shall be guarded against accidental contact by the use of approved cabinets or enclosures. Warning sign(s) shall be conspicuously placed on the enclosure.

Grounding of receptacles shall be accomplished in one of two ways:

- A built-in, green-colored ground wire may be attached to the ground pole of the receptacle; or
- The conduit system, if installed in an approved manner, may be relied upon for grounding of a receptacle serving single-phase appliances with ratings up to 230 volts. At outside construction sites, all single-phase 15- and 20-ampere receptacle outlets operating at 230 volts or less, which are not a part of the permanent wiring of the building or structure, must have GFCIs for personnel protection.

The outlet box for portable extension cords for outdoor use shall be weatherproofed and maintained in good condition.

3.1.4 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 lockout 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 lockout the system when necessary. Refer to SH&E SOP 410, *Hazardous Energy Control*, for additional information and requirements.

3.1.5 Hand Tool Usage

All manually operated hand tools and equipment shall be used in accordance with the following requirements:

- Use each tool only for the job it was designed to do.
- Discard damaged or abused tools promptly.
- Inspect for distortion, cracks, chips, wear, or mushrooming.
- Keep all tools clean and in working order.
- Be sure handles are fixed firmly to a tool's working end.
- Be sure tools and work mate properly to avoid slippage.
- Handles are made for the tool. Never use extensions.

- Confine impact forces to striking and struck tools.
- Hold work in a clamp or vise, not in your hand.
- Start off slowly when engaging the tool and the work.
- Shut current off before using a tool near electricity.
- Make sure the handle sits securely in your hand.
- Keep moving parts lightly lubed. Avoid lube leakage.
- Wear approved safety goggles when using hand tools.
- Keep hands away from sharp edges.
- Pull, don't push, a wrench handle for more leverage.
- Position your body securely while working with the tool.
- Keep jaw teeth, cutters, and blades sharp for better results.
- Keep tool's moving parts properly cleaned and tightened.
- Use steady pressure on jaws and cutters. Don't rock the tool.
- Support long, overhanging work in a vise at the far end.
- Use pads in the jaws to protect soft or crushable work.
- Use a tool close to the vise or clamp.
- Hold work in a clamp or vise with sufficient pressure.
- Keep clamped assemblies away from vibration and bumping.
- Discard a tool instead of repairing it by welding or brazing.
- Keep tools from excessive heat.
- For continuous work, use comfort grips or gloves.
- Follow instructions on the tool and/or package.
- Only non-sparking tools shall be used in locations where sources of ignition may cause a fire or explosion.
- Tools requiring heat treating or redressing shall be tempered, formed, dressed, and sharpened by personnel who are experienced in these operations.

3.1.6 Power Tool Usage

The following safety precautions will be followed by project personnel using power tools in accordance with the following requirements:

- Wear appropriate eye protection such as safety glasses or face shield.
- Switch off the tools before connecting them to a power supply.
- If a power cord feels more than comfortably warm, or if a tool is sparking excessively, have it checked by an electrician or other qualified person.
- Disconnect the power supply before making adjustments or changing accessories.
- Remove any wrenches and adjusting tools before turning on a tool.

- Inspect the cord for fraying or damage before each use. Tag defective tools clearly with an Out of Service tag and replace immediately with a tool in good running order.
- During use, keep power cords clear of tools and the path that the tool will take.
- Use clamps, a vice, or other devices to hold and support the piece being worked on when practical to do so. This will allow you to use both hands for better control of the tool and will help prevent injuries if a tool jams or binds in a work piece.
- Use only approved extension cords that have the proper wire size for the length of cord and power requirements of the electric tool that you are using. This will prevent the cord from overheating.
- For outdoor work, use outdoor extension cords marked “W-A” or “W”.
- Suspend power cords over aisles or work areas to eliminate stumbling or tripping hazards.
- Eliminate octopus connections: if more than one receptacle plug is needed, use a power bar or power distribution strip that has an integral power cord and a built-in over-current protection.
- Pull the plug, not the cord when unplugging a tool. Pulling the cord causes wear and may adversely affect the wiring to the plug. An electrical shock to the operator may result.
- Keep power cords away from heat, water, oil, sharp edges, and moving parts. They can damage the insulation and cause a shock.
- Avoid accidental starting by ensuring the tool is turned off before you plug it in. Also, do not walk around with a plugged-in tool with your finger touching the switch.
- Do not bypass the ON/OFF switch and operate the tools by connecting and disconnecting the power cord.
- Do not disconnect the power supply of the tool by pulling or jerking the cord from the outlet.
- Do not leave a running tool unattended. Do not leave it until it has been turned off, has stopped running completely, and has been unplugged.
- Do not use electric tools in wet conditions or damp locations unless tool is connected to a GFCI.
- Do not expose electric power tools to rain or wet conditions. Wet tools increase the likelihood for getting an electric shock.
- Avoid body contact with grounded surfaces like refrigerators, pipes, and radiators when using electric powered tools. This will reduce the likelihood of shock if the operator's body is grounded.
- Do not plug several power cords into one outlet by using single-to-multiple outlet adapters or converters (“cube taps”).
- Do not use light duty power cords.
- Do not connect or splice extension cords together to make a longer connection. The resulting extension cord may not be able to provide sufficient current or power safely.
- Do not carry electrical tools by the power cord.
- Do not tie power cords in knots. Knots can cause short circuits and shocks. Loop the cords or use a twist lock plug.
- Never break off the third prong on a plug: replace broken three-prong plugs and make sure the third prong is properly grounded.
- Never use extension cords as permanent wiring. Use extension cords only as a temporary power supply to an area that does not have a power outlet.

- Do not walk on or allow vehicles or other moving equipment to pass over unprotected power cords. Cords should be put in conduits or protected by placing planks on each side of them.
- Do not brush away sawdust, shavings, or turnings while the tool is running. Never use compressed air for cleaning surfaces or removing sawdust, metal turnings, etc.
- Do not operate tools in an area containing explosive vapors or gases.
- Do not clean tools with flammable or toxic solvents.
- Do not surprise or touch anyone who is operating a tool. Startling a tool operator could end up causing an accident or injury.

3.1.7 Motor Vehicle Operation

Operators of any equipment or vehicle shall be able to read and understand the signs, signals, and operating instructions in use.

Operators of motor vehicles, while on duty, shall not operate vehicles for a continuous period of more than ten hours in any 24-hour period; moreover, no employee, while on duty, may operate a motor vehicle after being in a duty status for more than twelve hours during any 24-hour period. A minimum of eight consecutive hours shall be provided for rest in each 24-hour period.

3.1.7.1 Motor Vehicle Operating Rules

The flowing guidelines are provided to ensure safe operation of privately owned vehicles (POV) or rental vehicles being used being used on the job site:

- Operators of motor vehicles being used on projects may only use cellular telephones with hands-free devices while the vehicle is in motion. Prior to using a hand-held cellular phone, drivers shall find a safe place to bring their vehicle to a stop.
- Text messaging is strictly prohibited while operating motor vehicles.
- The use of any other portable headphones, earphones, or other listening devices (except for hands–free cellular phones) while operating motor vehicles is prohibited.
- Operators of motor vehicles will not eat, drink, or smoke while the vehicle is in motion. Seat belts shall be installed and worn.
- GPS systems shall be mounted within the vehicle so that they do not create sight hazards for the operator and programming of dashboard GPS systems while driving is prohibited. The use of non-mounted GPS systems may only be used by the vehicle operator while the vehicle is stopped.
- The principles of defensive driving shall be practiced. At all times, the operator must have the vehicle under control and be able to bring it to a complete stop within a safe stopping distance.
- Vehicles may not be driven at speeds greater than the posted speed limit, with due regard for weather, traffic, intersections, width and character of the roadway, type of motor vehicle, and any other existing condition.
- Headlights shall be lighted from sunset to sunrise, during fog, smoke, rain, or other unfavorable atmospheric conditions, and at any other time when there is not sufficient light for the vehicle to be seen or the operator to see on the highway at a distance of 500 feet (150.4 meters), unless local regulations prohibit.
- Vehicles shall not be stopped, parked, or left standing on any road, or adjacent thereto, or in any area in a manner as to endanger the vehicle, other vehicles, or personnel using or passing that road or area.

- Vehicles shall not be left unattended until the motor has been shut off, the key removed (unless local regulations prohibit), parking brake set, and gear engaged in low, reverse, or park. If stopped on a hill or grade, front wheels shall be turned or hooked into the curb or the wheels securely chocked.
- When backing or maneuvering, operators will take the applicable precautions. If a signal person or spotter is not used, operators will walk behind their vehicle to view the area for possible hazards before backing their vehicle.
- All motor vehicles shall be shut down prior to and during fueling operations.

3.1.7.2 Transportation of Personnel

The number of passengers in passenger-type vehicles shall not exceed the number that can be seated. No person will be permitted to ride with arms or legs outside of a vehicle body, in a standing position on the body, on running boards, seated on side fenders, cabs, cab shields, bed of the truck, or on the load.

Vehicles transporting personnel shall not be moved until the driver has ascertained that all persons are seated and the guardrails and rear end gates are in place or doors closed. Getting on or off any vehicle while it is in motion is prohibited.

Explosives, flammable materials (excepting normal fuel supply), or toxic substances may not be transported in vehicles carrying personnel and all tools and equipment shall be guarded, stowed, and secured when transported with personnel.

3.1.7.3 Motor Vehicle Equipment

Every motor vehicle shall have:

- An operable speedometer;
- An operable fuel gage;
- An operable audible warning device (horn);
- An adequate rearview mirror or mirrors;
- A power-operated starting device;
- A windshield equipped with an adequate windshield wiper;
- An operable defrosting and defogging device;
- Non-slip surfaces on steps; and
- Cabs, cab shields, and other protection to protect the driver from the elements and falling or shifting materials.

Every person operating a motor vehicle shall possess, at all times while operating such vehicle, a license/permit valid for the equipment being operated. Licensing requirements will be as per State regulations for personnel. The operator must present the license/permit upon request. Failure to do so will result in the immediate prohibition of the operator to operate motor vehicles.

3.1.7.4 Inspections, Tests, Maintenance, and Repairs

Vehicle inspections, tests, maintenance, and repairs shall be conducted by a qualified person in accordance with the manufacturer's recommendations. Before initial use, vehicles not otherwise inspected by State or local authorities, shall be inspected by a qualified mechanic and found in safe operating condition and in compliance with all required published vehicle safety standards during this one-time inspection. The inspection shall be documented and available for inspection on the work site.

Vehicles shall be inspected on a scheduled maintenance program. Prior to each use, motor vehicles shall be checked by the operator to assure that the following parts, equipment, and accessories are in safe operating condition and free of apparent damage that could cause failure while in use:

- Service brakes, including trailer brake connections;
- Parking system (hand brake);
- Emergency stopping system (brakes);
- Tires;
- Horns;
- Steering mechanism;
- Coupling devices;
- Seat belts;
- Operating controls;
- Safety devices (e.g., backup alarms and lights, fire extinguishers, first-aid kits, etc.); and
- Accessories including lights, reflectors, windshield wipers, and defrosters where such equipment is necessary.

Inspection, test, repair, and maintenance records shall be maintained at the site available upon request.

Vehicles not meeting safe operating conditions shall be immediately removed from service, its use prohibited until unsafe conditions have been corrected, and re-inspected before being placed in service again.

Whenever visibility conditions warrant additional light, all vehicles, or combinations of vehicles, in use shall be equipped with the following:

- Two headlights, one on each side in the front;
- At least two red taillights and one red or amber stoplight on each side of the rear;
- Directional signal lights (both front and back); and
- Three emergency flares, reflective markers, or equivalent portable warning device.

3.1.8 Machinery and Mechanized Equipment

3.1.8.1 Preparation for Use

Before any machinery or mechanized equipment is placed into use, it shall be inspected and tested in accordance with the manufacturer's recommendations and requirements of this manual and shall be certified in writing by a competent person to meet the manufacturer's recommendations and requirements of this manual.

The company will keep records of tests and inspections. These records shall be made available in a timely manner upon request by USACE and, when submitted, shall become part of the official project file.

All safety deficiencies noted during the inspection shall be corrected prior to the equipment being placed in service at the project.

Subsequent re-inspections will be conducted at least annually thereafter. Anytime the machinery or mechanized equipment is removed and subsequently returned to the project (other than equipment removed for routine off-site operations as part of the project), it shall be re-inspected and recertified prior to use.

No modifications or additions that affect the capacity or safe operation of machinery or equipment shall be made without the manufacturer's written approval. If such modifications or changes are made, the capacity, operation, and maintenance instruction plates, tags, or decals shall be changed accordingly.

In no case shall the original safety factor of the equipment be reduced.

3.1.8.2 Daily/Shift Inspections and Tests

All machinery and equipment shall be inspected daily (when in use) to ensure safe operating conditions. The employer shall designate competent persons to conduct the daily inspections and tests.

Tests shall be made at the beginning of each shift during which the equipment is to be used to determine that the brakes and operating systems are in proper working condition and that all required safety devices are in place and functional.

Whenever any machinery or equipment is found to be unsafe, or whenever a deficiency that affects the safe operation of equipment is observed, the equipment shall be immediately taken out of service and its use prohibited until unsafe conditions have been corrected.

A tag indicating that the equipment shall not be operated, and that the tag shall not be removed, shall be placed in a conspicuous location on the equipment. Where required, lockout procedures shall be used. The tag shall remain in its attached location until it is demonstrated to the individual deadlining the equipment that it is safe to operate.

When corrections are complete, the machinery or equipment shall be retested and re-inspected before being returned to service.

3.1.8.3 Equipment Operation

Machinery and mechanized equipment shall be operated only by designated qualified personnel.

Machinery or equipment shall not be operated in a manner that will endanger persons or property nor shall the safe operating speeds or loads be exceeded.

Getting off or on any equipment while it is in motion is prohibited.

Machinery and equipment shall be operated in accordance with the manufacturer's instructions and recommendations.

The use of headphones for entertainment purposes while operating equipment is prohibited.

Inspections or determinations of road and shoulder conditions and structures shall be made in advance to assure that clearances and load capacities are safe for the passage or placing of any machinery or equipment.

Mechanized equipment shall be shut down before and during fueling operations.

Bulldozer and scraper blades, end-loader buckets, dump bodies, and similar equipment shall be either fully lowered or blocked when being repaired or when not in use. All controls shall be in a neutral position, with the engines stopped and brakes set, unless work being performed on the machine requires otherwise.

Equipment powered by an internal combustion engine will not be operated in or near an enclosed area unless adequate ventilation is provided to ensure the equipment does not generate a hazardous atmosphere.

No one shall be permitted in the truck cab during loading operations except the driver, and then only if the truck has a cab protector.

Safeguards, i.e., bumpers, railings, tracks, etc., shall be provided to prevent machinery and equipment operating on a floating plant or dock from going into the water.

Personnel shall not work in, pass under, or ride in the buckets or booms of loaders in operation.

Each bulldozer, scraper, dragline, crane, motor grader, front-end loader, mechanical shovel, backhoe, and other similar equipment shall be equipped with at least one dry chemical or CO_2 fire extinguisher with a minimum rating of 10-B:C.

3.1.8.4 Equipment Requirements

The following are guidelines relating to accessories will be present and operable:

- An operable fuel gage;
- An operable audible warning device (horn);
- Adequate rearview mirror or mirrors;
- Non-slip surfaces on steps;
- A power-operated starting device;
- Seats or equal protection must be provided for each person required to ride on equipment;
- Whenever visibility conditions warrant additional light, all vehicles, or combinations of vehicles, in use shall be equipped with at least two headlights and two taillights in operable condition;
- All equipment with windshields shall be equipped with powered wipers. Vehicles that operate under conditions that cause fogging or frosting of windshields shall be equipped with operable defogging or defrosting devices. Glass in windshields, windows, and doors shall be safety glass. Cracked or broken glass shall be replaced; and
- Mobile equipment, operating within an off-highway job site not open to public traffic, shall have a service brake system and a parking brake system capable of stopping and holding the equipment while fully loaded on the grade of operation. In addition, it is recommended that heavy-duty hauling equipment have an emergency brake system that will automatically stop the equipment upon failure of the service brake system. This emergency brake system should be manually operable from the driver's position.

3.1.8.5 Maintenance and Repairs

Maintenance, including preventive maintenance and repairs shall be in accordance with the manufacturer's recommendations and shall be documented. Records of maintenance and repairs conducted during the life of a contract shall be made available upon request.

All machinery or equipment shall be shut down and positive means taken to prevent its operation while repairs or manual lubrications are being done. Equipment designed to be serviced while running are exempt from this requirement.

Heavy machinery, equipment, or parts thereof that are suspended or held apart by slings, hoist, or jacks also shall be substantially blocked or cribbed before personnel are permitted to work underneath or between them.

3.1.8.6 Parking

Whenever equipment is parked, the parking brake shall be set.

Equipment parked on an incline shall have the wheels chocked or track mechanisms blocked and the parking brake set.

All equipment left unattended at night, adjacent to a highway in normal use or adjacent to construction areas where work is in progress, shall have lights or reflectors, or barricades equipped with lights or reflectors, to identify the location of the equipment.

3.1.8.7 Towing

All towing devices used on any combination of equipment shall be structurally adequate for the weight drawn and securely mounted.

Persons shall not be permitted to get between a towing vehicle and the piece of towed equipment until both have been completely stopped with all brakes set and wheels chocked on both vehicle and equipment.

3.1.9 Manual Lifting

Most materials associated with investigation and remedial activities are moved by hand. The human body is subject to severe damage in the forms of back injury, muscle strains, and hernia if caution is not observed in the handling process. Whenever possible, use at least two people to lift, or roll/lift with your arms as close to the body as possible. Under no circumstances should any one person lift more than 49 pounds unassisted. For additional requirements, refer to SH&E SOP 308, *Field Manual Lifting.*

3.1.10 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 SH&E SOP 405*, Drilling, Boring, and Direct-Push Probing.*

3.1.11 Traffic Exposure/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 will be used on public roadways in 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 SH&E SOP 306, *Highway and Road Work*, for additional requirements.

3.2 Environmental Hazards and Controls

3.2.1 Hazardous Noise Levels

Occupational noise is the most significant health hazard present in the modern industrial workplace. AECOM's Hearing Conservation Program (SH&E SOP 510 *Hearing Conservation Program*) complies with OSHA Occupational Noise Exposure Standards (CFR, Title 29, Part 1010.95). In addressing industrial noise, the following components are identified:

- Recognition;
- Evaluation;
- Control; and
- Training.

3.2.1.1 Hearing Protection for Noise

Certain operations can cause personnel to receive excessive exposure to noise. The Site Assessment investigation activity which has the most potential for causing over exposure to noise is drilling. When the drill rig is in operation, hearing protection will be donned by the field sampling team, including the drilling subcontractor. Hearing protection will be accomplished using earplugs, earmuffs, or a combination thereof.

3.3 Non-ionizing Radiation

To protect against exposure to ultraviolet (UV) radiation, workers will observe the following requirements:

- All workers will wear sunglass-type safety glasses at all times when working outdoors during daylight hours;
- Workers will utilize a commercial sunblock with a minimum solar protection factor (SPF) of 30 or higher; and
- Wide-brim hard hats are recommended as they provide additional UV protection.

3.4 Ionizing Radiation

Ionizing Radiation hazards are not anticipated for this project.

3.5 Biological Hazards

It should be assumed that biological hazards exist whenever working on undeveloped property. This can include insect activity any time that local temperatures exceed 40°F for a period of more than 24 hours. The stubble and roots of poisonous plants can be a hazard any time of year, including when some plants are dormant or mown.

Employees in the field where biological hazards exist will not enter the hazard areas unless they are wearing the appropriate protective clothing, repellants, and barrier creams specified below. If the hazard is recognized in the field but was not adequately assessed during the AHA, the affected employees shall stop work and not proceed until the AHA has been amended and protective measures implemented.

3.5.1 Microorganisms

Natural and artificial bodies of water (e.g., lakes, rivers, ponds, lagoons, etc.) may contain a variety of microorganisms. Microorganisms, in particular, present a significant hazard to personnel who may come into contact with water bodies. Contact with microorganisms in water may result in dermatitis, infection (i.e., in cuts/lacerations), digestive distress, and other diseases. Always be aware of areas that may contain excessive amounts of microorganisms. Such areas may include areas of standing water, areas of warm water (i.e., cooling tower effluents, etc.), and areas downstream of municipal wastewater treatment. To prevent exposure to microorganisms in water, always adhere to the following:

- Wear protective gloves (i.e., nitrile, etc.) and other appropriate PPE to prevent skin contact with water.
- Never drink from natural or artificial bodies of water. Such water is considered non-potable and is not safe for drinking.

3.5.2 Ticks

Data from the CDC indicates that tick-borne diseases have become increasingly prevalent. At the same time, tick repellents have become both safe and effective so it is possible to prevent the vast majority of bites and therefore most related illnesses. The most common and severe tick-borne illnesses in the U.S. are Lyme disease, Ehrlichiosis, and Rocky Mountain spotted fever.

3.5.3 Chiggers

Chiggers are mite larvae, approximately $^1/_2$ mm in size, and typically invisible to the naked eye. While chiggers are not known to carry infectious diseases, their bites and resulting rashes and itching can lead to dermatitis and a secondary infection. Chiggers are typically active from the last hard freeze in the winter or spring to the first hard freeze.

3.5.4 Spiders

Spiders can be found in derelict buildings, sheltered areas, basements, storage areas, well heads and even on open ground. Spiders can be found year round in sheltered areas and are often present in well heads and valve boxes. The black widow is present in northeast states and known to be dangerous to people. The black widow prefers moist, dark conditions. Black widow bites feel like a minor pinprick, but dull pains will soon develop in the area of the bite. The affected area will generally begin to cramp and other symptoms such as sweating, nausea and vomiting may occur. Other spiders native to the area possess venom but they are not harmful to humans.

Table 3-3
Poisonous Spider Identification Guide

Black widows (Latrodectus) • Females: shiny black with red hourglass on the bottom of abdomen • Males: more vibrant pattern on abdomen consisting of many red and white spots • Males are rarely encountered and are not known to bite humans • Cobweb spiders; spend most of	

their time in their webs • Make webs in undisturbed, uncluttered areas on porches and in sheds	

3.5.5 Mosquitoes

When a mosquito bites, it injects an enzyme that breaks down blood capillaries and acts as an anticoagulant. The enzymes induce an immune response in the host that results in itching and local inflammation. The tendency to scratch the bite sites can lead to secondary infections.

CDC data indicates that mosquito-borne illnesses, including the strains of encephalitis, are a health risk to employees working in outdoor environments. At least one of the Encephalitis strains listed below is known to exist in every area of the U.S. and in many other countries as well:

- Eastern Equine encephalitis (EEE);
- Western Equine encephalitis (WEE);
- West Nile Virus;
- St. Louis encephalitis (SLE); and
- La Crosse (LAC) encephalitis.

Other diseases including Dengue Fever and Malaria are spread by mosquitoes in the sub-tropic and tropical parts of the world.

3.5.6 Bees and Hornets

Bees, hornets, and wasps may be found in derelict buildings, sheltered areas, and even on open ground. The flying/stinging insects are not specifically included in the scope of this procedure and the PPE and other protective measures are not normally effective against aggressive, flying insects. Avoid reaching into areas where visibility is limited. If stung by a wasp, bee or hornet, notify a co-worker or someone who can help should you have an allergic reaction. Stay calm and treat the area with ice or cold water. Seek medical attention if you have any reactions to the sting such as developing a rash, excessive swelling, or pain at the site of the bite or sting or any swelling or numbness beyond the site of the bite or sting.

Employees with known allergies to insect stings should consult their personal physician for advice on any immediate medications that they should carry with them. It is recommended that employees with known allergies inform their co-workers of the allergy and the location of the medications they might carry for the allergy.

3.5.7 Small Mammals

Working in the field either directly or indirectly with small mammals has inherent risks of injury or exposure to zoonotic diseases (infectious diseases that can be transmitted from animals to humans) against which all field staff should protect themselves. 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). Avoid animals whenever possible, and if bitten, go to the nearest medical facility.

3.5.8 Snakes

Snakes are rarely aggressive towards humans. If a snake encounter occurs, the worker should simply maintain a safe distance and move away from it, or allow it to move away. Only two species of venomous snakes are found in northeast areaas of U.S., the copperhead and the timber rattlesnake. The best snakebite treatment is to avoid getting bitten. The following suggestions will help workers stay clear of venomous snakes.

- Learn to identify, by sight, the copperhead and timber rattlesnake.
- When working in areas where snakes might be found, watch where you put your hands and feet. Watch where you sit and where you place supplies.
- Wear suitable clothing, and when working in or around tall grass or heavy brush, wear long pants and heavy boots.
- Avoid rock piles, stacks of old boards and brush in wooded areas, as snakes use such areas frequently.
- Never handle "dead" venomous snakes; they may not be completely dead.
- Leave live snakes alone. DO NOT attempt to capture or kill them.

If bitten by any venomous animal, 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. Bites from a black widow should be treated as medical emergencies. All other bites should be reported, proper first aid implemented, and the wound progression tracked.

Table 3-4
Venomous Snake Identification Guide

Northern Copperhead (Agkistrodon contortrix mokas) • Color is a rich, reddish, brown with a series of darker hourglass markings down back • Head is usually a bright copper color; belly is pinkish • Seldom exceeds three feet in length • Dark dorsal markings which are narrow on the back and broad on the sides • Found in remote rocky, wooded areas	

Timber Rattlesnake (Crotalus horridus horridus) • Only species of snake in region with a segmented rattle at the end of its tail • Brown or black cheveron-shaped markings on a yellow background, down its back • Background color may vary from a bright yellow to a dull gray; Entirely black specimens also occur • Rarely exceeds six feet in length • Found in the remote rocky, mountainous areas	

3.5.9 Poisonous Plants

Poisonous Plants including poison ivy, oak, and sumac, which contain the oil urushiol that produces a rash, can lead to dermatitis and infections. Exposure to urushiol produces a rash that can be irritating and cause the exposed employee to scratch the affected area, increasing susceptibility for an infection. It should be noted that each time an employee is exposed to urushiol the severity of the reaction increases. In cases that involve severe rashes, medical treatment may be necessary to control the rash.

Employees who develop a rash as a result of exposure to poisonous plants shall report the exposure immediately to the Site Supervisor or PM who will then forward the report to the Regional SH&E Manager.

Table 3-5
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	 
Poison Sumac • Grows in boggy areas, especially in the Southwest and Northern states • Shrub up to 15 feet tall • Seven to 13 smooth-edged leaflets • Glossy pale yellow or cream-colored berries	 

Table 3-5
Hazardous Plant Identification Guide (Continued)

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	

3.5.10 Personal Precautions and Protective Measures for Biological Hazards

The following precautions and protective measures will be implemented by employees conducting fieldwork where biological hazards exist:

- Chemically-treated field clothing, full length clothing, or Tyvek coveralls;
- Application of insect repellent to clothing and/or exposed skin; and
- Routine personal checks.

Disposable gloves may be cotton, leather, or synthetic materials and must not be reused after removing.

Exercise care and avoid reaching into areas where visibility is limited. If stung by an insect or bitten by a spider or tick, attempt to identify the attacker and notify a co-worker or someone who can help should the bite site become painful, discolored, or swollen. Stay calm and treat the area with ice or cold water. Seek medical attention if you have any reactions to the sting such as developing a rash, excessive swelling, or pain at the site of the bite, or any swelling or numbness beyond the site of the bite.

Oil of lemon eucalyptus, DEET and Permethrin, have been recommended by the Centers for Disease Control and Prevention (CDC) for effective protection against mosquitoes that may carry the West Nile virus and related diseases.

3.5.11 PPE for Poisonous Plants

Employees working in areas where poisonous plants exist shall wear either long sleeve clothing or Tyvek coveralls, and disposable cotton, leather or synthetic gloves. Employees must not touch exposed skin (neck and face) with potentially contaminated gloves. Tyvek and gloves worn to protect from exposure to poisonous plants will be treated as contaminated, removed from the body is a manner that the contamination is not spread, and placed in plastic bags for disposal.

Personal clothing that has been exposed to poisonous plants shall be decontaminated with a poisonous plant cleanser such as Tecnu or removed in a careful manner, bagged and washed separately from other clothing to remove urushiol. Work boots will be decontaminated with either soap and water or a cleansing agent such as Tecnu cleanser.

In the fall and winter, the hazard still exists in the form of stubble and roots. Employees who develop a rash as a result of exposure to poisonous plants shall report the exposure immediately to the Site Supervisor or PM who will forward the report to the Regional SH&E Manager.

3.5.12 Chemical Treatment of Field Clothing

Oil of lemon eucalyptus, DEET, and Permethrin have been recommended by the CDC for effective protection against mosquitoes that may carry the West Nile virus and related diseases.

When selected as part of project's PPE requirements, the PM will ensure that field teams wear clothing treated with the chemical Permethrin, which is an insecticide with repellent properties registered with the USEPA, and recommended by the CDC. Permethrin is highly effective in preventing tick bites when applied to clothing, but is not effective when applied directly to the skin. Two options are available for Permethrin treatment of clothing worn during fieldwork:

- Pre-treatment of fabric by the clothing manufacturer; or
- Employee treatment of their personal clothing using 0.5% Permethrin spray.

3.5.12.1 Pretreatment of Field Clothing

The Permethrin pretreatment is odorless and retains its effectiveness for approximately 25 washings. After 25 washings, the pretreated clothing will be considered no longer effective and removed from service. Clothing that has been manually treated by employees will be considered effective for five wash cycles.

Use of clothing that has been pretreated with Permethrin offers a reduction in the use and application of other insect repellants that must be applied directly to the skin.

If an employee opts not to utilize chemically pretreated clothing while potentially exposed to insects, spiders, and/or ticks, they must either wear Tyvek coveralls taped to the boots or clothing consisting of long legged pants and long sleeved shirts treated with an insect repellant containing Permethrin DEET or an organic alternative to their work clothing.

3.5.12.2 Lemon Eucalyptus

Lemon Eucalyptus is a plant-based insect repellent on the market as Repel Lemon Eucalyptus. The products have been proven to be effective against mosquitoes, deer ticks, and no-see-ums for up to 6 hours. Derived from Oil of Lemon Eucalyptus, this non-greasy lotion or spray have a pleasant scent and are not known to be toxic to humans. The spray or lotions will be effective for approximately two to six hours and should be reapplied each two hours to sustain protection. Lemon Eucalyptus products cannot be applied to fire retardant clothing.

3.5.12.3 Personal Hygiene and Body Checks

Tick borne diseases typically require that the tick be imbedded for four hours to begin disease transfer. The oils from poisonous plants can take up to 4 hours after exposure to penetrate the skin and react with the live proteins under the skin.

It is recommended that exposed skin be checked frequently for the presence of ticks, insects, rashes, or discolorations. External clothing should also be checked for the presence of ticks and insects; these should be retained for identification and to determine if medical treatment is needed.

Employees will shower as soon as practical after working in the field and examine their bodies for the presence of ticks, insect bites, rashes, or swollen areas. If imbedded ticks are found they should be removed; the tick should preserved with the date and location of the bite noted, and retained for identification if medical treatment is needed.

The presence of an imbedded tick, rash, or abnormal reactions will be reported as an SH&E Incident to the PM or Site Supervisor who will forward the report to the Regional SH&E Manager for follow up.

3.6 Assessment of chemical Exposure Hazards by Task

The tasks outlined in this document have been further analyzed for potential for chemical exposure in the following subsections.

3.6.1 Mobilization

Mobilization does not involve contact with contaminated groundwater and/or soil. Chemical exposure is not anticipated for this task.

3.6.2 Soil Boring and Sample Collection

The anticipated PPE level for this activity is Level D.

Inhalation – An inhalation hazard exists during well installation activities. The monitoring procedures and action levels established in Section 8 will be followed to avoid potential exposure.

Skin Contact – A contact hazard exists during well installation activities. Employees will don the prescribed PPE to avoid contact with impacted soils.

Ingestion – Protection against exposure via ingestion can be accomplished by performance of proper decontamination procedures when exiting contaminated work areas (see Section 12).

3.6.3 Groundwater Sampling

The anticipated PPE level for this activity is Level D. The monitoring procedures shown below will be followed during all groundwater sampling activities.

Any well which has been sealed for longer than 6 hours will be allowed to ventilate for a minimum of 5 minutes upon opening, then monitored for VOC concentration using a PID. A reading in excess of 50 ppm will require additional ventilation, followed by re-monitoring. If an acceptable VOC concentration cannot be reached within 30 minutes of opening a well, reseal it and contact the Safety Professional for guidance.

Inhalation – An inhalation hazard exists during groundwater sampling activities. The monitoring procedures and action levels established in Section 8 will be followed to avoid potential exposure.

Skin Contact – A contact hazard exists during groundwater sampling activities from coming into contact with impacted groundwater. Employees will don the prescribed PPE to avoid contact with impacted groundwater.

Ingestion – Protection against exposure via ingestion can be accomplished by performance of proper decontamination procedures when exiting contaminated work areas (see Section 12).

3.6.4 Additional Work Operations

If additional work operations become necessary, the anticipated level of PPE and hazard controls will be detailed din the applicable AHA developed for the task.

4 Staff organization, Qualifications, and responsibilities

All personnel are responsible for continuous adherence to the APP and SSHP procedures during the performance of their work. Staff Organization, Qualifications, Responsibilities, and lines of authority are presented in Section 4.0 of the APP.

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5 Training

5.1 General Training

Personnel performing work at the job site must be qualified as HAZWOPER workers (unless otherwise noted in specific AHAs or by the SSHO), and must meet the medical monitoring and training requirements specified in the following safety procedures:

- SH&E SOP 003, *SH&E Training*;
- SH&E SOP 507, *Hazardous Materials Communication*;
- SH&E SOP 210, *Project Safety Meetings*; and
- SH&E SOP 509, *Hazardous Waste Operations and Emergency Response (HAZWOPER) Activities*.

Personnel who participate in field activities associated with this project are subject to the training requirements presented in Section 6.0 of the APP.

5.2 Project-Specific Training

All personnel performing field activities at the site will be trained in accordance with SH&E SOP 003, *SH&E Training*. For this project, training will include the requirements specified in the following:

- SH&E SOP 507, *Hazardous Materials Communication*;
- SH&E SOP 210, *Project Safety Meetings*; and
- SH&E SOP 509, *Hazardous Waste Operations and Emergency Response (HAZWOPER) Activities*.

In addition to the general health and safety training programs, personnel will be:

- Instructed on the contents of applicable portions of this SSHP and any supplemental health and safety information developed for the tasks to be performed;
- Workers will be instructed on the proper ultraviolet radiation protection measures per SH&E SOP 517, *Non-Ionizing Radiation*;
- Informed about the potential routes of exposure, protective clothing, precautionary measures, and symptoms or signs of chemical exposure and heat stress;
- Made aware of task-specific physical hazards and other hazards that may be encountered during site work. This includes any client-specific required training for health and safety; and
- Made aware of fire prevention measures, fire extinguishing methods, and evacuation procedures.

The site-specific training will be performed prior to the worker performing the subject task or handling the impacted materials and on an as-needed basis thereafter. Training will be conducted by the SSHO (or his/her designee) and will be documented on the form attached to SH&E SOP 210, *Project Safety Meetings*.

5.2.1 Competent Person Training Requirements

In order to complete the planned scope of work, an OSHA-designated competent person must be onsite to perform the required daily inspections of equipment and/or operations. The competent person may be an AECOM or subcontractor employee and is defined as:

> *One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.*

AECOM personnel must be designated by the SH&E Department per accordance with SH&E SOP 202 *Competent Person Designation*.

6 Personnel Protective Equipment

6.1 Personal Protective Equipment

The purpose of 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. SH&E SOP 208, *Personal Protective Equipment Program*, lists the general requirements for selection and usage of PPE. All Site Assessment field activities will be conducted in Level D PPE. Table 6-1 lists the minimum PPE required during Level D site operations. The specific PPE requirements for each work task are specified in the individual AHAs found in Attachment A.

Prior to the start of field operations, the SSHO will ensure that all personnel have been trained on when and what PPE is necessary; how to properly don, doff, adjust and wear PPE; limitations of PPE; and proper care, inspection, testing, and maintenance; useful life; and storage and disposal of PPE.

By signing Section 15 (Personnel Acknowledgement) of this SSHP, you are agreeing that you have been properly trained in the use, limitations, care, and maintenance of the protective equipment you will use at this project. If you have not received training on the proper use, care, and, limitations of the PPE required for this project, please see the Project Manager or SSHO for the proper training prior to signing this SSHP.

Table 6-1
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		If overhead hazard is present. 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	Nitrile	
Sunscreen	SPF 30 or higher	
Cold Weather Gear	Hard hat liner, hand warmers, insulated gloves, and thick, warm socks	

6.2 PPE Doffing and Donning Information

The following information is to provide field personnel with helpful hints that, when applied, make donning and doffing of PPE 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; and
- Never perform personal decontamination with a pressure washer.

7 Medical Surveillance

All on-site personnel must participate in a medical surveillance program that complies with OSHA 1910.120 where the evaluation includes a judgment of the employee's ability to use respiratory protective equipment and to participate in hazardous waste site activities. Additionally, personnel trained and certified in First Aid and Cardiopulmonary Resuscitation (CPR) will be onsite at all times when work is being performed.

All current certifications and training records for site personnel will be maintained on-site for the duration of the project. Individuals without proper training records will not be permitted on-site. All training and certification records will be made available upon request.

7.1 Exemptions/Exceptions to Medical Surveillance and Training

The support zone (SZ) is defined as the work zone where no contamination is present and no potential for exposure exists. AECOM personnel who remain in the SZ and never enter the exclusion zone (EZ) or contamination reduction zone (CRZ) will not be subject to exposure potential. Therefore, they are exempt from all provisions of the standard, including medical surveillance and training, as per the preamble and 29 CFR 1910.120(a)(i). This exemption to the standard holds true for all personnel working in situations where lack of exposure potential can be demonstrated.

Client and/or regulators will be responsible for the compliance parameters prescribed for their representatives, employees, visitors, subcontractors, and affiliates, as these personnel do not fall under AECOM's Health and Safety Program, the APP/SSHP, and/or AECOM authority. However, if client and/or regulatory personnel enter the AECOM exclusion zone, they will be required to wear the prescribed PPE worn by AECOM employees. Additionally, they are responsible for having documentation that they are medically capable and trained to be in the work area and/or wear the PPE. Client and/or regulatory personnel will be responsible for ensuring compliance with this requirement and are required to attend a site-specific training session given by their safety representative.

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8 Exposure Monitoring / Air Sampling Program

Monitoring procedures will be employed during site characterization activities to assess employee exposure to chemical and physical hazards. Monitoring will consist primarily of on-site determination of various parameters (e.g., airborne contaminant concentrations and heat stress effects), but may be supplemented by more sophisticated monitoring techniques, if necessary. The suspected contaminants of concern (COC), identified by the historical site use data, may include VOCs, SVOCs, TPH, PAH, and Metals.

8.1 Real-Time Exposure Measurement

Monitoring will be performed within the work area in order to detect the presence and relative levels of toxic substances. The data collected throughout monitoring will be used to determine the appropriate levels of PPE. Monitoring will be conducted as specified in each AHA (Attachment A) as work is performed.

Table 8-1 specifies the real-time monitoring equipment, which will be used for this project.

Table 8-1
Monitoring Parameters and Equipment

Instrument	Manufacturer/Model*	Substances Detected
Photoionization Detector (PID)	RAE Systems Mini-RAE Photovac Microtip HNu Model Hnu (10.6 eV bulb)	VOCs, SVOCs, TPH, PAH

It is not anticipated that groundwater sampling will result in a sufficient dispersal of contaminants to pose an inhalation risk. While no historical data is available for heavy metal concentrations in soil, any dispersal of dust will be controlled through the utilization of DPT to advance the soil borings. Risk due to ingestion and dermal exposure will be controlled through the use of PPE and worksite housekeeping to reduce handling or dispersal of contaminated media.

8.1.1 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.

All field activities will be conducted in Level D PPE. If ambient levels are measured which exceed the action level (see Table 8-2), all investigations at that location will be shut down.

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; or
- 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; or
- Change in work task that will reduce exposure to hazardous materials.

8.1.2 Monitoring Procedures

A summary of the monitoring procedures and action levels are presented in Table 8-2. Any well which has been sealed for longer than six hours will be allowed to ventilate for a minimum of five minutes upon opening, then monitored at the well head for VOC concentrations using a PID. A reading in excess of 2.5 ppm will require additional ventilation, followed by re-monitoring. If an acceptable VOC concentration (below 2.5 ppm) cannot be reached within 30 minutes of opening a well, reseal it and contact the Regional Health and Safety Manager for guidance. The procedures summarized in Table 8-2 will be followed during drilling operations.

During drilling and advancement of soil borings and handling of IDW, the breathing zone will be monitored for VOC concentrations. If ambient levels are measured that exceed the action levels, on-site workers must be implement the mitigative actions and control measures prior to commencing or continuing activities at the specific work area.

The lower alarm limit of the PID should be set at 2.5 ppm and the upper alarm limit should be set at 15 ppm. A lower level alarm sustained for 5 minutes requires additional analysis with VC Drager tubes. An upper level alarm sustained for 5 minutes requires stop work. The provisions below provide for the appropriate action level and action to afford respiratory protection to on-site workers during this scope of services.

Table 8-2
Monitoring Procedures and Action Levels

VOCs measured by PID (10.6 eV bulb) calibrated to Isobutylene		
Zone Location and Monitoring Interval	**Response Level (sustained in BZ for ≥5 minutes)**	**Response Activity**
Worker Breathing Zone, continuous during all activities	0 - 2.5 ppm	Continue work in required PPE, station personnel up-wind, and continue monitoring.
	> 2.5 - 15 ppm	Continue work in required PPE, continue monitoring. Implement engineering controls (dilution ventilation).
	> 15 - 25 ppm	STOP WORK. Contact the SSHO, implement mitigation measures and prepare for upgrade to Level C. Contact HSM and PM.
	> 25 ppm	STOP WORK, shut down all equipment, exit, and contact the HSM and PM.

8.1.3 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.

8.1.4 Personal Sampling

Should site activities warrant performing personal sampling to better assess chemical exposures experienced by employees, the SSHO, under the direction of a Certified Industrial Hygienist (CIH), will be responsible for specifying the monitoring required. Within five working days after the receipt of monitoring results, the CIH 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 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 SSHO for use in determining the potential for other employees' exposure.

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9 Heat and Cold Stress

Heat and cold stress may vary based upon work activities, PPE/clothing selection, the season of the year, 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. For additional requirements, see Section 9.14 of the APP, Heat/Cold Stress Monitoring Plan.

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 as specified in the APP.

Heat Stress monitoring and work-rest regiments will be implemented using the Adjusted Temperature Method outlined in SH&E 511, *Heat Stress*. All temperature monitoring results, physiological monitoring results, and temperature stress controls will be documented in field records using the Heat Stress Monitoring form attached to the SOP.

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10 Standard Operating Safety Procedures, Engineering controls, and work practices

10.1 Safe Work Practices

Personnel are charged with performing all job duties in a responsible manner, following and complying with regulatory standards, company safety policies, industry standards, work practices, guidelines, and project-specific requirements governing the scope of work.

Personnel must be aware of the job site conditions, work environments, client operations, contractor activities, and general public (if applicable) that may impact an employee or be impacted by or affected by one's work by observing the following guidelines:

- Work in a manner that will not put oneself, other personnel or equipment or facilities at risk;
- Identify hazardous conditions and activities in the work environment consistent with the job and training;
- If one can't remove a hazard, it should be reported to the PM promptly;
- Implement established control methods consistent with project procedures and/or training.
- Unsafe employee actions or behavior are prohibited;
- Employees performing inspections, construction observations, investigations, reviews, surveys or visits to remote sites shall work in teams of a minimum of two persons present (buddy system), or an alternate communication plan must be provided;
- Work involving the removal, handling, storage or disposal of hazardous materials or wastes requires the approval of the Regional SH&E Manager;
- Immediately report all potentially dangerous conditions and injuries, regardless of severity, to the SSHO; and
- Report all accidents that result in medical treatment, equipment damage or near miss incidents to supervision immediately.

10.2 Personal Standards

Any employee who willfully disregards company or client safety standards, rules, or requirements is subject to disciplinary action, including removal from the project and dismissal. The following guidelines are provided:

- Carrying firearms or other weapons on company or a client's property is prohibited.
- Fighting and gambling are not permitted.
- Be considerate of the safety and welfare of others. Distracting other's attention or engaging in practical jokes and horseplay is prohibited.
- Employees are not permitted to use, sell or distribute, be under the influence, or have in their possession any controlled substances, drugs, or alcohol. The only exception is if an employee is taking prescription medication(s) under the direction of a physician. It is then the responsibility of the employee to notify one's Project Manager if the medication may impair their ability to perform their job function in a safe manner, in which case they shall be removed from that task.

- Smoking is prohibited in any area specifically designated as "NO SMOKING" and in all company facilities.
- Be alert at all times. Obey safety signs, heed warning signs and instructions.
- Report unsafe equipment, conditions, and actions or behavior to one's task leader or supervisor promptly.
- Avoid back injuries by knowing one's capabilities, using proper lifting techniques, and seeking assistance when needed.
- Employees should operate vehicles in a safe and conscientious manner.
- Use only designated project entrances, parking areas and facilities.
- Show or produce evidence of identification or required training if requested to gain entry to or while on a project.
- Personal cameras, video recorders, and other photographic equipment shall not be permitted on site without the PM and client's approval.
- All employees shall direct any questions or concerns they may have about the project APP/SSHP, job tasks, instructions or conditions to the SSHO, PM or Regional SH&E Manager.

10.3 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 SH&E SOP 001 *Safe Work Standards and Rules* and SH&E SOP 307 *Worksite Housekeeping*.

Employees are required to practice "good housekeeping" when performing job tasks at all company locations and offices. Such practices include:

- Overseeing that work areas are kept clean and organized by using approved cleaning materials for tools and equipment; proper packaging and disposal of waste materials including hazardous materials; and leaving a work area clean and orderly. This includes office workstations and occupancies.
- One should plan work tasks before beginning work and consider any hazards that may exist and how to avoid them through proper work practices.
- One should keep an eye out for and take care of one's "buddy" in the field.
- Obey all warning signs (e.g., "Do Not Enter," "No Smoking," "Eye, Hearing or Respiratory Protection Required," "Permit Required Confined Space," "Authorized Personnel Only").
- Do not jump from any elevated surface or platform, including truck beds, equipment, and scaffolding.
- Taking shortcuts leads to injury. Use appropriate ladders, platforms, and stairs. Do not block, deface or remove any signage, barricade or fencing without approval.
- Keep passageways clean and clear of debris, materials, hoses, cords, and tripping obstructions. Items should be moved to low activity areas or overhead.
- Permits may be required when performing non-routine tasks and work involving hazards. Seek advice from the PM.
- Use only designated sanitary facilities.
- Be alert to work going on, around or above you including contractor activities and motoring public vehicles.

- Be familiar with project emergency procedures. Report all emergency situations to the PM immediately.
- Hand tools, electronic devices, and equipment may not be used for any purpose other than their intended use. Damaged equipment and tools with worn part(s) shall be reported to the Site Supervisor for repair or replacement.
- Electric power tools must be properly grounded or double insulated. Electric power tools shall be Ground Fault Circuit Interrupter-protected when use in wet and exterior conditions.
- Defective tools and equipment, frayed and ungrounded electrical cords and unguarded tools and machinery shall not be used. Report same to the Project Manager.
- Employees shall not remove floor covering, guardrails, or other working surfaces from any floor or perimeter side opening without approval by the PM.
- Defective or unsecured ladders shall not be used.
- Employees shall not ascend or descend a ladder without free use of both hands while facing the ladder.

10.3.1 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.

10.3.2 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.

10.3.3 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 five 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.

10.3.4 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 SH&E SOP 314 *Working Alone and Remote Travel* will be followed at all times.

10.4 Safety Equipment Rules

The following guidelines are provided that relate to safety equipment:

- Always wear assigned safety equipment and PPE.
- Always use protective equipment in accordance with manufacturer's instructions and company training and procedures.
- All employees, subcontractors, subconsultants, visitors, and vendors shall wear a hard hat, high visibility vest, sturdy work boots, and eye protection on projects. Other PPE may be required based on the nature of the work.
- Wear clothing suitable for the work being performed. Minimum attire consists of long pants and shirt with a minimum 4-inch sleeve, tank tops are not permitted unless otherwise specified.
- Hearing protection devices shall be used when conducting drilling operations.
- Fall protection equipment is required for all work with a fall exposure greater than 6 feet on any elevated structure or aerial platform including structural steel, incomplete work platforms, scaffolding, open surface work, and aerial lifts.
- Modification or alteration of any safety equipment is prohibited as it changes the equipment's design strength and manufacturer's certifications.
- PPE use shall be consistently enforced in accordance with rules established for the project and federal and state safety regulations.

10.5 Work Ergonomic Rules

The following guidelines are provided that address ergonomic issues:

- Use proper methods to perform all job functions so as to minimize the risk of physical injury.
- Take reasonable precautions when lifting heavy or large objects that could cause back injury or hernia.
- Do not exceed one's capability and strength. Seek assistance.
- Make suitable adjustments to one's workstation including office furniture, chair, keyboard platform, computer monitor for comfort, equipment, and work.
- Avoid routine, repetitive motion hand activities. Integrate varying motions and body parts.
- Change work routines e.g., phones, typing, files. Stretch and take mini-breaks.

10.6 Tailgate Meetings

Prior to the commencement of daily project activities, a tailgate meeting will be conducted by the SSHO to review the specific requirements of this HASP and applicable AHA. 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 SSHO.

10.7 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 SSHP 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 SSHO for review and filing (the SSHO 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.).

10.8 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.

10.9 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 SH&E SOP 002, *Stop Work Authority for Unsafe Work*. 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 SSHO 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 SSHO 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.

10.10 Client Specific Safety Requirements

The client has specified no additional health and safety requirements.

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11 Site Control Measures

11.1 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 activities and are attached to this section.

11.2 Controlled Work Areas

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

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

Each zone will be periodically monitored in accordance with the air monitoring requirements established in this SSHP. The EZ and the CRZ are considered work areas. The SZ is accessible to the public (e.g., vendors, inspectors). Example layouts of the work zones for drilling operation is presented in Figures 11-1.

11.2.1 Exclusion Zone

The EZ 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 AHA and Sections 4 and 5 will be allowed in an EZ.

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. To meet this requirement, the following minimum distances will be used:

- **Drilling and Soil Sampling**: Determine the mast height of the drill rig. This height will be cleared, if practical, in all directions from the borehole 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.
- **Groundwater Sampling:** A distance of 10 feet will be cleared in all directions from the monitoring well. The cleared area will be sufficient to accommodate sampling equipment and supplies.

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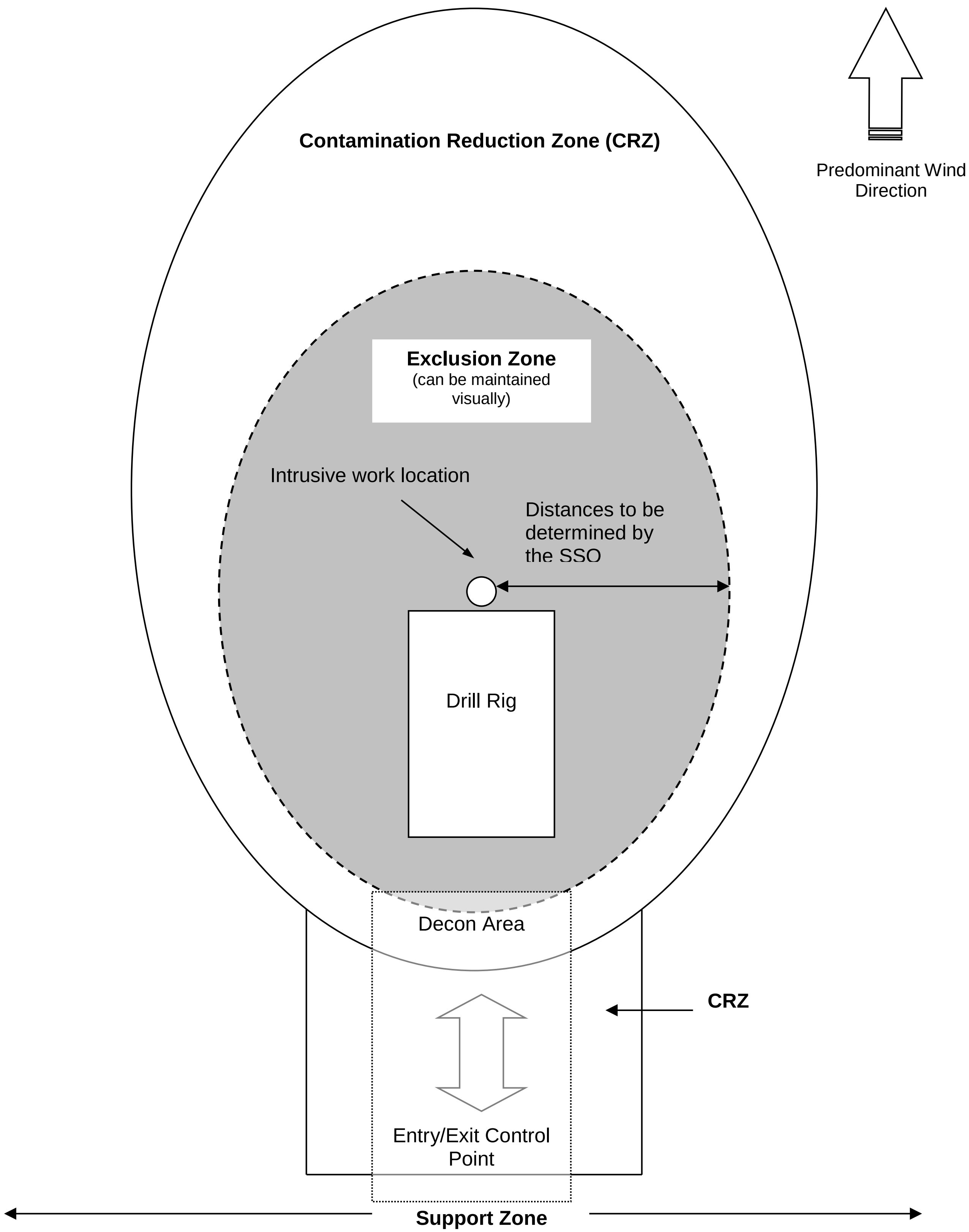
Figure 11-1
Example Drilling Site Control Layout



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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).

11.2.2 Contamination Reduction Zone

The CRZ 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. Decontamination procedures are further explained in Section 12.

11.2.3 Support Zone

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

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

11.3 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.

11.3.1 Visitor Access

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

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

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

11.4 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; and
- Avoid interference with safe working procedures.

To maintain site security during working hours:

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

To maintain site security during off-duty hours:

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

12 Personal Hygiene and Decontamination

12.1 Personal Hygiene

Section 9.4 of the APP contains the site sanitation plan for the project.

12.2 Decontamination 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 EZ.

All persons and equipment entering the EZ shall be considered contaminated, and thus, must be properly decontaminated in the CRZ 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 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.

12.2.1 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. 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 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.

12.2.2 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.

12.2.3 Personal and 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; and
- Thoroughly wash hands.

For 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 Site Supervisor and/or SSHO 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:

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

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

13 Emergency Equipment and First Aid

A complete first aid kit, Type III, 16 unit or larger in a waterproof container, and containing at a minimum, a one pocket mouthpiece for CPR, absorbent compresses, adhesive bandages, adhesive tape, antiseptic swabs, burn gel, sterile pads, and a triangular bandage will be readily available on-site. Its contents will be evaluated and possibly modified for this specific project. It will be located in the SZ.

The contents will be checked prior to their utilization for sterility and to replace expended items. The SSHO or other designated individual will inventory the kit weekly.

Prior to the start of work, the SSHO will discuss with site personnel the prevention steps, symptoms and medical persons available to assist with injuries or questions on diseases, plants or animals that could be encountered while working on this project.

A working cell phone and radio with adequate signal in this area will be maintained on-site and fully charged at the start of each work day.

A fire extinguisher will be readily available on-site. It will be located in the SZ, not more than 25 feet from the SZ activities. A minimum of a 5-lb. B: C fire extinguisher will be maintained in each vehicle as well. Personnel will be instructed on the proper use of fire extinguishers.

13.1 Emergency Supplies

At a minimum, the following supplies will be immediately available for on-site use:

- First aid equipment and supplies;
- Emergency eyewash station as per American National Standards Institute (ANSI) Z-358.1 if exposure to corrosive materials is present;
- Spill control material and equipment;
- Radio and cell phone;
- A minimum of two Type 10 A:B:C fire extinguishers;
- A vehicle parked at an exit point; and
- Each field team will have a first aid kit, eye wash, fire extinguisher, air horn, and communications equipment. Additional emergency response equipment will be located at the field office.

13.2 Accident Prevention Signs, Tags and Labels

Standard accident prevention signs, tags, and labels will be used to communicate hazards and precautions in accordance with Section 8 of EM 385-1-1. Examples that may be used include:

- Danger, Warning and Caution signs;
- Work zone signs;
- PPE requirement signs;
- Lockout/ tag out tags;

- Inspection and Do Not Use tags;
- NFPA or HMIS hazardous material signs and labels; and
- Specific items and quantities will be determined by SSHO.

14 Emergency Response and Contingency Procedures

AECOM personnel will follow the emergency response procedures established in Section 9.0 of the APP.

14.1 Emergency Response Plan

Although the potential for an emergency to occur is remote, an emergency response plan (ERP) has been prepared in accordance with SH&E SOP 203, *Emergency Response Planning* 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 ERP will be reviewed by all personnel prior to the start of field activities.

Three major categories of emergencies could occur during site operations:

- Illnesses and physical injuries (including injury-causing chemical exposure);
- Catastrophic events (fire, explosion, earthquake, or chemical); and
- Safety equipment problems.

14.2 Emergency Coordinator

The duties of the Emergency Coordinator (EC) include:

- Implement the ERP based on the identified emergency condition;
- Notify the appropriate project and SH&E Department personnel of the emergency (Table 14-2);
- Verify emergency evacuation routes and muster points are accessible; and
- Conduct routine ERP drills and evaluate compliance with the ERP.

14.3 Site-Specific Emergency Procedures

Prior to the start of site operations, the EC will complete Table 14-1 with any site-specific information regarding evacuations, muster points, communication, and other site-specific emergency procedures. The emergency hospital route/detail map will also be included as Figure 14-1.

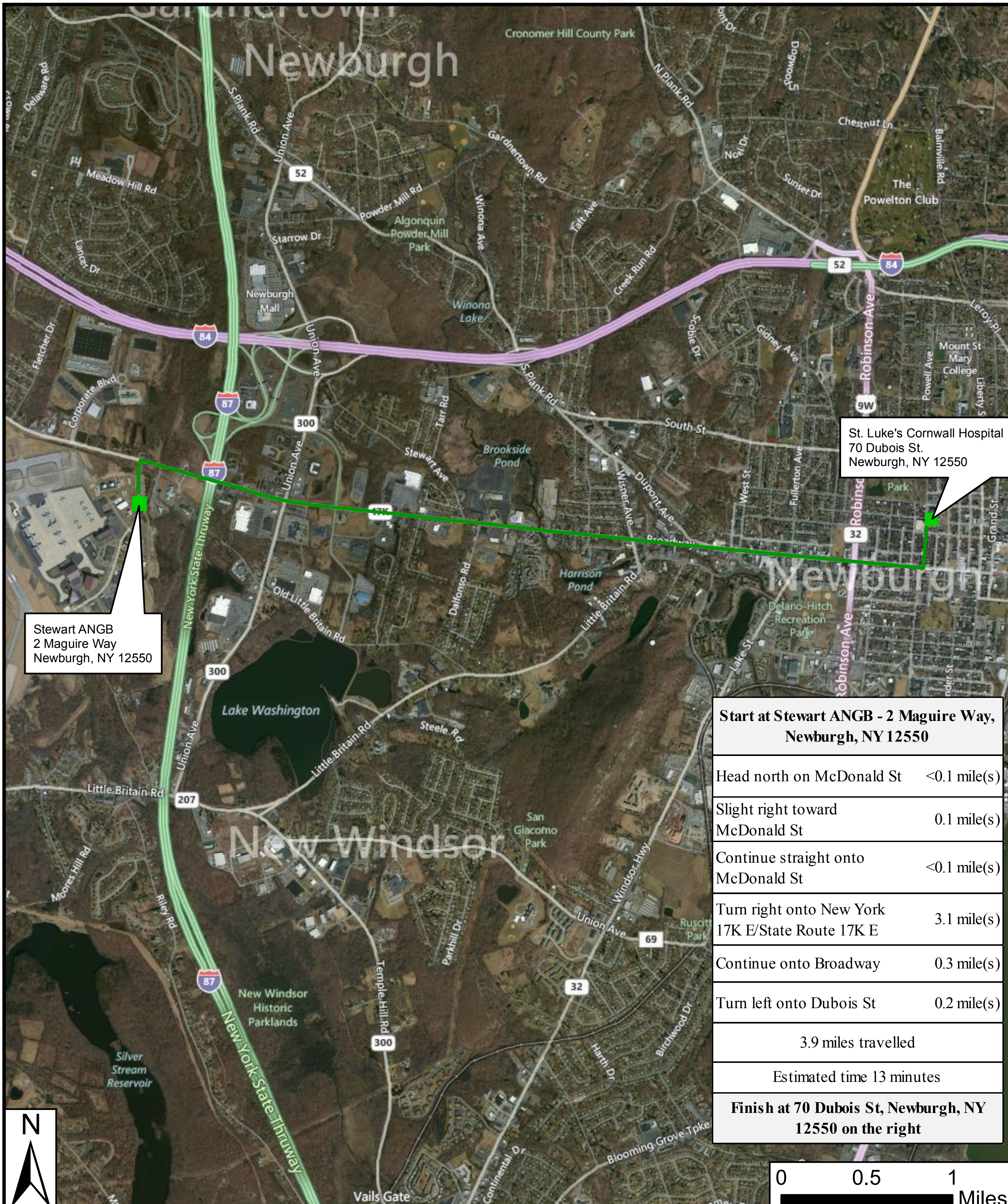
Table 14-1
Emergency Planning

Emergency	Evacuation Route	Muster Location
Chemical Spill	Upwind	TBD
Fire/Explosion	Upwind	TBD
Severe Weather	Closest available shelter	TBD
Lightning	Closest available shelter	TBD
Additional Information		
Communication Procedures	Cell Phones	
CPR/First Aid Trained Personnel	TBD	
Site-Specific Spill Response Procedures	Use absorbents and spill kit for any incidental fuel spills from equipment	

Table 14-2
Emergency Contacts

Emergency Coordinators / Key Personnel			
Name	**Title/Workstation**	**Telephone Number**	**Mobile Phone**
Mark MacEwan	Project Manager	(703) 739-4736	(202) 375-9353
TBD	SSHO	TBD	TBD
TBD	Site Supervisor	TBD	TBD
Mike Grasso, CIH	Regional SH&E Manager	TBD	TBD
Incident Reporting	Incident Reporting Line	(800) 348-5046	N/A
Ann-Alyssa Hill	DOT/IATA Shipping Expert	(804) 515-8506	(804) 640-4815

Organization / Agency	
Name	**Telephone Number**
Police Department (local)	911
Fire Department (local)	911
State Police	911
Ambulance Service (EMT will determine appropriate hospital for treatment)	911
Emergency Hospital (Use by site personnel is only for emergency cases)	(845) 561-4400
Hospital Information St. Luke's Cornwall Hospital 70 Dubois St. Newburgh, NY 12550	
WorkCare: 24-hr On-Call Occupational Nurse (*minor First Aid assistance only*)	(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) 535-5053
Title 3 Hotline	(800) 424-9346
Public Utilities	
Call Before You Dig	



Start at Stewart ANGB - 2 Maguire Way, Newburgh, NY 12550	
Head north on McDonald St	<0.1 mile(s)
Slight right toward McDonald St	0.1 mile(s)
Continue straight onto McDonald St	<0.1 mile(s)
Turn right onto New York 17K E/State Route 17K E	3.1 mile(s)
Continue onto Broadway	0.3 mile(s)
Turn left onto Dubois St	0.2 mile(s)
3.9 miles travelled	
Estimated time 13 minutes	
Finish at 70 Dubois St, Newburgh, NY 12550 on the right	

CONTRACT NO
60308608

CARTOGRAPHY BY
A. Weber

CHECKED BY	DATE
B. McGuinness	October 2013
SCALE	SHEET
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Stewart_ANGB_Route.mxd

Stewart Air National Guard Base

Driving Directions From
Stewart Air National Guard Base to
St. Luke's Cornwall Hospital

AECOM
675 N. Washington Street, Suite 300, Alexandria VA 22314
Phone 703.549.8728 Fax 703.549.9134 aecom.com

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15 Personnel Acknowledgement

By signing below, the undersigned acknowledges that he/she has read and reviewed the AECOM APP and SSHP for Fort Ritchie OU4. 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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16 References

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Attachment A

Activity Hazard Analysis

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ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC) (Use highest code): M

Date: TBD

Project: ANGB PA/SI

Activity: Soil Boring and Sample Collection

Activity Location: ANGB

Prepared By: Brendan McGuinness

Risk Assessment Code Matrix

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

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Add Identified Hazards

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Establish EZ and Air Monitoring in Work Area	-Slips, trips, and uneven surfaces -Cuts/lacerations from sharp objects and hand tool usage -Biological Hazards -Traffic in roads and parking lots	Keep work area clear of surface encumbrances Use proper hand protection (leather work gloves) and approved cutting devices (tubing cutter) -Use proper PPE and repellents -Use combination of vehicle and cones, traffic barriers and/or caution tape	L
X	Conduct DPT drilling of borehole	-Heat Stress and UV sunlight -Slips, trips, and uneven surfaces -Underground and overhead utilities -Potential contaminant exposure -Heavy equipment operations -Cuts/lacerations from sharp objects and hand tool usage -Traffic in roads, parking lots, and garage	-Monitor for heat stress and use UV protection -Work in areas clear of surface encumbrances -Conduct utility locates, maintain appropriate distances -Use proper PPE and follow air monitoring procedures -Use hand signals, keep clear of moving equipment, ensure eye contact with operator. Do not wear loose clothing or jewelry. Use hearing protection. -Use proper cutting devices and wear leather work gloves. -Use combination of vehicles and cones, traffic barriers and/or caution tape	M
X	Collect Soil Samples	-Heat Stress and UV sunlight -Slips, trips, and uneven surfaces -Potential contaminant exposure	-Monitor for heat stress and use UV protection -Work in areas clear of surface encumbrances -Use proper PPE and follow air monitoring procedures	L
X	Backfill boring hole	-Heat Stress and UV sunlight - Slips, trips, and uneven surfaces -Potential contaminant exposure -Traffic in roads, parking lots, and garage	-Monitor for heat stress and use UV projection -Work in areas clear of surface encumbrances -Use proper PPE and follow air monitoring procedures -Use combination of vehicles and cones, traffic barriers and/or caution tape	L

ACTIVITY HAZARDS ANALYSIS

EQUIPMENT	TRAINING	INSPECTION
Add Items		

	EQUIPMENT	TRAINING	INSPECTION
X	EPA Level D	Knowledge of the components of the Level "D" ensemble	Daily Serviceability Checks
X	Communications Equipment	Familiarity with the equipment. Knowledge of Emergency Response Procedures.	Daily communications Checks
X	Fire Extinguishers	Limitations and placement of the extinguishers. Techniques for the use of the extinguishers	Initial and Monthly Serviceability Checks
X	First Aid Kits	First Aid/CPR training current. Universal safety precautions for blood borne pathogens.	Weekly Inspection/Inventory
X	Hand Tools	Use hand tools for their intended purposes. Familiarity with the equipment.	Inspect hand tools for serviceability
X	Drill rig	Operator Training Complete Verified by SSHO. Familiarity with the vehicle being operated. Personnel working adjacent to have awareness level type training.	Daily Preventative Maintenance Checks Ensure all equipment is equipped with necessary fire extinguishers (min 5 lbs BC). Ensure back-up alarms are working properly and follow equipment inspection procedures.
X	Sampling equipment & supplies	Familiarity with sample collection process and equipment	Inspect sampling equipment before going into field to ensure all parts are present. Use approved cutting devices (no FBOK) to cut tubing Watch for broken glass and acid preservatives.

Involved Personnel:

Competent Persons:
Drill Rig Operator: TBD
SSHO: TBD
Inspections will be conducted by driller for heavy equipment and technicians for hand tools.
SSHO will verify training documentation and ensure all personnel work safely.

Acceptance Authority (digital signature): ____________________

ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC) (Use highest code): L

Date: TBD

Project: ANGB

Activity: Groundwater Sampling

Activity Location: ANGB

Prepared By: Brendan McGuinness

Risk Assessment Code Matrix

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

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Add Identified Hazards

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Establish EZ and Air Monitoring in Work Area	-Slips, trips, and uneven surfaces -Cuts/lacerations from sharp objects and hand tool usage -Biological Hazards -Traffic in roads and parking lots -Heat Stress	Keep work area clear of surface encumbrances Use proper hand protection (leather work gloves) and approved cutting devices (tubing cutter) -Use proper PPE and repellents -Use combination of vehicle and cones, traffic barriers and/or caution tape -Follow heat stress monitoring procedures. Drink fluids and take breaks in AC or shaded areas.	L
X	Sample collection via low-flow submersible pumps	-Slips, trips, and uneven surfaces -Underground and overhead utilities -Potential contaminant exposure -Cuts/lacerations from sharp objects and hand tool usage -Splashing water. Eye/contact hazards	-Work in areas clear of surface encumbrances -Conduct utility locates, maintain appropriate distances -Use proper PPE and follow air monitoring procedures -Ensure workers familiar with tool usage. Watch hand placement on stake while driving with hammer. Wear leather work gloves to avoid burrs and splinters. -Use proper cutting devices and wear leather work gloves. -Ensure safety glasses are being worn. Avoid contact with purge water.	L
X	Package and ship samples	- Slips, trips, and uneven surfaces -Potential contaminant exposure -Sprains/Strains from lifting equipment/ supplies -Broken glass and spilled preservatives	-Work in areas clear of surface encumbrances -Use proper PPE and follow air monitoring procedures -Use proper lifting techniques and get assistance when lifting heavy objects (sample coolers). -inspect coolers for broken glass. Use leather work gloves with nitrile to clean up to protect from cuts and acid preservative. Wipe down remaining sample jars and inside of cooler with water and flush.	L

Add Items

ACTIVITY HAZARDS ANALYSIS

	EQUIPMENT	TRAINING	INSPECTION
X	EPA Level D	Knowledge of the components of the Level "D" ensemble. May include use of face shield.	Daily Serviceability Checks
X	Communications Equipment	Familiarity with the equipment. Knowledge of Emergency Response Procedures.	Daily communications Checks
X	Fire Extinguishers	Limitations and placement of the extinguishers. Techniques for the use of the extinguishers	Initial and Monthly Serviceability Checks
X	First Aid Kits	First Aid/CPR training current. Universal safety precautions for blood borne pathogens.	Weekly Inspection/Inventory
X	Hand Tools	Use hand tools for their intended purposes. Familiarity with the equipment.	Inspect hand tools for serviceability
X	Sample Equipment/Supplies	Familiarity with sample collection process and equipment.	Inspect sampling equipment before going into field to ensure all parts are present. Use approved cutting devices (no FBOK) to cut tubing Watch for broken glass and acid preservatives.

Involved Personnel:

Competent Persons: N/A
SSHO: TBD
Inspections will be conducted by technicians for hand tools.
SSHO will verify training documentation and ensure all personnel work safely.

Acceptance Authority (digital signature): ____________________

ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC) (Use highest code): L

Date: TBD

Project: ANG PA/SI

Activity: Mobilization/Demobilization

Activity Location: TBD

Prepared By: Brendan McGuinness

Risk Assessment Code Matrix

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

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Add Identified Hazards

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	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 SSHP or ask your supervisor if you have questions.	L
X	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.	-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. -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 or the truck. It can cause property damage or serious injuries to others or yourself by falling-off from vehicle.	L

ACTIVITY HAZARDS ANALYSIS

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Perform perimeter walk around of vehicle for damage or unusual conditions.	-Low air pressure, flat tire, blowout, impaired vision, collision, injury.	-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.	L
X	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.	L
X	DURING TRIP - Keep your eyes moving. Aim high in steering.	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 distraction 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.	L
X	Driving and/or walking to sample locations.	Damage to equipment or vehicles due to surface/subsurface obstructions. Fixed facilities Biologic hazards such as insects, poison ivy, spiders, and snakes.	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/walk 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. 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).	L

Add Items

	EQUIPMENT	TRAINING	INSPECTION
X	Level D PPE	Knowledge of the components of the Level "D" ensemble. May include use of face shield.	Daily Serviceability Checks
X	Communications Equipment	Familiarity with the equipment. Knowledge of Emergency Response Procedures.	Daily communications Checks
X	Fire Extinguishers	Limitations and placement of the extinguishers. Techniques for the use of the extinguishers	Initial and Monthly Serviceability Checks

ACTIVITY HAZARDS ANALYSIS

	EQUIPMENT	TRAINING	INSPECTION
X	First Aid Kits	First Aid/CPR training current. Universal safety precautions for blood borne pathogens.	Weekly Inspection/Inventory
X	Hand Tools	Use hand tools for their intended purposes. Familiarity with the equipment.	Inspect hand tools for serviceability
X	Sample Equipment/Supplies	Familiarity with sample collection process and equipment.	Inspect sampling equipment before going into field to ensure all parts are present. Use approved cutting devices (no FBOK) to cut tubing Watch for broken glass and acid preservatives.

Involved Personnel:

Competent Persons: N/A
SSHO: TBD
Inspections will be conducted by technicians for hand tools.
SSHO will verify training documentation and ensure all personnel work safely.

Acceptance Authority (digital signature): ____________________

ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC) (Use highest code): M

Date: TBD

Project: ANGB PA/SI

Activity: Concrete Coring

Activity Location: ANGB

Prepared By: Brendan McGuinness

Risk Assessment Code Matrix

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

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Add Identified Hazards

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Set up coring equipment, water supply, and electrical supply	-Slips, trips, and uneven surfaces -Cuts/lacerations from sharp objects and hand tool usage -Traffic in roads, parking lots, and garage -Electrical usage -Flying objects	Keep work area clear of surface encumbrances Use proper hand protection (leather work gloves), boots, and eye protection -Use combination of vehicle and cones, traffic barriers and/or caution tape -Inspect electrical supply, GFCI, and extension cords	L
X	Conduct concrete coring	-Slips, trips, and uneven surfaces -Cuts/lacerations from sharp objects and hand tool usage -Traffic in roads, parking lots, and garage -Electrical usage -Flying objects	Keep work area clear of surface encumbrances Use proper hand protection (leather work gloves), boots, and eye protection -Use combination of vehicle and cones, traffic barriers and/or caution tape -Maintain electrical cords and water hoses free and clear and protect from tripping	M

Add Items

	EQUIPMENT	TRAINING	INSPECTION
X	EPA Level D	Knowledge of the components of the Level "D" ensemble	Daily Serviceability Checks
X	Communications Equipment	Familiarity with the equipment. Knowledge of Emergency Response Procedures.	Daily communications Checks
X	Fire Extinguishers	Limitations and placement of the extinguishers. Techniques for the use of the extinguishers	Initial and Monthly Serviceability Checks

ACTIVITY HAZARDS ANALYSIS

	EQUIPMENT	TRAINING	INSPECTION
X	First Aid Kits	First Aid/CPR training current. Universal safety precautions for blood borne pathogens.	Weekly Inspection/Inventory
X	Hand Tools	Use hand tools for their intended purposes. Familiarity with the equipment.	Inspect hand tools for serviceability
X	Concrete coring rig	Operator Training Complete Verified by SSHO. Familiarity with the vehicle being operated. Personnel working adjacent to have awareness level type training.	Daily Preventative Maintenance Checks

Involved Personnel:

Competent Persons:
Coring Rig Operator: TBD
SSHO: TBD
Inspections will be conducted for coring equipment and technicians for hand tools.
SSHO will verify training documentation and ensure all personnel work safely.

Acceptance Authority (digital signature): ________________________

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Attachment B

Material Safety Data Sheets (To Be Updated Prior to Operations)

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CITGO PETROLEUM CORP -- NO 2 FUEL OILS, DIESEL FUELS-ALL GRADES, 1763 -- 9150-00N060728

===================== Product Identification =====================

Product ID:NO 2 FUEL OILS, DIESEL FUELS-ALL GRADES, 1763
MSDS Date:11/11/1994
FSC:9150
NIIN:00N060728
MSDS Number: BXWZC
=== Responsible Party ===
Company Name:CITGO PETROLEUM CORP
Box:3758
City:TULSA
State:OK
ZIP:74102
Country:US
Info Phone Num:918-495-5933
Emergency Phone Num:800-424-9300(CHEMTREC)
CAGE:1JW40
=== Contractor Identification ===
Company Name:CITGO PETROLEUM CORP
Address:OFF HWY 108
Box:3758
City:LAKE CHARLES
State:LA
ZIP:70602
Country:US
Phone:918-561-5165
CAGE:1JW40
Company Name:CITIES SERVICE CO
Address:110 W 7TH
Box:300
City:TULSA
State:OK
ZIP:74102
Country:US
CAGE:12518

============= Composition/Information on Ingredients =============

Ingred Name:NO INGREDIENT FOR THIS FORMULATION_INGREDIENT

===================== Hazards Identification =====================

LD50 LC50 Mixture:SEE INGREDIENTS
Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
Health Hazards Acute and Chronic:LOW HAZ UNDER AMBIENT CNDTNS. VAPS, MISTS & FUMES HAZ. NORMALLY OF LOW TOX EXCEPT ON INGEST, IF MISTING OCCURS/DERM ABSORP. ACUTE:INHAL:MISTS/FUMES ABOVE TLV MAY CAUSE TRANSIENT EUPHORIA, RESP & GI IR RIT, HDCH, DIZZ, CNS & GENERALIZED DEPRESS, COMA, PARTICULARLY IN OXYG-DEFICIENT ATM. PULM IRRIT. SKIN:(EFTS OF OVEREXP)
Explanation of Carcinogenicity:NOT RELEVANT
Effects of Overexposure:HLTH HAZS:MILD TEMP IRRIT. EYES:MILD TO MOD IRRIT. INGEST:TOX DOSE:1 OZ TO 1 PINT FOR HUMAN ADULT. SYMPS

INCLUDE BURNING OF MOUTH & UPPER GI TRACT, VOMIT & DIARR. LESS THAN 1 OZ W/RETENTION MAY PRDCE GEN DEPRESS, SEDATION, RESP & CARDIAC INSUFFICIENCY & COMA. INJECTION:IRRIT, ERYTHEMA, EDEMA. CHRONIC:PRLNGD, (ING 10)
Medical Cond Aggravated by Exposure:PRE-EXISTING DERMATOSIS.

====================== First Aid Measures ======================

First Aid:INHAL:REMOVE FROM EXPOS, SEEK IMMED MED AID. SKIN:WASH W/SOAP & WATER. DO NOT WEAR HEAVILY CONTAM CLTHG BEFORE CLEANING. EYES:FLUSH W/LG VOLS OF TEPID WATER FOR @ LST 15 MIN. INGEST:DO NOT INDUCE VOMI T. SEEK MED AID. INJECTION:SEEK IMMED MED AID. NOTE TO MD:THIS IS LOW VISCOSITY MATL, W/SAYBOLT VISCOSITY @ 100F OF 32.6-40 SUS. IF INGEST & VOMIT OCCURS, THERE EXISTS HIGH PULM ASPIR HAZ, (SUP DAT)

==================== Fire Fighting Measures ====================

Flash Point Method:CC
Flash Point:>126F,>52C
Extinguishing Media:CO*2, DRY CHEMICAL, FOAM, WATER FOG.
Fire Fighting Procedures:WEAR NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT .
Unusual Fire/Explosion Hazard:MATERIAL IS HIGHLY VOLATILE AND EMITS VAPORS WHICH MAY BE IGNITED BY OTHER IGNITION SOURCES.

================== Accidental Release Measures ==================

Spill Release Procedures:REMOVE SOURCES OF IGNIT, VENT AREA. SM SPILLS:TAKE UP W/NONCOMBUST ABOSRB SUCH AS FULLERS EARTH/SAND. PLACE INTO CNTNRS FOR LATER DISP. LG SPILLS:CNTN SPILL IN EARTHEN DIKES FOR LATER RECOVERY. CTL IG NIT SOURCES AROUND SPILL AREA. FIRE-FIGHT (ING 4)
Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

====================== Handling and Storage ======================

Handling and Storage Precautions:KEEP CNTNR TIGHTLY CLSD & AWAY FROM HEAT & FLAME. DO NOT STORE W/STRONG OXIDIZERS. CAUTN:COMBUST LIQ. DO NOT INHALE VAPS, FUMES/MISTS. PVNT DERM CONT.
Other Precautions:CAUTN:EMPTY CNTNRS MAY CNTN PROD RESIDUE WHICH COULD INCLUDE FLAM/EXPLO VAPS. CONSULT FED, STATE & LOC AUTHS BEFORE REUSING, RECNDTNING, RECLAIMING, RECYCLING/DISP OF EMPTY CNTNRS &/OR WASTE RESIDUES OF PROD. PROT MEASURES DURING (ING 7)

============= Exposure Controls/Personal Protection =============

Respiratory Protection:NIOSH/MSHA APPROVED ORGANIC RESPIRATOR ABOVE THE TLV'S.
Ventilation:USE IN WELL VENT AREA. IN CONFINED SPACES, MECH VENT MAY BE REQ TO KEEP LEVELS OF CERTAIN COMPONENTS BELOW (ING 9)
Protective Gloves:OIL IMPERVIOUS GLOVES.
Eye Protection:ANSI APPRVD CHEM WORKERS GOGGS &(SUPDAT)
Other Protective Equipment:ANSI APPRVD EMER EYE WASH & DELUGE SHOWER . WEAR BODY-COVERING WORK CLTHS TO AVOID PRLNGD/RPTD EXPOS.
Work Hygienic Practices:WASH EXPOSED SKIN THOROUGLY WITH SOAP AND WATER. LAUNDER SOILED WORK CLOTHES BEFORE REUSE.

Supplemental Safety and Health
APPEAR & ODOR:OIL/DIESEL FUEL:WATER WHITE TO LEMON LIQ, PETROL ODOR. FIRST AID PROC:POSS INDUCING LIPOID PNEUM. FOR QTYS >FEW DROPS, USE CAREFUL GASTRIC LAVAGE W/TIGHT FITTING, CUFFED ENDOTRACHEAL TUB E. EYE PROT:FULL LENGTH FACE SHIELD

================== Physical/Chemical Properties ==================

Boiling Pt:B.P. Text:>342F,>172C
Vapor Density:>1
Spec Gravity:0.87 (H*2O=1)
Evaporation Rate & Reference:<1 (BUTYL ACETATE=1)
Solubility in Water:NEGLIGIBLE
Appearance and Odor:HIGH SULFUR FUEL OIL/DIESEL FUEL:RED LIQ, PETROL ODOR. LOW SULFUR FUEL (SUP DAT

================= Stability and Reactivity Data =================

Stability Indicator/Materials to Avoid:YES
CAUSTICS, OXIDIZING AGENTS AND STRONG ACIDS.
Stability Condition to Avoid:HEAT, FLAME.
Hazardous Decomposition Products:CO*2, (CO UNDER INCOMPLETE COMBUSTION).

==================== Disposal Considerations ====================

Waste Disposal Methods:DISP MUST BE I/A/W FED, STATE & LOC REGS IT IS RESPONSIBILITY OF USER TO DETERM IF MATL IS HAZ WASTE AT TIME OF DISP. CHECK BEFORE DISPOSING TO BE SURE YOU ARE IN COMPLIANCE W/ALL APPLIC LAWS & REGS. RCRA EMER HOTLINE #:800-424-9346.

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CITGO PETROLEUM CORP -- GASOLINES-ALL GRADES UNLEADED, 1600 -- 9140-00N060727

==================== Product Identification ====================

Product ID:GASOLINES-ALL GRADES UNLEADED, 1600
MSDS Date:10/21/1994
FSC:9140
NIIN:00N060727
MSDS Number: BXWZB
=== Responsible Party ===
Company Name:CITGO PETROLEUM CORP
Box:3758
City:TULSA
State:OK
ZIP:74102
Country:US
Info Phone Num:918-495-5933
Emergency Phone Num:800-424-9300(CHEMTREC)
CAGE:1JW40
=== Contractor Identification ===
Company Name:CITGO PETROLEUM CORP
Address:OFF HWY 108
Box:3758
City:LAKE CHARLES
State:LA
ZIP:70602
Country:US
Phone:918-561-5165
CAGE:1JW40
Company Name:CITIES SERVICE CO
Address:110 W 7TH
Box:300
City:TULSA
State:OK
ZIP:74102
Country:US
CAGE:12518

============= Composition/Information on Ingredients =============

Ingred Name:PETROLEUM DISTILLATES; (PETROLEUM DISTILLATES MFR CAS #:MIXTURE)
Fraction by Wt: 85-98%
OSHA PEL:N/K
ACGIH TLV:N/K

Ingred Name:BENZENE (SARA 313) (CERCLA); LD50(ORAL,RAT):>5.0 G/KG
CAS:71-43-2
RTECS #:CY1400000
Fraction by Wt: <5%
OSHA PEL:SEE 1910.1028
ACGIH TLV:10 PPM; A2
EPA Rpt Qty:10 LBS
DOT Rpt Qty:10 LBS

Ingred Name:LOWER ALIPHATIC ALCOHOLS; LD50(ORAL,RAT):>5.0 G/KG

Fraction by Wt: 0-11%
OSHA PEL:N/K
ACGIH TLV:N/K

Ingred Name:LOWER ALIPHATIC ETHERS; LD50(ORAL,RAT):4 ML/KG
Fraction by Wt: 0-15%
OSHA PEL:N/K
ACGIH TLV:N/K

Ingred Name:TERT-BUTYL ALCOHOL; (TERTIARY BUTYL ALCOHOL) (SARA 313)
CAS:75-65-0
RTECS #:EO1925000
Fraction by Wt: 0-10%
OSHA PEL:100 PPM
ACGIH TLV:100 PPM

Ingred Name:BENZENE ETHYL-; (ETHYL BENZENE) (SARA 313)
CAS:100-41-4
RTECS #:DA0700000
Fraction by Wt: 0-5%
OSHA PEL:100 PPM
ACGIH TLV:100 PPM
EPA Rpt Qty:1000 LBS
DOT Rpt Qty:1000 LBS

Ingred Name:ETHER, TERT-BUTYL METHYL; (METHYL-T-BUTYL ETHER) (SARA 313)
(CERCLA)
CAS:1634-04-4
RTECS #:KN5250000
Fraction by Wt: 0-15%
OSHA PEL:N/K
ACGIH TLV:N/K
EPA Rpt Qty:1 LB
DOT Rpt Qty:1 LB

Ingred Name:TOLUENE (SARA 313) (CERCLA)
CAS:108-88-3
RTECS #:XS5250000
Fraction by Wt: 0-25%
OSHA PEL:200 PPM
ACGIH TLV:S, 50 PPM
EPA Rpt Qty:1000 LBS
DOT Rpt Qty:1000 LBS

Ingred Name:BENZENE, 1,2,4-TRIMETHYL-; (1,2,4-TRIMETHYLBENZENE) (SARA
313)
CAS:95-63-6
RTECS #:DC3325000
Fraction by Wt: 0-5%
OSHA PEL:25 PPM
ACGIH TLV:25 PPM

Ingred Name:XYLENE; (XYLENE (MIXED ISOMERS)) (SAR
CAS:1330-20-7
RTECS #:ZE2100000
EPA Rpt Qty:1000 LBS
DOT Rpt Qty:1000 LBS

===================== Hazards Identification =====================

LD50 LC50 Mixture:SEE INGREDIENTS
Routes of Entry: Inhalation:YES Skin:YES Ingestion:NO
Reports of Carcinogenicity:NTP:YES IARC:YES OSHA:YES
Health Hazards Acute and Chronic:ACUTE:INHAL:MOD RISK OF VAP INTOX. MAJOR RISK IN ENCLSD SPACES W/POOR VENT:EUPHORIA, LUNG IRRIT & EDEMA, HDCH, DIZZ, DROW, CONVLS, COMA, CYANOSIS, GENERALIZED DEPRESSION. SKIN:DEFATTING W/DRYING. EYE: IRRIT. INGEST:BURNING OF MOUTH & UPPER GI TRACT, VOMIT & DIARR. ABOVE 1 OZ/< 1 OZ W/RETENTION:GENERAL (EFTS OF OVEREXP)
Explanation of Carcinogenicity:BENZENE:IARC MONOGRAPHS, SUPP, VOL 7, PG 20, 1987:GROUP 1. NTP 7TH ANNUAL RPT ON CARCINS, 1994:KNOWN TO BE (SUP DATA)
Effects of Overexposure:HLTH HAZS:DEPRESS, SEDATION, RESP DEPRESS, COMA. CHRONIC:SKIN:DRYING (DERM). INHAL:BENZENE HAS BEEN CLASSIFIED AS LEUKEMOGEN, & MAY PRDCE ANEMIA, LEUKEMIA FROM RPTD/PRLNGD EXPOS TO HIGH CONCS. AMERICA N PETROL INSTITUTE SPONSORED CHRONIC INHAL STUDIES OF UNLEADED GASOLINE VAPS INDICATING UNLEADED GASOLINE IS (ING 12)
Medical Cond Aggravated by Exposure:PRE-EXISTING DERMATOSES.

======================= First Aid Measures =======================

First Aid:INHAL:REMOVE TO FRESH AIR. RESP SUPPORT, IF NEC. SEEK MED AID. SKIN:WASH W/SOAP & WATER. DO NOT WEAR HEAVILY CONTAM CLTHG BEFORE CLEANING. EYES:FLUSH W/LG VOLS OF WATER FOR AT LST 15 MIN. SEEK MED AID . INGEST:DO NOT INDUCE VOMIT. SEEK MED AID. NOTE TO MD:THIS IS LOW VISCOSITY MATL W/SAYBOLT VISCOSITY @ 100F OF <40 SUS. PULM HIGH ASPIR HAZ, POSS PRDCING LIPOID PNEUM IF SWALLOWED & VOMIT (ING 14)

===================== Fire Fighting Measures =====================

Flash Point Method:COC
Flash Point:-45F,-43C
Lower Limits:1.4%
Upper Limits:7.6%
Extinguishing Media:CO*2, DRY CHEMICAL, FOAM, WATER FOG.
Fire Fighting Procedures:WEAR NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT .
Unusual Fire/Explosion Hazard:MATERIAL IS HIGHLY VOLATILE AND EMITS VAPORS WHICH MAY BE IGNITED BY OTHER IGNITION SOURCES.

================== Accidental Release Measures ==================

Spill Release Procedures:REMOVE SOURCES OF IGNIT, VENT AREA. SM SPILLS:TAKE UP W/NON-COMBUST ABSORB SUCH AS FULLERS EARTH/SAND. PLACE INTO CNTNRS FOR LATER DISP. LG SPILL:CNTN IN EARTHEN DIKES FOR LATER RECOVERY. CTL IGNIT SO URCES AROUND SPILL AREA. FIRE-FIGHTING (ING 15)
Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

====================== Handling and Storage ======================

Handling and Storage Precautions:KEEP CNTNR TIGHTLY CLSD & AWAY FROM

HEAT & FLAME & STRONG OXIDIZERS (NFPA CLASS 1A FLAM). DO NOT STORE W/STRONG OXIDIZERS.
Other Precautions:CAUTN:EMPTY CNTNRS MAY CNTN PROD RESIDUE WHICH COULD PRDCE FLAM & EXPLO VAPS. CONSULT APPROP FED, STATE & LOC AUTHS BEFORE REUSING, RECNDNTING, RECLAIMING, RECYCLING/DISP OF EMPTY CNTNRS &/OR WASTE RE SIDUES OF PROD. PROT MEASURES (ING 22)

============= Exposure Controls/Personal Protection =============

Respiratory Protection:IF HIGH VAPOR CONCENTRATION IS EXPECTED, USE NIOSH/MSHA APPROVED ORGANIC RESPIRATOR. TLV:TWA: 300 PPM (900 MG/M3) STEL:500 PPM (1500 MG/M3) ACGIH-1987-88.
Ventilation:USE IN WELL VENT AREA. IN CONFINED SPACE, MECH VENT MAY BE REQ TO KEEP LEVELS OF CERTAIN COMPONENTS BELOW (ING 20)
Protective Gloves:OIL IMPERVIOUS GLOVES, SUCH AS (ING 21)
Eye Protection:ANSI APPROVED CHEM WORKERS GOGGS .
Other Protective Equipment:ANSI APPRVD EMER EYE WASH & DELUGE SHOWER . WEAR BODY-COVERING GARMENTS TO PVNT PRLNGD/RPTD DIRECT DERM EXPOS.
Work Hygienic Practices:WASH EXPOSED SKIN THORO WITH SOAP AND WATER. LAUNDER GASOLINE SOAKED CLOTHING BEFORE REUSE.
Supplemental Safety and Health
BP:>79F,>26C (SUBJECT TO SEASONAL CHANGE). VP:7-15 (MEETS SEASONAL RVP REQS SPECIFIED BY EPA). APPEAR & ODOR:LIQ, GASOLINE ODOR. MIDGRADE:LIGHT YELLOW, TO PINK, TO LIGHT RED, GASOLINE ODOR. EXPLAN OF CARCIN:CARCIN. FED REGISTER, VOL 52, PG34460, 1987:OSHA-CANCER HAZ HUMAN:MYELOID LEUKEMIA, HODGKINS DISEASE, LYMPHOMA.

================== Physical/Chemical Properties ==================

Boiling Pt:B.P. Text:SUPP DATA
Vapor Pres:SUPP DATA
Vapor Density:3-4
Spec Gravity:0.75 (H*2O=1)
Evaporation Rate & Reference:>1 (BUTYL ACETATE=1)
Solubility in Water:NEGLIGIBLE
Appearance and Odor:UNLEADED:LIGHT YELLOW OR CLEAR LIQ, GASOLINE ODOR. PREMIUM:RED CLEAR (SUPP DATA
Percent Volatiles by Volume:HIGH

================= Stability and Reactivity Data =================

Stability Indicator/Materials to Avoid:YES
STRONG OXIDANTS, STRONG ACIDS, CAUSTICS.
Stability Condition to Avoid:HIGH TEMPERATURE, FLAME.
Hazardous Decomposition Products:CO*2, (CO UNDER INCOMPLETE COMBUSTION).

==================== Disposal Considerations ====================

Waste Disposal Methods:DISP MUST BE I/A/W FED, STATE & LOC REGS IT IS RESPONSIBILITY OF USER TO DETERM IF MATL IS HAZ WASTE AT TIME OF DISP. CHECK BEFORE DISP TO BE SURE YOU ARE IN COMPLIANCE W/ALL APPLIC LAWS & REGS. RCRA EMER HOTLINE #:800-424-9346.

expressly or implied, warrants this information to be accurate and disclaims all liability for its use. Any person utilizing this document should seek competent professional advice to verify and assume responsibility for the suitability of this information to their particular situation.

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SHERWIN-WILLIAMS COMPANY SPRAYON PRODUCTS GROUP -- S03700 QUICKMARK WATERBASED MARKING PAINT(OTHER INFORMATION) -- -

==================== Product Identification ====================

Product ID:S03700 QUICKMARK WATERBASED MARKING PAINT(OTHER INFORMATION)
MSDS Date:06/28/1999
FSC:NIIN:Submitter:N EN
Status Code:A
MSDS Number: CKWSX
=== Responsible Party ===
Company Name:SHERWIN-WILLIAMS COMPANY SPRAYON PRODUCTS GROUP
Address:101 PROSPECT AVENUE N.W.
City:CLEVELAND
State:OH
ZIP:44115
Country:US
Info Phone Num:800-777-2966
Emergency Phone Num:216-566-2917
CAGE:54646
=== Contractor Identification ===
Company Name:SHERWIN-WILLIAMS COMPANY SPRAYON PRODUCTS GROUP
Address:101 PROSPECT AVENUE N.W.
Box:City:CLEVELAND
State:OH
ZIP:44115
Country:US
Phone:800-777-2966
CAGE:54646

============= Composition/Information on Ingredients =============

Ingred Name:PROPANE: VP: 760.00.
CAS:74-98-6
RTECS #:TX2275000
= Wt:16.
OSHA PEL:1000 PPM
ACGIH STEL:2500 PPM

Ingred Name:LIGHT ALIPHATIC HYDROCARBON SOLVENT. (MFR CAS #68410-97-9).
VP: 100.00
= Wt:18.

Ingred Name:MINERAL SPIRITS. (MFR CAS # 64742-88-7). VP: 2.00.
CAS:64475-85-0
RTECS #:PY8240000
= Wt:6.
OSHA PEL:100 PPM
ACGIH TLV:100 PPM

Ingred Name:ETHYLBENZENE. VP: 7.10.
CAS:100-41-4
RTECS #:DA0700000
= Wt:2.
OSHA PEL:100 PPM
OSHA STEL:125 PPM
ACGIH TLV:100 PPM

ACGIH STEL:125 PPM
EPA Rpt Qty:1000 LBS
DOT Rpt Qty:1000 LBS

Ingred Name:XYLENE. VP: 5.90
CAS:1330-20-7
RTECS #:ZE2100000
= Wt:9.
OSHA PEL:100 PPM
OSHA STEL:150 PPM
ACGIH TLV:100 PPM
ACGIH STEL:150 PPM
EPA Rpt Qty:1000 LBS
DOT Rpt Qty:1000 LBS

===================== Hazards Identification =====================

Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
Health Hazards Acute and Chronic:ACUTE: EFFECTS OF OVEREXPOSURE: IRRITATION OF EYES, SKIN AND RESPIRATORY SYSTEM. MAY CAUSE NERVOUS SYSTEM DEPRESSION. EXTREME OVEREXPOSURE MAY RESULT IN UNCONSCIOUSNESS AND POSSIBLY DEATH. CHRONIC: PROLONGED OVEREXPOSURE TO SOLVENT INGREDIENTS MAY CAUSE ADVERSE EFFECTS TO LIVER, URINARY AND REPRODUCTIVE SYSTEMS. REPORTS HAVE ASSOCIATED REPEATED OR PROLONGED OVER EXPOSURE TO SOLVENTS WITH PERMANE NT BRAIN AND NERVOUS SYSTEM DAMAGE.
Explanation of Carcinogenicity:NO INGREDIENT IN THIS PRODUCT IS AN IARC, NTP OR OSHA LISTED CARCINOGEN (MFR).
Effects of Overexposure:HEADACHE, DIZZINESS, NAUSEA, AND LOSS OF COORDINATION ARE INDICATIONS OF EXCESSIVE EXPOSURE TO VAPORS OR SPRAY MISTS. REDNESS AND ITCHING OR BURNING SENSATION MAY INDICATE EYE OR EXCESSIVE SKIN EXPOSU RE.
Medical Cond Aggravated by Exposure:NONE GENERALLY RECOGNIZED.

======================= First Aid Measures =======================

First Aid:IF INHALED: IF AFFECTED, REMOVE FROM EXPOSURE. RESTORE BREATHING. KEEP WARM & QUIET. IF ON SKIN: WASH AFFECTED AREA THOROUGHLY WITH SOAP & WATER. REMOVE CONTAMINATED CLOTHING & LAUNDER BEFORE RE-USE. IF IN EYES: FLUSH EYES WITH LARGE AMOUNTS OF WATER FOR 15 MINUTES. GET MEDICAL ATTENTION. IS SWALLOWED: NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. DO NOT INDUCE VOMITING. GIVE CONSCIOUS P ATIENT SEVERAL GLASSES OF WATER. SEEK MEDICAL ATTENTION.

===================== Fire Fighting Measures =====================

Flash Point:<-17.6C, 0.F
PROPELLANT <0F
Lower Limits:1.0
Upper Limits:9.5
Extinguishing Media:CARBON DIOXIDE, DRY CHEMICAL, ALCOHOL FOAM.
Fire Fighting Procedures:FULL PROTECTIVE EQUIPMENT INCLUDING NIOSH-APPROVED SELF-CONTAINED BREATHING APPARATUS SHOULD BE USED. WATER SPRAY MAY BE INEFFECTIVE. IF WATER USED, FOG NOZZLES PREFERABLE. WATER MAY BE USED TO COOL C LOSED CONTAINERS TO PREVENT

PRESSURE BUILD-UP & POSSIBLE AUTOIGNITION OR EXPLOSION WHEN EXPOSED TO EXTREME HEAT.
Unusual Fire/Explosion Hazard:CLOSED CONTAINERS MAY EXPLODE (DUE TO BUILD-UP OF PRESSURE) WHEN EXPOSED TO EXTREME HEAT.

================== Accidental Release Measures ==================

Spill Release Procedures:REMOVE ALL SOURCES OF IGNITION. VENTILATE AND REMOVE WITH INERT ABSORBENT.

====================== Handling and Storage ======================

Handling and Storage Precautions:KEEP AWAY FROM HEAT, SPARKS & OPEN FLAME. VAPORS WILL ACCUMULATE READILY & MAY IGNITE EXPLOSIVELY. DURING USE & UNTIL ALL VAPORS ARE GONE: KEEP AREA VENTILATED-DO NOT SMOKE-EXTINGUISH ALL FLAMES, PILO T LIGHTS & HEATERS. TURN OFF STOVES, ELECTRIC TOOLS & APPLIANCES & ANY (OTHER PRECAUTIONS)
Other Precautions:(HANDLING/STORAGE)-OTHER SOURCES OF IGNITION. CONSULT NFPA CODE. USE APPROVED BONDING & GROUNDING PROCEDURES. CONTENTS UNDER PRESSURE. DO NOT PUNCTURE, INCINERATE OR EXPOSE TO TEMP ABOVE 120F. HEAT FR OM SUNLIGHT, RADIATORS, STOVES, HOT WATER & OTHER HEAT SOURCES COULD CAUSE CONTAINER (STATE REG)

============= Exposure Controls/Personal Protection =============

Respiratory Protection:IF PERSONAL EXPOSURE CANNOT BE CONTROLLED BELOW APPLICABLE LIMITS BY VENTILATION, WEAR A PROPERLY FITTED ORGANIC VAPOR/PARTICULATE RESPIRATOR APPROVED BY NIOSH FOR PROTECTION AGAINST MATERIALS LISTED IN HAZARDOUS INGREDIENTS SECTION. WHEN SANDING OR ABRADING DRIED FILM, WEAR A NIOSH APPROVED DUST/MIST RESPIRATOR FOR DUST WHICH MAY BE GENERATED FROM PRODUCT.
Ventilation:LOCAL EXHAUST PREFERABLE. GENERAL EXHAUST ACCEPTABLE IF EXPOSURE TO MATLS IS MAINTAINED BELOW APPLICABLE EXPOSURE LIMITS. REFER TO OSHA STD (SUP DATA)
Protective Gloves:CHEMICAL-RESISTANT GLOVES FOR LONG/REPEATED CONTACT. NONE REQUIRED (SUP DATA)
Eye Protection:ANSI APPROVED CHEMICAL SAFETY GOGGLES AND FULL FACE SHIELD . (SUP DATA)
Other Protective Equipment:EYEWASH AND DELUGE SHOWER MEETING ANSI DESIGN CRITERIA .
Work Hygienic Practices:WASH HANDS AFTER USING.
Supplemental Safety and Health
GLOVES (CONT'D): FOR NORMAL APPLIC OF AEROSOL PRODUCTS WHERE MINIMAL SKIN CONTACT IS EXPECTED. EYE PROTECTION (CONT'D): WEAR SAFETY SPECTACLES WITH UNPERFORATED SIDESHIELD (MFR). VENT (CONT'D): 1910.9 4, 1910.107, 1910.108.

================== Physical/Chemical Properties ==================

Boiling Pt:<-237.2C, -395.F
B.P. Text:<0 -395F
Melt/Freeze Pt:M.P/F.P Text:N.A.
Vapor Pres:SEE OTHER INFO.
Vapor Density:HEAV AIR
Spec Gravity:0.81
pH:7.0
VOC Grams/Liter:6.75

Evaporation Rate & Reference:FASTER THAN ETHER
Solubility in Water:N.A.
Appearance and Odor:NO APPEARANCE OR ODOR SPECIFIED BY MANUFACTURER .
Percent Volatiles by Volume:90%

================= Stability and Reactivity Data =================

Stability Indicator/Materials to Avoid:YES
NONE KNOWN.
Stability Condition to Avoid:NONE KNOWN.
Hazardous Decomposition Products:BY FIRE: CARBON DIOXIDE, CARBON MONOXIDE.
Conditions to Avoid Polymerization:WILL NOT OCCUR.

==================== Disposal Considerations ====================

Waste Disposal Methods:WASTE FROM THIS PRODUCT MAY BE HAZARDOUS AS DEFINED UNDER RCRA 40 CFR 261. WASTE MUST BE TESTED FOR IGNITABILITY TO DETERMINE APPLICABLE EPA HAZARDOUS WASTE NUMBERS. DO NOT INCINERATE. DEPRESSURIZE CO NTAINER. DISPOSE OF IN ACCORDANCE WITH FEDERAL, STATE & LOCAL REGUALTIONS REGARDING POLLUTION.

===================== Regulatory Information =====================

SARA Title III Information:SARA 313 (40 CFR 372.65C) SUPPLIER NOTIFICATION: CAS #100-41-4: ETHYLBENZENE, 2% BY WT. CAS #1330-20-7: XYLENE, 9% BY WT.
Federal Regulatory Information:TSCA CERTIFICATION: ALL CHEMICALS IN THIS PRODUCT ARE LISTED, OR ARE EXEMPT FROM LISTING, ON THE TSCA INVENTORY.
State Regulatory Information:CALIFORNIA PROPOSITION 65: WARNING: PRODUCT CONTAINS CHEMICALS KNOWN TO STATE OF CA TO CAUSE CANCER & BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM--ETHYLBENZENE & XYLENE. OTHER PRECAUTIONS (CONT'D):TO BU RST. DO NOT TAKE INTERNALLY. KEEP OUT OF REACH OF CHILDREN. INTENTIONAL MISUSE BY DELIBERATELY CONCENTRATING & INHALING CONTENTS CAN BE HARMFUL OR FATAL. USE ONLY W/ADEQUATE VENTILATION. AVOID BREATHI NG VAPOR & SPRAY MIST. AVOID CONTACT WITH SKIN & EYES. WASH HANDS AFTER USING. THIS COATING MAY CONT AIN MATERIALS CLASSIFIED AS NUISANCE PARTICULATES WHICH MAY BE PRESENT AT HAZARDOUS LEVELS ONLY DURING SANDING/ABRADING (OTHER INFORMATION)

======================= Other Information =======================

Attachment C

Equipment Safety Cards (To Be Updated Prior to Operations)

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SAFETY CARD

CORE DRILLING MACHINE

Objective / Overview:

Core drilling machines are used on all types of jobs. They can be electrical or gas powered and come with a stand or can be hand held. Caution should be used when operating such a machine. It may look harmless and easy to run, but drilling machines have many hazards.

Safe Operating Guidelines:

Clean the flanges before mounting the blade. Make sure the blade is correct for the material being cut and the arrow on the blade corresponds with the direction of rotation of the machine spindle. Avoid tilting the blade when cutting. Use only the machines that have an approved safety guard. Remove the diamond blade from the machine during transit to prevent accidental damage. Inspect the blades frequently to detect cracks or undercutting of the steel center. Don't let excessive heat be generated at the cutting edge of the blade. Use adequate water supply to both sides of the blade. Follow the manufacturers recommended pulley sizes and operating speeds for specific blade diameters. Make sure to tighten drive belts to ensure full available power. Don't force the blade on the blade shaft or mount blade on an undersized spindle.

Potential Hazards:

- Electrical shock
- Flying debris
- Severe cuts
- Hearing loss
- Breathing fumes or dust

Training Requirements:

- Review of Applicable SOPs (SH&E 610, *Hand and Power Tools* & SH&E 611, *Electrical Safety-Portable Electrical Equipment*)
- Demonstrated knowledge on the use of a coring machine
- Review and follow manufacturers operating guidelines

Personal Protective Equipment (Level D PPE) and:

- Leather gloves
- Face shield
- Hearing protection
- Respirator or dust mask

Other Safety Tips:

- Keep fingers and hands away from the cutting edge.
- Hold handle firmly when operating.
- A subsurface utility clearance should be performed prior to initiating drilling operations.

Safety Card

Power Drill

Objective / Overview:

Available in a variety of types and capacities, portable power drills are undoubtedly the most used power tools. Because of their handiness and application to a wide range of jobs, drills often receive heavy use. For this reason, you'll need to carefully check your drill's capacity limitations and accessory recommendations.

Safe Operating Guidelines:

Check carefully for loose power cord connections and frays or damage to the cord. Replace damaged tool and extension cords immediately. Be sure the chuck is tightly secured to the spindle. This is especially important on reversible type drills. Tighten the bit securely as prescribed by the owner / operator's manual. The chuck key must be removed from the chuck before starting the drill. A flying key can be an injury-inflicting missile. Check auxiliary handles, if part of the tool. Be sure they are securely installed. Always use the auxiliary drill handle when provided. It gives you more control of the drill, especially if stalled conditions occur. Grasp the drill firmly by insulated surfaces. Always hold or brace the tool securely. Brace against stationary objects for maximum control. If drilling in a clockwise -- forward -- direction, brace the drill to prevent a counter-clockwise reaction. Don't force a drill. Apply enough pressure to keep the drill bit cutting smoothly. If the drill slows down, relieve the pressure. Forcing the drill can cause the motor to overheat, damage the bit and reduce operator control.

Potential Hazards:

- Electrical shock
- Leaving chuck wrench in tool
- Puncture wounds
- Flying debris
- Severe cuts
- Fire
- Burns (hot bits)
- Sprains/strains (wrist)

Training Requirements:

- Review of Applicable SOPs (SH&E 610, *Hand and Power Tools* & SH&E 611, *Electrical Safety-Portable Electrical Equipment*)
- Demonstrated knowledge on the use of a power drill
- Review and follow manufacturers operating guidelines

Personal Protective Equipment (Level D PPE) and:

- Leather Gloves

Other Safety Tips:

- Electric drills must be double-insulated or plugged into a GFCI outlet.
- Never carry tool by cord or yank it to disconnect from receptacle.
- Keep cord away from sharp edges.

SAFETY NOW NO OTHER WAY

AECOM

SAFETY CARD

PRESSURE WASHERS

Objective / Overview:

High pressure washers can operate up to pressures of 5,000 psi and come in a variety of types ranging from gas operated to electrical. If not used correctly and safely, pressure washers can be a dangerous piece of work equipment. Earth Tech only allows trained, authorized personnel to operate the high pressure washers. Along with training, other safety measures include: reviewing the manufacturers instructional booklet, proper maintenance of equipment, and personal protective equipment.

Safe Operating Guidelines:

The gun valve must always be pointed at the work area, NEVER point the gun valve at yourself or another person. High pressure washers shall be used to clean or decontaminate equipment, surfaces or structures only. High pressure washers WILL NOT be used to clean or decontaminate workers or personal protective equipment while it is being worn. Always set the tripper safety lock when the gun valve is not in use.

Potential Hazards:

- Kickback – Sudden and violent reverse movement of the gun
- Flying debris
- Slips and trips on wet surfaces and hoses
- Exhaust fumes/carbon monoxide (CO) in enclosed spaces
- Severe cuts

Training Requirements:

- Review of Applicable SOPs (SH&E 613, *Pressure Washers*)
- Demonstrated knowledge on the use of a pressure washer
- Review of manufacturers operating guidelines

Personal Protective Equipment (Level D PPE) and:

- Hard hat with faceshield
- Heavy gloves
- Hearing protection
- PVC (or equivalent) rain suit

Other Safety Tips:

- Never fill a pressure washer fuel tank with fuel while the engine is running or if the engine is still hot
- Non-operators must remain a minimum of 25 feet from the operator
- High pressure washing equipment should be cleaned often to avoid dirt buildup, especially around the trigger and guard area
- Always set the trigger safety lock when the gun valve is not in use
- Relieve the pressure in the system before coupling and uncoupling hoses
- Visually inspect the full length of high pressure discharge hose and inspect other high pressure fluid-handling components for abrasions or cuts, damage caused by exposure to chemicals and for damage caused by kinks in the hose

SAFETY NOW NO OTHER WAY

AECOM

SAFETY CARD

UTILITY KNIVES / RAZORS

Objective / Overview:

Utility knives serve a variety of purposes at worksites, and can be a useful tool, when used safely and correctly. Learning proper positioning and correctly using a utility knife will drastically reduce the potential of cut related injuries.

Safe Operating Guidelines:

Always be sure that knives are sharp and not dull. A dull blade will require more force to cut, increasing the likelihood of slipping. Be sure to blade is seated in the frame of the knife correctly, closed, and fastened together properly. Always keep body parts away from the cut line, (e.g., fingers), and ensure that the material being cut is on firm ground and not against a body part (cutting rope against your leg). Always pull the knife, never push the knife (the blade may break, and momentum could cause the body to come into contact with broken blade). Always retract the blade when not in use.

Potential Hazards:

Lacerations from direct contact with the blade
- Lacerations from blade breaking or shattering
- Ergonomics

Training Requirements:

- Review of Applicable SOPs (SH&E 610, *Hand and Power Tools*)
- Demonstrated knowledge on the safe use of a utility knives
- Review and follow manufacturers operating guidelines for specialized or unusual knives.

Personal Protective Equipment (Level D PPE) and:

Cut resistant gloves (Kevlar, thick leather, etc.).

Other Safety Tips:

- Purchase safety equipped utility knives with guarding or automatically retracting blades
- Replace dull blades – When knife begins to tear rather than cut, it is a good indicator the blade is dull.
- Always wear a cut resistant glove on your free hand.
- Always use the right tool for the job – NEVER use the blade as a screwdriver or prying tool.
- When using a knife to cut thicker materials, use several passes. Increased force on the blade can cause it to stray from the intended cut path, or break the blade.
- When changing blades, always handle from the non-sharp side. Cover blade with duct tape and dispose.
- Use an alternate tool when possible (scissors, wire cutters, etc.)

Utility Knives with Gaurding

Appendix D

Field Standard Operating Procedures

3-02	Logbooks
3-03	Recordkeeping, Sample Labeling and Chain-of-Custody
3-04	Sample Handling, Storage, and Shipping
3-05	IDW Management
3-06	Equipment Decontamination
3-12	Monitoring Well Installation
3-13	Monitoring Well Development
3-14	Monitoring Well Sampling
3-17	Direct Push Sampling Techniques
3-20	Operation and Calibration of a PID
3-21	Surface and Subsurface Soil Sampling
3-37	Grab Groundwater Sampling Techniques

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AECOM

Logbooks

Procedure 3-02

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes the activities and responsibilities pertaining to the identification, use, and control of logbooks and associated field data records.

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

2.1 In order to keep the logbook clean, store it in a clean location and use it only when outer gloves used for PPE have been removed.

3.0 Terms and Definitions

3.1 **Logbook**

A logbook is a bound field notebook with consecutively numbered, water-repellent pages that is clearly identified with the name of the relevant activity, the person assigned responsibility for maintenance of the logbook, and the beginning and ending dates of the entries.

3.2 **Data Form**

A data form is a predetermined format utilized for recording field data that may become, by reference, a part of the logbook (e.g., soil boring logs, trenching logs, surface soil sampling logs, groundwater sample logs, and well construction logs are data forms).

4.0 Training and Qualifications

4.1 The **Project Manager** or **designee** is responsible for determining which team members shall record information in field logbooks and for obtaining and maintaining control of the required logbooks. The **Project Manager** shall review the field logbook on at least a monthly basis. The **Project Manager** or **designee** is responsible for reviewing logbook entries to determine compliance with this procedure and to ensure that the entries meet the project requirements.

4.2 A knowledgeable individual such as the **Field Manager**, **Project Manager**, or **Program Quality Manager** shall perform a technical review of each logbook at a frequency commensurate with the level of activity (weekly is suggested, or, at a minimum, monthly). Document these reviews by the dated signature of the reviewer on the last page or page immediately following the material reviewed.

4.3 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

4.4 The **Field Manager** is responsible for ensuring that all **field personnel** follow these procedures and that the logbook is completed properly and daily. The **Field Manager** is also responsible for submitting copies to the **Project Manager**, who is responsible for filing them and submitting a copy (if required by the project's Statement of Work).

4.5 The **logbook user** is responsible for recording pertinent data into the logbook to satisfy project requirements and for attesting to the accuracy of the entries by dated signature. The **logbook user** is also responsible for safeguarding the logbook while having custody of it.

4.6 All **field personnel** are responsible for the implementation of this procedure.

5.0 Equipment and Supplies

5.1 Field logbooks shall be bound field notebooks with water-repellent pages.

5.2 Pens shall have indelible black ink.

6.0 Procedure

6.1 The field logbook serves as the primary record of field activities. Make entries chronologically and in sufficient detail to allow the writer or a knowledgeable reviewer to reconstruct the applicable events. Store the logbook in a clean location and use it only when outer gloves used for personal protective equipment (PPE) have been removed.

6.2 Individual data forms may be generated to provide systematic data collection documentation. Entries on these forms shall meet the same requirements as entries in the logbook and shall be referenced in the applicable logbook entry. Individual data forms shall reference the applicable logbook and page number. At a minimum, include names of all samples collected in the logbook even if they are recorded elsewhere.

6.3 Enter field descriptions and observations into the logbook, as described in Attachment 1, using indelible black ink.

6.4 Typical information to be entered includes the following:

- Dates (month/day/year) and times (military) of all on-site activities and entries made in logbooks/forms;
- Site name and description;
- Site location by longitude and latitude, if known;
- Weather conditions, including temperature and relative humidity;
- Fieldwork documentation, including site entry and exit times;
- Descriptions of, and rationale for, approved deviations from the work plan (WP) or field sampling plan;
- Field instrumentation readings;
- Names, job functions, and organizational affiliations of on-site personnel;
- Photograph references;
- Site sketches and diagrams made on site;
- Identification and description of sample morphology, collection locations, and sample numbers;
- Sample collection information, including dates (month/day/year) and times (military) of sample collections, sample collection methods and devices, station location numbers, sample collection depths/heights, sample preservation information, sample pH (if applicable), analysis requested (analytical groups), etc., as well as chain-of-custody (COC) information such as sample identification numbers cross-referenced to COC sample numbers;

- Sample naming convention;
- Field quality control (QC) sample information;
- Site observations, field descriptions, equipment used, and field activities accomplished to reconstruct field operations;
- Meeting information;
- Important times and dates of telephone conversations, correspondence, or deliverables;
- Field calculations;
- PPE level;
- Calibration records;
- Contractor and subcontractor information (address, names of personnel, job functions, organizational affiliations, contract number, contract name, and work assignment number);
- Equipment decontamination procedures and effectiveness;
- Laboratories receiving samples and shipping information, such as carrier, shipment time, number of sample containers shipped, and analyses requested; and
- User signatures.

6.5 The logbook shall reference data maintained in other logs, forms, etc. Correct entry errors by drawing a single line through the incorrect entry, then initialing and dating this change. Enter an explanation for the correction if the correction is more than for a mistake.

6.6 At least at the end of each day, the person making the entry shall sign or initial each entry or group of entries.

6.7 Enter logbook page numbers on each page to facilitate identification of photocopies.

6.8 If a person’s initials are used for identification, or if uncommon acronyms are used, identify these on a page at the beginning of the logbook.

6.9 At least weekly and preferably daily, the **preparer** shall photocopy and retain the pages completed during that session for backup. This will prevent loss of a large amount of information if the logbook is lost.

7.0 Quality Control and Assurance

7.1 Review per Section 4.2 shall be recorded.

8.0 Records, Data Analysis, Calculations

8.1 Retain the field logbook as a permanent project record. If a particular project requires submittal of photocopies of logbooks, perform this as required.

8.2 Deviations from this procedure shall be documented in field records. Significant changes shall be approved by the **Program Quality Manager**.

9.0 Attachments or References

9.1 Attachment 1 – Description of Logbook Entries

9.2 Department of Defense, United States (DoD). 2005. *Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP-QAPP Manual*. Final Version 1. DoD: DTIC ADA 427785, EPA-505-B-04-900A. In conjunction with the U. S. Environmental Protection Agency

and the Department of Energy. Washington: Intergovernmental Data Quality Task Force. March. On-line updates available at: http://www.epa.gov/fedfac/pdf/ufp_qapp_v1_0305.pdf.

Attachment 1
Description of Logbook Entries

Logbook entries shall be consistent with Section A.1.4 *Field Documentation SOPs* of the UFP-QAPP Manual (DoD 2005) and contain the following information, as applicable, for each activity recorded. Some of these details may be entered on data forms, as described previously.

Name of Activity	For example, Asbestos Bulk Sampling, Charcoal Canister Sampling, Aquifer Testing.
Task Team Members and Equipment	Name all members on the field team involved in the specified activity. List equipment used by serial number or other unique identification, including calibration information.
Activity Location	Indicate location of sampling area as indicated in the field sampling plan.
Weather	Indicate general weather and precipitation conditions.
Level of PPE	Record the level of PPE (e.g., Level D).
Methods	Indicate method or procedure number employed for the activity.
Sample Numbers	Indicate the unique numbers associated with the physical samples. Identify QC samples.
Sample Type and Volume	Indicate the medium, container type, preservative, and the volume for each sample.
Time and Date	Record the time and date when the activity was performed (e.g., 0830/08/OCT/89). Use the 24-hour clock for recording the time and two digits for recording the day of the month and the year.
Analyses	Indicate the appropriate code for analyses to be performed on each sample, as specified in the WP.
Field Measurements	Indicate measurements and field instrument readings taken during the activity.
Chain of Custody and Distribution	Indicate chain-of-custody for each sample collected and indicate to whom the samples are transferred and the destination.
References	If appropriate, indicate references to other logs or forms, drawings, or photographs employed in the activity.
Narrative (including time and location)	Create a factual, chronological record of the team's activities throughout the day including the time and location of each activity. Include descriptions of general problems encountered and their resolution. Provide the names and affiliations of non-field team personnel who visit the site, request changes in activity, impact the work schedule, request information, or observe team activities. Record any visual or other observations relevant to the activity, the contamination source, or the sample itself. It should be emphasized that logbook entries are for recording data and chronologies of events. The logbook author must include observations and descriptive notations, taking care to be objective and recording no opinions or subjective comments unless appropriate.
Recorded by	Include the signature of the individual responsible for the entries contained in the logbook and referenced forms.
Checked by	Include the signature of the individual who performs the review of the completed entries.

Recordkeeping, Sample Labeling, and Chain-of-Custody

Procedure 3-03

1.0 Purpose and Scope

1.1 The purpose of this standard operating procedure is to establish standard protocols for all field personnel for use in maintaining field and sampling activity records, writing sample logs, labeling samples, ensuring that proper sample custody procedures are utilized, and completing chain-of-custody/analytical request forms.

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

Not applicable.

3.0 Terms and Definitions

3.1 **Logbook**

A logbook is a bound field notebook with consecutively numbered, water-repellent pages that is clearly identified with the name of the relevant activity, the person responsible for maintenance of the logbook, and the beginning and ending dates of the entries.

3.2 **Chain-of-Custody**

Chain-of-custody (COC) is documentation of the process of custody control. Custody control includes possession of a sample from the time of its collection in the field to its receipt by the analytical laboratory, and through analysis and storage prior to disposal.

4.0 Training and Qualifications

4.1 The **Project Manager** is responsible for determining which team members shall record information in the field logbook and for checking sample logbooks and COC forms to ensure compliance with these procedures. The **Project Manager** shall review COC forms on a monthly basis at a minimum.

4.2 The **Project Manager** and **Program Quality Manager** are responsible for evaluating project compliance with the Project Procedures Manual.

4.3 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

4.4 The **Laboratory Project Manager** or **Sample Control Department Manager** is responsible for reporting any sample documentation or COC problems to the **Project Manager** or **Project Laboratory Coordinator** within 24 hours of sample receipt.

4.5 The **Field Manager** is responsible for ensuring that all **field personnel** follow these procedures. The **Project Laboratory Coordinator** is responsible for verifying that the COC/analytical request forms have been completed properly and match the sampling and analysis plan. The **Project Manager** or **Project Laboratory Coordinator** is responsible for notifying the **laboratory**, **data managers**, and **data validators** in writing if analytical request changes are required as a corrective action. These small changes are different from change orders, which involve changes to the scope of the subcontract with the laboratory and must be made in accordance with a respective contract (e.g., CLEAN remedial action contract).

4.6 All **field personnel** are responsible for following these procedures while conducting sampling activities. **Field personnel** are responsible for recording pertinent data into the logbook to satisfy project requirements and for attesting to the accuracy of the entries by dated signature.

5.0 Procedure

This procedure provides standards for documenting field activities, labeling the samples, documenting sample custody, and completing COC/analytical request forms. The standards presented in this section shall be followed to ensure that samples collected are maintained for their intended purpose and that the conditions encountered during field activities are documented.

5.1 Recordkeeping

The field logbook serves as the primary record of field activities. Make entries chronologically and in sufficient detail to allow the writer or a knowledgeable reviewer to reconstruct each day's events. Field logs such as soil boring logs and ground-water sampling logs will also be used. These procedures are described in Procedure 3-02, *Logbooks*.

5.2 Sample Labeling

Affix a sample label with adhesive backing to each individual sample container. Place clear tape over each label (preferably prior to sampling) to prevent the labels from tearing off, falling off, being smeared, and to prevent loss of information on the label. Record the following information with a waterproof marker on each label:

- Project name or number (optional);
- COC sample number;
- Date and time of collection;
- Sampler's initials;
- Matrix (optional);
- Sample preservatives (if applicable); and
- Analysis to be performed on sample (this shall be identified by the method number or name identified in the subcontract with the laboratory).

These labels may be obtained from the analytical laboratory or printed from a computer file onto adhesive labels.

5.3 Custody Procedures

For samples intended for chemical analysis, sample custody procedures shall be followed through collection, transfer, analysis, and disposal to ensure that the integrity of the samples is maintained. Maintain custody of samples in accordance with the U.S. Environmental Protection Agency (EPA) COC guidelines prescribed in EPA *NEIC Policies and Procedures*, National Enforcement Investigations Center, Denver, Colorado, revised May 1986; EPA *RCRA Ground Water Monitoring Technical Enforcement Guidance Document* (TEGD); *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA OSWER Directive 9355 3-01); Appendix 2 of the *Technical Guidance Manual for Solid Waste Water*

Quality Assessment Test (SWAT) Proposals and Reports; and *Test Methods for Evaluating Solid Waste* (EPA SW-846)

A description of sample custody procedures is provided below.

5.3.1 Sample Collection Custody Procedures

According to the U.S. EPA guidelines, a sample is considered to be in custody if one of the following conditions is met:

- It is in one's actual physical possession or view;
- It is in one's physical possession and has not been tampered with (i.e., it is under lock or official seal);
- It is retained in a secured area with restricted access; and
- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal.

Place custody seals on sample containers immediately after sample collection and on shipping coolers if the cooler is to be removed from the sampler's custody. Place custody seals in such a manner that they must be broken to open the containers or coolers. Label the custody seals with the following information:

- Sampler's name or initials; and
- Date and time that the sample/cooler was sealed.

These seals are designed to enable detection of sample tampering. An example of a custody seal is shown in Attachment 1.

Field personnel shall also log individual samples onto COC forms (carbon copy or computer generated) when a sample is collected. These forms may also serve as the request for analyses. Procedures for completing these forms are discussed in Section 7.4, indicating sample identification number, matrix, date and time of collection, number of containers, analytical methods to be performed on the sample, and preservatives added (if any). The **samplers** will also sign the COC form signifying that they were the personnel who collected the samples. The COC form shall accompany the samples from the field to the laboratory. When a cooler is ready for shipment to the analytical laboratory, the **person delivering the samples for transport** will sign and indicate the date and time on the accompanying COC form. One copy of the COC form will be retained by the **sampler** and the remaining copies of the COC form shall be placed inside a self-sealing bag and taped to the inside of the cooler. Each cooler must be associated with a unique COC form. Whenever a transfer of custody takes place, **both parties** shall sign and date the accompanying carbon copy COC forms, and the **individual relinquishing the samples** shall retain a copy of each form. One exception is when the samples are shipped; the **delivery service personnel** will not sign or receive a copy because they do not open the coolers. The **laboratory** shall attach copies of the completed COC forms to the reports containing the results of the analytical tests. An example COC form is provided in Attachment 2.

5.3.2 Laboratory Custody Procedures

The following custody procedures are to be followed by an **independent laboratory** receiving samples for chemical analysis; the procedures in their Naval Facilities Engineering Service Center-evaluated Laboratory Quality Assurance Plan must follow these same procedures. A **designated sample custodian** shall take custody of all samples upon their arrival at the analytical laboratory. The **custodian** shall inspect all sample labels and COC forms to ensure that the information is consistent, and that each is properly completed. The **custodian** will also measure the temperature of the temperature blank in the coolers upon arrival using either a National Institute for Standards and Technology calibrated thermometer or an infra-red temperature gun. The **custodian** shall note the condition of the samples including:

- If the samples show signs of damage or tampering;
- If the containers are broken or leaking;
- If headspace is present in sample vials;
- If proper preservation of samples has occurred (made by pH measurement, except volatile organic compounds [VOCs] and purgeable total petroleum hydrocarbons [TPH] and temperature). The pH of VOC and purgeable TPH samples will be checked by the **laboratory analyst** after the sample aliquot has been removed from the vial for analysis; and
- If any sample holding times have been exceeded.

All of the above information shall be documented on a sample receipt sheet by the **custodian**.

Discrepancies or improper preservation shall be noted by the **laboratory** as an out-of-control event and shall be documented on an out-of-control form with corrective action taken. The out-of-control form shall be signed and dated by the **sample control custodian** and **any other persons** responsible for corrective action. An example of an out-of-control form is included as Attachment 4.

The **custodian** shall then assign a unique laboratory number to each sample and distribute the samples to secured storage areas maintained at 4 degrees Celsius (soil samples for VOC analysis are to be stored in a frozen state until analysis). The unique laboratory number for each sample, COC sample number, client name, date and time received, analysis due date, and storage shall also be manually logged onto a sample receipt record and later entered into the laboratory's computerized data management system. The **custodian** shall sign the shipping bill and maintain a copy.

Laboratory personnel shall be responsible for the care and custody of samples from the time of their receipt at the laboratory through their exhaustion or disposal. Samples should be logged in and out on internal laboratory COC forms each time they are removed from storage for extraction or analysis.

5.4 Completing COC/Analytical Request Forms

COC form/analytical request form completion procedures are crucial in properly transferring the custody and responsibility of samples from field personnel to the laboratory. This form is important for accurately and concisely requesting analyses for each sample; it is essentially a release order from the analysis subcontract.

Attachment 2 is an example of a generic COC/analytical request form that may be used by **field personnel**. Multiple copies may be tailored to each project so that much of the information described below need not be handwritten each time. Attachment 3 is an example of a completed site-specific COC/analytical request form, with box numbers identified and discussed in text below.

COC forms tailored to each CTO can be drafted and printed onto multi-ply forms. This eliminates the need to rewrite the analytical methods column headers each time. It also eliminates the need to write the project manager, name, and number; QC Level; TAT; and the same general comments each time.

Complete one COC form per cooler. Whenever possible, place all VOC analyte vials into one cooler in order to reduce the number of trip blanks. Complete all sections and be sure to sign and date the COC form. One copy of the COC form must remain with the field personnel.

Box 2 **Bill To:** List the name and address of the person/company to bill only if it is not in the subcontract with the laboratory.

Box 3 **Sample Disposal Instructions:** These instructions will be stated in the Master Service Agreement or each CTO statement of work with each laboratory.

Shipment Method: State the method of shipment (e.g., hand carry or air courier via FedEx or DHL).

Comments: This area shall be used by the field team to communicate observations, potential hazards, or limitations that may have occurred in the field or additional information regarding analysis (e.g., a specific metals list, samples expected to contain high analyte concentrations).

Box 4 **Cooler No.:** This will be written on the inside or outside of the cooler and shall be included on the COC. Some laboratories attach this number to the trip blank identification, which helps track samples for VOC analysis. If a number is not on the cooler, field personnel shall assign a number, write it on the cooler, and write it on the COC.

QC Level: Enter the reporting quality control (QC) requirements (e.g., Full Data Package, Summary Data Package).

Turnaround time (TAT): TAT will be determined by a sample delivery group (SDG), which may be formed over a 14-day period, not to exceed 20 samples. Once the SDG has been completed, standard TAT is 21 calendar days from receipt of the last sample in the SDG. Entering NORMAL or STANDARD in this field will be acceptable. If quicker TAT is required, it shall be in the subcontract with the laboratory and reiterated on each COC to remind the laboratory.

Box 5 **Type of Containers:** Write the type of container used (e.g., 1-liter glass amber, for a given parameter in that column).

Preservatives: Field personnel must indicate on the COC the correct preservative used for the analysis requested. Indicate the pH of the sample (if tested) in case there are buffering conditions found in the sample matrix.

Box 6 **Sample Identification (ID) Number:** This is typically a five-character alphanumeric identifier used by the contractor to identify samples. The use of this identifier is important since the laboratories are restricted to the number of characters they are able to use. Sample numbering shall be in accordance with the project-specific sampling and analysis plan.

Description (Sample ID): This name will be determined by the location and description of the sample, as described in the project-specific sampling and analysis plan. This sample identification should not be submitted to the laboratory, but should be left blank. If a computer COC version is used, the sample identification can be input, but printed with this block black. A cross-referenced list of the COC Sample Number and sample identification must be maintained separately.

Date Collected: Record the collection date in order to track the holding time of the sample. Note: For trip blanks, record the date it was placed in company with samples.

Time Collected: When collecting samples, record the time the sample is first collected. Use of the 24-hour military clock will avoid a.m. or p.m. designations (e.g., 1815 instead of 6:15 p.m.). Record local time; the laboratory is responsible for calculating holding times to local time.

Lab ID: This is for laboratory use only.

Box 7 **Matrix/QC:** Identify the matrix (e.g., water, soil, air, tissue, fresh water sediment, marine sediment, or product). If a sample is expected to contain high analyte concentrations (e.g., a tank bottom sludge or distinct product layer), notify the laboratory in the comment section. Mark an "X" for the sample(s) that have extra volume for laboratory QC matrix spike/matrix spike duplicate (MS/MSD) purposes. The sample provided for MS/MSD purposes is usually a field duplicate.

Box 8 **Analytical Parameters:** Enter the parameter by descriptor and the method number desired (e.g., BTEX 8260B, PAHs 8270C, etc.). Whenever practicable, list the parameters as they appear in the laboratory subcontract to maintain consistency and avoid confusion.

If the COC does not have a specific box for number of sample containers, use the boxes below the analytical parameter, to indicate the number of containers collected for each parameter.

Box 9 **Sampler's Signature:** The person who collected samples must sign here.

Relinquished By: The person who turned over the custody of the samples to a second party other than an express mail carrier, such as FedEx or DHL, must sign and date here.

Received By: Typically, a representative of the receiving laboratory signs and dates here. Or, a field crew member who delivered the samples in person from the field to the laboratory might sign here. A courier, such as FedEx or DHL, does not sign here because they do not open the coolers. It must also be used by the prime contracting laboratory when samples are to be sent to a subcontractor.

Relinquished By: In the case of subcontracting, the primary laboratory will sign and date the Relinquished By space and fill out an additional COC to accompany the samples being subcontracted.

Received By (Laboratory): This space is for the final destination (e.g., at a subcontracted laboratory). A representative of the final destination (e.g., subcontracted laboratory) must sign and date here.

Box 10 **Lab No. and Questions:** This box is to be filled in by the laboratory only.

Box 11 **Control Number:** This number is the "COC" followed by the first contractor identification number in that cooler, or contained on that COC. This control number must be unique (i.e., never used twice). Record the date the COC is completed. It should be the same date the samples are collected.

Box 12 **Total # of Containers:** Sum the number of containers in that row.

Box 13 **Totals:** Sum the number of containers in each column. Because COC forms contain different formats depending on who produced the form, not all of the information listed in items 1 to 13 may be recorded; however, as much of this information as possible shall be included.

6.0 Quality Control and Assurance

6.1 Recordkeeping, sample labeling, and chain-of-custody activities must incorporate quality control measures to ensure accuracy and completeness.

6.2 Deviations from this procedure or the project-specific project work plan shall be documented in field records. Significant changes shall be approved by the **Program Quality Manager**.

7.0 Records, Data Analysis, Calculations

7.1 The COC/analytical request form shall be faxed approximately daily to the **Project Laboratory Coordinator** for verification of accuracy. Following the completion of sampling activities, the sample logbook and COC forms will be transmitted to the **Project Manager** for storage in project files. The **data validators** shall receive a copy also. The original COC/analytical request form shall be submitted by the **laboratory** along with the data delivered. Any changes to the analytical requests that are required shall be made in writing to the laboratory. A copy of this written change shall be sent to the data validators and placed in the project files. The reason for the change shall be included in the project files so that recurring problems can be easily identified.

7.2 Deviations from this procedure or the project-specific sampling and analysis plan shall be documented in the records. Significant changes shall be approved by the **Program Quality Manager**.

8.0 Attachments or References

8.1 Attachment 1 – Chain-of-Custody Seal

8.2 Attachment 2 – Generic Chain-of-Custody/Analytical Request Form

8.3 Attachment 3 – Sample Completed Chain-of-Custody

8.4 Attachment 4 – Sample Out-of-Control Form

8.5 Environmental Protection Agency, United States (EPA). 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.* Interim Final. EPA/540/G-89/004. Office of Emergency and Remedial Response. October.

8.6 EPA. 1992. *RCRA Groundwater Monitoring Draft Technical Guidance*. EPA/530/R-93/001. Office of Solid Waste. November.

8.7 EPA. 1997. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846. 3rd ed., Final Update IIIA. Office of Solid Waste.

8.8 Water Resources Control Board, State of California. 1988. *Technical Guidance Manual for Solid Waste Water Quality Assessment Test (SWAT) Proposals and Reports*. August.

8.9 Procedure 3-02, *Logbooks.*

Attachment 1
Chain-of-Custody Seal

CHAIN-OF-CUSTODY SEAL

<table>
<tr><td rowspan="3">[LABORATORY]</td><td>SAMPLE NO.</td><td>DATE</td><td>SEAL BROKEN BY</td></tr>
<tr><td colspan="2">SIGNATURE</td><td>DATE</td></tr>
<tr><td colspan="3">PRINT NAME AND TITLE (Inspector, Analyst or Technician</td></tr>
</table>

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Attachment 2
Generic Chain-of-Custody/Analytical Request Form

M901376

CHAIN OF CUSTODY RECORD

Page ____ of ____

Client/Project Name:	Project Location:	Analysis Requested
Project Number:	Field Logbook No.:	
Sampler: (Print Name) /Affiliation: Signature:	Chain of Custody Tape No.: Send Results/Report to:	

Field Sample No./ Identification	Date	Time	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid, Sludge, Etc.)	Preservative	Field Filtered							Lab I.D.	Remarks

Relinquished by: (Print Name) Signature:	Date: Time:	Received by: (Print Name) Signature:	Date: Time:	Analytical Laboratory (Destination):
Relinquished by: (Print Name) Signature:	Date: Time:	Received by: (Print Name) Signature:	Date: Time:	
Relinquished by: (Print Name) Signature:	Date: Time:	Received by: (Print Name) Signature:	Date: Time:	Serial No.

Attachment 3
Sample Completed Chain-of-Custody

Chain-of-Custody

11 Control Number: 96H0HC205

Date 9 / 3 / 96 Page 1 of 1

1

CTO/DO Manager:	Joe Smith
CTO/DO Name:	Former Navy Landfill
CTO/DO Number:	CTO 0250
Deliver results to the address above or as stated in contract	

4

Cooler No:	413
QC Level: PACDIV Level D	TAT: Normal - per contract

2

Bill To:	CLEAN/RAC Contractor
Company:	company name
Address:	Oahu, Hawaii

3

Sample Disposal	by lab
Shipment Method:	Express Courier
Comments:	PACDIV Level D, Measure Cooler Temperature at Lab

5 6 7 8 12

Sample ID (EPA ID)	Sample ID (Navy IRP Use Only)	Date Collected	Time Collected	Lab ID	Soil	Water	Other (drum, sludge, etc.)	Field Duplicate (MS/MSD)	TPH 8015B	CLP VOAs	CLP SVOAs	CLP Pesticides	CLP Metals	EPA 8080 (PCBs only)	EPA 8240	EPA 8270	Total Lead by EPA 6010					Extra Volume MS/MSD	HOLD	Total # of Containers
container # (water):									1	2	2	1	2	1								2		
Preservatives:									HCL	HCL			HNO3											
HC205		9/6/96	9:35		X				X	X	X	X	X	X										1
HC206		9/6/96	9:50		X				X	X	X	X	X	X										1
HC207		9/6/96	10:15		X				X	X	X	X	X	X										1
HC208		9/6/96	10:25		X				X	X	X	X	X	X										1
HC209		9/6/96	10:45		X				X	X	X	X	X	X										1
HC210		9/6/96	10:55			X		X		X														2
HC211		9/6/96	12:50			X			X	X	X	X	X	X										8
13								TOTALS:	6	8	7	6	7	6										16

9

Samplers Signature	Date	Time
Relinquished By:	Date	Time
Received By:	Date	Time
Relinquished By:	Date	Time
Received By (LAB):	Date	Time

Original (white), Lab Copy (yellow), Field Copy (pink)

10 For Lab Use

Lab No.:

Does COC match samples: Y or N
Broken container: Y or N
Received within holding time: Y or N
COC seal intact: Y or N
Any other problems: Y or N
If problems, Client contacted: Y or N
Date contacted: ___/___/___
Temperature (°C):

Attachment 4
Sample Out-of-Control Form

OUT OF CONTROL FORM	Status	Date	Initial
	Noted OOC		
	Submit for CA*		
	Resubmit for CA*		
	Completed		

Date Recognized:		By:	
Dated Occurred:		Matrix	
Parameter (Test Code):		Method:	
Analyst:		Supervisor:	
1. Type of Event (Check all that apply)		2. Corrective Action (CA)* (Check all that apply)	
	Calibration Corr. Coefficient <0.995		Repeat calibration
	%RSD>20%		Made new standards
	Blank >MDL		Reran analysis
	Does not meet criteria:		Sample(s) redigested and rerun
	Spike		Sample(s) reextracted and rerun
	Duplicate		Recalculated
	LCS		Cleaned system
	Calibration Verification		Ran standard additions
	Standard Additions		Notified
	MS/MSD		Other (please explain)
	BS/BSD		
	Surrogate Recovery		
	Calculations Error		
	Holding Times Missed		
	Other (Please explain	Comments:	

Samples Affected (List by Accession AND Sample No.)

3. Results of Corrective Action
☐ Return to Control (indicated with)
☐ Corrective Actions Not Successful - DATA IS TO BE FLAGGED with _____________.

Analyst:	Date:
Supervisor:	Date:
QA Department:	Date:

AECOM

Sample Handling, Storage, and Shipping

Procedure 3-04

1.0 Purpose and Scope

1.1 This standard operating procedure describes the actions to be used by personnel engaged in handling, storing, and transporting samples. The objective is to obtain samples of actual conditions with as little alteration as possible.

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

2.1 Avoid lifting heavy coolers with back muscles; instead, use leg muscles or dollies.

2.2 Wear proper gloves, such as blue nitrile and latex, as defined in the project-specific health and safety plan, when handling sample containers to avoid contacting any materials that may have spilled out of the sample containers.

3.0 Terms and Definitions

None.

4.0 Training and Qualifications

4.1 The **Project Manager** and the **Laboratory Project Manager** are responsible for identifying instances of non-compliance with this procedure and ensuring that future sample transport activities comply with this procedure.

4.2 The **Field Manager** is responsible for ensuring that all samples are shipped according to this procedure.

4.3 **Field personnel** are responsible for the implementation of this procedure.

4.4 The **Program Quality Manager** is responsible for ensuring that sample handling, storage, and transport activities conducted during all CTOs comply with this procedure.

4.5 All **field personnel** are responsible for the implementation of this procedure.

5.0 Procedure

5.1 Handling and Storage

Immediately following collection, label all samples according to Procedure 3-03, *Recordkeeping, Sample Labeling, and Chain-of-Custody*. The lids of the containers shall not be sealed with duct tape, but may be covered with custody seals or placed directly into self-sealing bags. Place the sample containers in an insulated cooler with frozen gel packs (e.g., “blue ice”) or ice in double, sealed self-sealing bags. Samples should occupy the lower portion of the cooler, while the ice should occupy the upper portion. Place an absorbent material (e.g., proper absorbent cloth material) on the bottom of the cooler to contain liquids in case of spillage. Fill all empty space between sample containers with Styrofoam® “peanuts” or other appropriate material. Prior to shipping, wrap glass sample containers on the sides, tops, and bottoms with bubble wrap or other appropriate padding and/or surround them in Styrofoam to prevent breakage during transport. Pack all glass containers for water samples in an upright position, never stacked or on their sides. Prior to shipment, replace the ice or cold packs in the coolers so that samples will be maintained as close to 4 degrees Celsius (°C) as possible from the time of collection through transport to the analytical laboratory. Ship samples within 24 hours or on a schedule allowing the laboratory to meet holding times for analyses. The procedures for maintaining sample temperatures at 4°C pertain to all field samples.

5.2 Shipping

Follow all appropriate U.S. Department of Transportation regulations (e.g., 49 Code of Federal Regulations [CFR], Parts 171-179) for shipment of air, soil, water, and other samples. Elements of these procedures are summarized below.

5.2.1 Hazardous Materials Shipment

Field personnel must state whether any sample is suspected to be a hazardous material. A sample should be assumed hazardous unless enough evidence exists to indicate it is non-hazardous. If not suspected to be hazardous, shipments may be made as described in the Section 5.2.2 for non-hazardous materials. If hazardous, follow the procedures summarized below.

Any substance or material that is capable of posing an unreasonable risk to life, health, or property when transported is classified as hazardous. Perform hazardous materials identification by checking the list of dangerous goods for that particular mode of transportation. If not on that list, materials can be classified by checking the Hazardous Materials Table (49 CFR 172.102 including Appendix A) or by determining if the material meets the definition of any hazard class or division (49 CFR Part 173), as listed in Attachment 2.

All **persons shipping hazardous materials** must be properly trained in the appropriate regulations, as required by HM-126F, Training for Safe Transportation of Hazardous Materials (49 CFR HM-126F Subpart H). The training covers loading, unloading, handling, storing, and transporting of hazardous materials, as well as emergency preparedness in the case of accidents. **Carriers**, such as commercial couriers, must also be trained. Modes of shipment include air, highway, rail, and water.

When shipping hazardous materials, including bulk chemicals or samples suspected of being hazardous, the proper shipping papers (49 CFR 172 Subpart C), package marking (49 CFR 172 Subpart D), labeling (49 CFR 172 Subpart E), placarding (49 CFR 172 Subpart F, generally for carriers), and packaging must be used. Attachment 1 shows an example of proper package markings. Refer to a copy of 49 CFR each time hazardous materials/potentially hazardous samples are shipped.

According to Section 2.7 of the International Air Transport Association Dangerous Goods Regulations publication, very small quantities of certain dangerous goods may be transported without certain marking and documentation requirements as described in 49 CFR Part 172; however, other labeling and packing requirements must still be followed. Attachment 2 shows the volume or weight for different classes of substances. A “Dangerous Goods in Excepted Quantities” label must be completed and attached to the associated shipping cooler (Attachment 3). Certain dangerous goods are not allowed on certain airlines in any quantity.

As stated in item 4 of Attachment 4, the Hazardous Materials Regulations do not apply to hydrochloric acid (HCl), nitric acid (HNO_3), sulfuric acid (H_2SO_4), and sodium hydroxide (NaOH) added to water samples if their pH or percentage by weight criteria is met. These samples may be shipped as non-hazardous materials as discussed below.

5.2.2 **Non-Hazardous Materials Shipment**

If the samples are suspected to be non-hazardous based on previous site sample results, field screening results, or visual observations, if applicable, then samples may be shipped as non-hazardous.

When a cooler is ready for shipment to the laboratory, place two copies of the chain-of-custody form inside a self-sealing bag and tape it to the inside of the insulated cooler. Then, seal the cooler with waterproof tape and label it with “Fragile,” “This-End-Up” (or directional arrows pointing up), or other appropriate notices. Place chain-of-custody seals on the coolers as discussed in Procedure 3-03, *Recordkeeping, Sample Labeling, and Chain-of-Custody*.

5.2.3 **Shipments from Outside the Continental United States**

Shipment of sample coolers to the United States from locations outside the continental United States is controlled by the U.S. Department of Agriculture (USDA) and is subject to their inspection and regulation. A “USDA Soil Import Permit” is required to prove that the receiving analytical laboratory is certified by the USDA to receive and properly dispose of soil. In addition, all sample coolers must be inspected by a **USDA representative**, affixed with a label indicating that the coolers contain environmental samples, and accompanied by shipping forms stamped by the **USDA inspector** prior to shipment.

In addition, the U.S. Customs Service must clear samples shipped from U.S. territorial possessions or foreign countries upon entry into the United States. As long as the commercial invoice is properly completed (see below), shipments typically pass through U.S. Customs Service without the need to open coolers for inspection.

Completion and use of proper paperwork will, in most cases, minimize or eliminate the need for the USDA and U.S. Customs Service to inspect the contents. Attachment 5 shows an example of how paperwork may be placed on the outside of coolers for non-hazardous materials. For hazardous materials, refer to Section 5.2.1.

In summary, tape the paperwork listed below to the outside of the coolers to accompany sample shipments. If a shipment is made up of multiple pieces (e.g., more than one cooler), the paperwork need only be attached to one cooler, provided that the **courier** agrees. All other coolers in the shipment need only to be taped and have the address and chain-of-custody seals affixed.

1. **Courier Shipping Form & Commercial Invoice:** See Attachment 6 and Attachment 7 for examples of the information to be included on the commercial invoices for soil and water, respectively. Place the courier shipping form and commercial invoice inside a clear, plastic, adhesive-backed pouch that adheres to the package (typically supplied by the courier) and place it on the cooler lid as shown in Attachment 5.
2. **Soil Import Permit (soil only):** See Attachment 8 and Attachment 9 for examples of the soil import permit and soil samples restricted entry labels, respectively. The **laboratory** shall supply these documents prior to mobilization. The USDA often stops shipments of soil without these documents. Staple together the 2-inch × 2-inch USDA label (described below) and soil import permit, and place them inside a clear plastic pouch. The **courier** typically supplies the clear, plastic, adhesive-backed pouches that adhere to the package.

   Placing one restricted entry label as shown in Attachment 5 (covered with clear packing tape) and one stapled to the actual permit is suggested.

   The USDA does not control water samples, so the requirements for soil listed above do not apply.

3. **Chain-of-Custody Seals:** The **laboratory** should supply the seals. **CTO personnel** must sign and date these. At least two seals should be placed in such a manner that they stick to both the cooler lid and body. Placing the seals over the tape (as shown in Attachment 5), then covering it with clear packing tape is suggested. This prevents the seal from coming loose and enables detection of tampering.
4. **Address Label:** Affix a label stating the destination (laboratory address) to each cooler.
5. **Special Requirements for Hazardous Materials:** See Section 5.2.1.

Upon receipt of sample coolers at the laboratory, the **sample custodian** shall inspect the sample containers as discussed in Procedure 3-03, *Recordkeeping, Sample Labeling, and Chain-of-Custody*. The samples shall then be immediately extracted and/or analyzed, or stored in a refrigerated storage area until they are removed for extraction and/or analysis. Whenever the samples are not being extracted or analyzed, they shall be returned to refrigerated storage.

6.0 Quality Control and Assurance

6.1 Sample handling, storage, and shipping must incorporate quality control measures to ensure conformance to these and the project requirements.

7.0 Records, Data Analysis, Calculations

7.1 Maintain records as required by implementing these procedures.

7.2 Deviations from this procedure or the project-specific sampling and analysis plan shall be documented in field records. Significant changes shall be approved by the **Program Quality Manager**.

8.0 Attachments or Reference

8.1 Attachment 1 – Example Hazardous Material Package Marking

8.2 Attachment 2 – Packing Groups

8.3 Attachment 3 – Label for Dangerous Goods in Excepted Quantities

8.4 Attachment 4 – SW-846 Preservative Exception

8.5 Attachment 5 – Non-Hazardous Material Cooler Marking Figure for Shipment from Outside the Continental United States

8.6 Attachment 6 – Commercial Invoice – Soil

8.7 Attachment 7 – Commercial Invoice – Water

8.8 Attachment 8 – Soil Import Permit

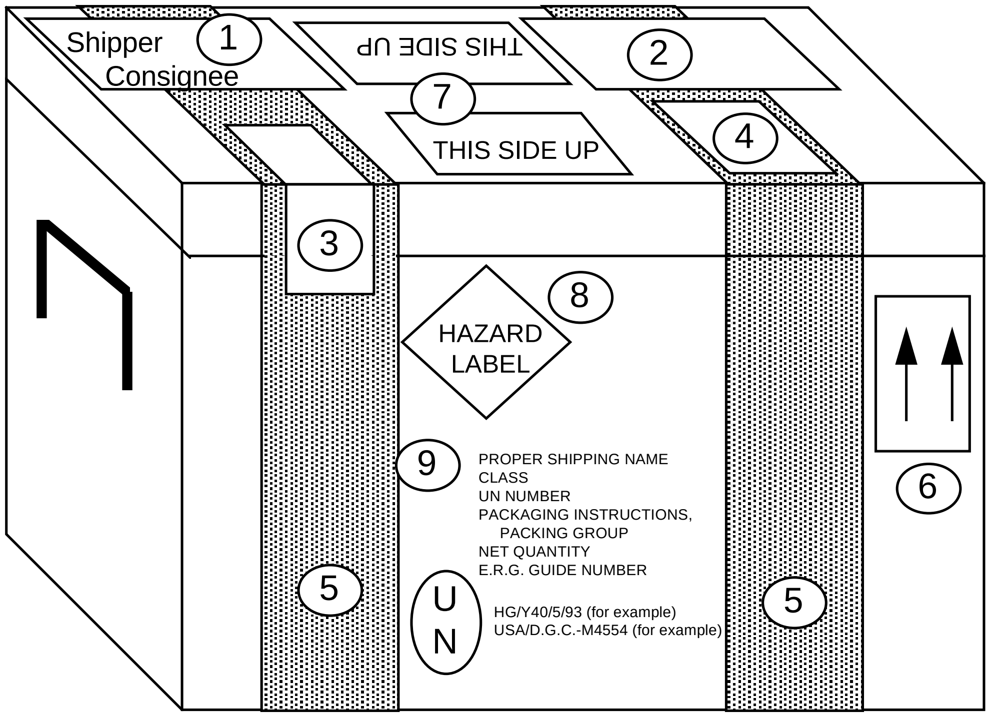
8.9 Attachment 9 – Soil Samples Restricted Entry Labels

8.10 EM 200-1-6, *Chemical Quality Assurance for HTRW Projects,* October 1997.

8.11 NAVSEA T0300-AZ-PRO-010. *Navy Environmental Compliance Sampling and Field Testing Procedures Manual*. August 2009.

8.12 Procedure 3-03, *Recordkeeping, Sample Labeling, and Chain-of-Custody*.

Attachment 1
Example Hazardous Material Package Marking



1. **AIR BILL/COMMERCIAL INVOICE**
2. **USDA PERMIT (Letter to Laboratory from USDA)**
3. **CUSTODY SEAL**
4. **USDA 2" X 2" SOIL IMPORT PERMIT**
5. **WATERPROOF STRAPPING TAPE**
6. **DIRECTION ARROWS STICKER - TWO REQUIRED**
7. **THIS SIDE UP STICKERS**
8. **HAZARD LABEL**
9. **HAZARDOUS MATERIAL INFORMATION**
10. **PACKAGE SPECIFICATIONS**

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Attachment 2
Packing Groups

PACKING GROUP OF THE SUBSTANCE	PACKING GROUP 1		PACKING GROUP II		PACKING GROUP III	
CLASS or DIVISION of PRIMARY or SUBSIDIARY RISK	Packagings		Packagings		Packagings	
	Inner	Outer	Inner	Outer	Inner	Outer
1: Explosives	---------------------------- Forbidden (Note A) ----------------------------------					
2.1: Flammable Gas	---------------------------- Forbidden (Note B) ----------------------------------					
2.2: Non-Flammable, non-toxic gas	---------------------------- See Notes A and B ----------------------------------					
2.3: Toxic gas	---------------------------- Forbidden (Note A) ----------------------------------					
3. Flammable liquid	30 mL	300 mL	30 mL	500 mL	30 mL	1 L
4.1 Self-reactive substances	Forbidden		Forbidden		Forbidden	
4.1: Other flammable solids	Forbidden		30 g	500 g	30 g	1 kg
4.2: Pyrophoric substances	Forbidden		Not Applicable		Not Applicable	
4.2 Spontaneously combustible substances	Not Applicable		30 g	500 g	30 g	1 kg
4.3: Water reactive substances	Forbidden		30 g or 30 mL	500 g or 500 mL	30 g or 30 mL	1 kg or 1 L
5.1: Oxidizers	Forbidden		30 g or 30 mL	500 g or 500 mL	30 g or 30 mL	1 kg or 1 L
5.2: Organic peroxides (Note C)	See Note A		30 g or 30 mL	500 g or 250 mL	Not Applicable	
6.1: Poisons - Inhalation toxicity	Forbidden		1 g or 1 mL	500 g or 500 mL	30 g or 30 mL	1 kg or 1 L
6.1: Poisons - oral toxicity	1 g or 1 mL	300 g or 300 mL	1 g or 1 mL	500 g or 500 mL	30 g or 30 mL	1 kg or 1 L
6.1: Poisons - dermal toxicity	1 g or 1 mL	300 g or 300 mL	1 g or 1 mL	500 g or 500 mL	30 g or 30 mL	1 kg or 1 L
6.2: Infectious substances	---------------------------- Forbidden (Note A) ----------------------------------					
7: Radioactive material (Note D)	---------------------------- Forbidden (Note A) ----------------------------------					
8: Corrosive materials	Forbidden		30 g or 30 mL	500 g or 500 mL	30 g or 30 mL	1 kg or 1 L
9: Magnetized materials	---------------------------- Forbidden (Note A) ----------------------------------					
9: Other miscellaneous materials (Note E)	Forbidden		30 g or 30 mL	500 g or 500 mL	30 g or 30 mL	1 kg or 1 L

Note A: *Packing groups are not used for this class or division.*
Note B: *For inner packagings, the quantity contained in receptacle with a water capacity of 30 mL. For outer packagings, the sum of the water capacities of all the inner packagings contained must not exceed 1 L.*
Note C: *Applies only to Organic Peroxides when contained in a chemical kit, first aid kit or polyester resin kit.*
Note D: *See 6.1.4.1, 6.1.4.2, and 6.2.1.1 through 6.2.1.7, radioactive material in excepted packages.*
Note E: *For substances in Class 9 for which no packing group is indicated in the List of Dangerous Goods, Packing Group II quantities must be used.*

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Attachment 3
Dangerous Goods in Excepted Quantities

DANGEROUS GOODS IN EXCEPTED QUANTITIES

This package contains dangerous goods in excepted small quantities and is in all respects in compliance with the applicable international and national government regulations and the IATA Dangerous Goods Regulations.

____
Signature of Shipper

______________________ ____________________
Title Date

____

____
Name and address of Shipper

This package contains substance(s) in Class(es)
(check applicable box(es))

Class:	2	3	4	5	6	8	9
	☐	☐	☐	☐	☐	☐	☐

and the applicable UN Numbers are:

Attachment 4
SW-846 Preservative Exception

Measurement	Vol. Req. (mL)	Container[2]	Preservative[3,4]	Holding Time[5]
MBAS	250	P, G	Cool, 4ºC	48 Hours
NTA	50	P, G	Cool, 4ºC	24 Hours

1. More specific instructions for preservation and sampling are found with each procedure as detailed in this manual. A general discussion on sampling water and industrial wastewater may be found in ASTM, Part 31, p. 72-82 (1976) Method D-3370.

2. Plastic (P) or Glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.

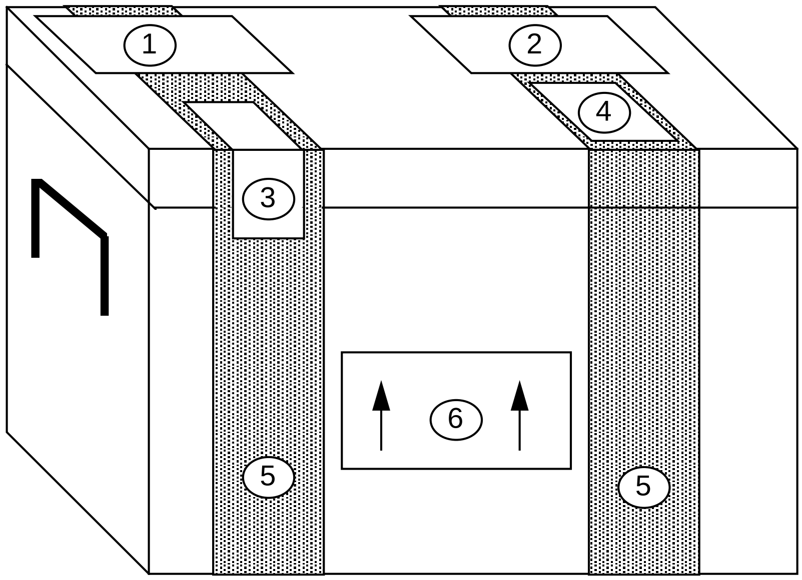
3. Sample preservation should be performed immediately upon sample collection. For composite samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then samples may be preserved by maintaining at 4ºC until compositing and sample splitting is completed.

4. When any sample is to be shipped by common carrier or sent through the United States Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. for the preservation requirements of Table 1, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentration of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

5. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of sample under study are stable for the longer time, and has received a variance from the Regional Administrator. Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample stability.

6. Should only be used in the presence of residual chlorine.

Attachment 5
Non-Hazardous Material Cooler Marking Figure for Shipment from Outside the Continental United States



1 AIR BILL/COMMERCIAL INVOICE

2 USDA PERMIT (Letter to Laboratory from USDA)

3 CUSTODY SEAL

4 USDA 2" X 2" SOIL IMPORT PERMIT

5 WATERPROOF STRAPPING TAPE

6 DIRECTION ARROWS STICKER - TWO REQUIRED

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Attachment 6
Commercial Invoice – Soil

DATE OF EXPORTATION 1/1/94	EXPORT REFERENCES (i.e., order no., invoice no., etc.) <CTO #>
SHIPPER/EXPORTER (complete name and address) Joe Smith Ogden c/o <hotel name> <hotel address>	CONSIGNEE Sample Receipt <Lab Name> <Lab Address>
COUNTRY OF EXPORT Guam, USA	IMPORTER - IF OTHER THAN CONSIGNEE
COUNTRY OF ORIGIN OF GOODS Guam, USA	
COUNTRY OF ULTIMATE DESTINATION USA	

INTERNATIONAL AIR WAYBILL NO.		(NOTE: All shipments must be accompanied by a Federal Express International Air Waybill)

MARKS/NOS	NO. OF PKGS	TYPE OF PACKAGING	FULL DESCRIPTION OF GOODS	QTY	UNIT OF MEASURE	WEIGHT	UNIT VALUE	TOTAL VALUE
	3	cooler	Soil samples for laboratory analy				$1.00	$3.00
	TOTAL NO. OF PKGS.					TOTAL WEIGHT		TOTAL INVOICE VALUE
	3							$3.00
								Check one ☐ F.O.B. ☐ C&F ☐ C.I.F.

THESE COMMODITIES ARE LICENSED FOR THE ULTIMATE DESTINATION SHOWN.

DIVERSION CONTRARY TO UNITED STATES LAW IS PROHIBITED.

I DECLARE ALL THE INFORMATION CONTAINED IN THIS INVOICE TO BE TRUE AND CORRECT

SIGNATURE OF SHIPPER/EXPORTER (Type name and title and sign)

Joe Smith, Ogden	Joe Smith	1/1/94
Name/Title	Signature	Date

AECOM

Attachment 7
Commercial Invoice – Water

DATE OF EXPORTATION 1/1/94	EXPORT REFERENCES (i.e., order no., invoice no., etc.) <CTO #>
SHIPPER/EXPORTER (complete name and address) Joe Smith Ogden c/o <hotel name> <hotel address>	CONSIGNEE Sample Receipt <Lab Name> <Lab Address>
COUNTRY OF EXPORT Guam, USA	IMPORTER - IF OTHER THAN CONSIGNEE
COUNTRY OF ORIGIN OF GOODS Guam, USA	
COUNTRY OF ULTIMATE DESTINATION USA	

INTERNATIONAL AIR WAYBILL NO. (NOTE: All shipments must be accompanied by a Federal Express International Air Waybill)

MARKS/NOS	NO. OF PKGS	TYPE OF PACKAGING	FULL DESCRIPTION OF GOODS	QTY	UNIT OF MEASURE	WEIGHT	UNIT VALUE	TOTAL VALUE
	3	coolers	Water samples for labo analysis only				$1.00	$3.00
	TOTAL NO. OF PKGS.					TOTAL WEIGHT		TOTAL INVOICE VALUE
	3							$3.00

Check one
☐ F.O.B.
☐ C&F
☐ C.I.F.

THESE COMMODITIES ARE LICENSED FOR THE ULTIMATE DESTINATION SHOWN.

DIVERSION CONTRARY TO UNITED STATES LAW IS PROHIBITED.

I DECLARE ALL THE INFORMATION CONTAINED IN THIS INVOICE TO BE TRUE AND CORRECT

SIGNATURE OF SHIPPER/EXPORTER (Type name and title and sign)

Joe Smith, Ogden   Joe Smith   1/1/94

Attachment 8
Soil Import Permit

UNITED STATES DEPARTMENT OF AGRICULTURE

Animal and Plant Health Inspection Service

Plant Protection and Quarantine

Soil Permit

Permit Number: S-52299

Issued To: Columbia Analytical Services
(Lee Wolf)
1317 S. 13th Avenue
Kelso, Washington 98626

TELEPHONE: (360) 577-7222

Under the authority of the Federal Plant Pest Act of May 23, 1957, permission is hereby granted to the facility/individual named above subject to the following conditions:

1. Valid for shipments of soil not heat treated at the port of entry, only if a compliance agreement (PPQ Form 519) has been completed and signed. Compliance Agreements and Soil permits are non-transferable. If you hold a Soil Permit and you leave your present employer or company, you must notify your local USDA office promptly.
2. To be shipped in sturdy, leakproof, containers.
3. To be released without treatment at the port of entry.
4. To be used only for analysis and only in the facility of the permittee at Columbia Analytical Services, located in Kelso, Washington.
5. No use of soil for growing purposes is authorized, including the isolation or culture of organisms imported in soil.
6. All unconsumed soil, containers, and effluent is to be autoclaved, incinerated, or heat treated by the permittee at the conclusion of the project as approved and prescribed by Plant Protection and Quarantine.
7. This permit authorizes shipments from all foreign sources, including Guam, Hawaii, Puerto Rico, and the U.S. Virgin Islands through any U.S. port of entry.

JUNE 30, 2006
Expiration Date

Deborah M. Knott
Approving Official DEBORAH M. KNOTT

WARNING: Any alteration, forgery, or unauthorized use of this Federal form is subject to civil penalties of up to $250,000 (7 U.S.C. s 7734(b)) or punishable by a fine of not more than $10,000, or imprisonment of not more than 5 years, or both (18 U.S.C. s 1001).

PPQ FORM 525B (8/94)

Pt. 1 - PERMITTEE

Attachment 9
Soil Samples Restricted Entry Labels

U.S. DEPARTMENT OF AGRICULTURE

ANIMAL AND PLANT HEALTH INSPECTION SERVICE

PLANT PROTECTION AND QUARANTINE

HYATTSVILLE, MARYLAND 20782

SOIL SAMPLES

RESTRICTED ENTRY

The material contained in this package is imported under authority of the Federal Plant Pest Act of May 23, 1957.

For release without treatment if addressee is currently listed as approved by Plant Protection and Quarantine.

PPQ FORM 550 *Edition of 12/77 may be used*

(JAN 83)

AECOM

Investigation Derived Waste Management

Procedure 3-05

1.0 Purpose and Scope

This standard operating procedure (SOP) describes activities and responsibilities of AECOM personnel responsible for the management of investigation-derived waste (IDW). The purpose of this procedure is to provide guidance for the minimization, handling, labelling, temporary storage, inventory, classification, and disposal of IDW generated during field activities. This procedure will also apply to personal protective equipment (PPE), sampling equipment, decontamination fluids, non-IDW trash, non-indigenous IDW, and hazardous waste generated during implementation of removal or remedial actions. The information presented will be used to prepare and implement work plans (WPs) for IDW-related field activities. The results from implementation of WPs will then be used to develop and implement final IDW disposal plans.

If there are procedures whether it be from AECOM, state and/or federal that are not addressed in this SOP and are applicable to IDW then those procedures may be added as an appendix to the project specific SAP.

This procedure shall serve as management-approved professional guidance for AECOM fieldwork and is consistent with protocol in the Uniform Federal Policy-Quality Assurance Project Plan (DoD 2005). As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgment during unforeseen circumstances. Deviations from this procedure while planning or executing planned activities must be approved by both the Project Manager and the Quality Assurance (QA) Manager or Technical Director, and documented.

2.0 Safety

The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the project Accident Prevention Plan/Site-specific Safety and Health Plan (APP/SSHP).

All **Field Personnel** responsible for IDW management must adhere to the APP/SSHP and must wear the PPE specified in the site-specific APP/SSHP. Generally, this includes, at a minimum, steel-toed boots or steel-toed rubber boots, safety glasses, American National Standards Institute-standard hard hats, and hearing protection (if heavy equipment is in operation). If safe alternatives are not achievable, discontinue site activities immediately.

3.0 Terms and Definitions

None.

4.0 Training and Qualifications

4.1 The **Project Manager** is responsible for ensuring that IDW management activities comply with this procedure. The **Project Manager** is responsible for ensuring that all personnel involved in IDW management shall have the appropriate education, experience, and training to perform their assigned tasks.

4.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

4.3 The **Field Manager** is responsible for ensuring that all IDW is managed according to this procedure.

4.4 All **Field Personnel** are responsible for the implementation of this procedure.

5.0 Equipment and Supplies

The equipment and supplies required for implementation of this SOP include the following:

- Containers for waste (e.g., [U.S. Department of Transportation] DOT approved 55-gallon open and closed top drums) and material to cover waste to protect from weather (e.g., plastic covering);
- Hazardous /non-hazardous waste drum labels (weatherproof);
- Permanent marking pens;
- Inventory forms for project file;
- Plastic garbage bags, zip lock storage bags, roll of plastic sheeting; and
- Steel-toed boots, chemical resistant gloves, coveralls, safety glasses, and any other PPE required in the HASP.

6.0 Procedure

The following procedures are used to handle the IDW.

6.1 Drum Handling

6.1.1 IDW shall be containerized using DOT approved drums. The drums shall be made of steel or plastic, have a 55-gallon capacity, be completely painted or opaque, and have removable lids (i.e., United Nations Code 1A2 or 1H2). Typically 55-gallon drums are used, however small drums may be used depending on the amount of waste generated. New steel drums are preferred over recycled drums.

6.1.2 Recycled drums should not be used for hazardous waste, PCBs or other regulated shipments. For short-term storage of liquid IDW prior to discharge, double-walled bulk steel or plastic storage tanks may be used. For this scenario, consider the scheduling and cost-effectiveness of this type of bulk storage, treatment, and discharge system versus longer-term drum storage.

6.1.3 For long-term IDW storage at other project locations, the DOT approved drums with removable lids are recommended. Verify the integrity of the foam or rubber sealing ring located on the underside of some drum lids prior to sealing drums containing IDW liquids.

6.1.4 If the ring is only partially attached to the drum lid, or if a portion of the ring is missing, select another drum lid with a sealing ring that is in sound condition.

6.1.5 To prepare IDW drums for labeling, wipe clean the outer wall surfaces and drum lids of all material that might prevent legible and permanent labeling. If potentially contaminated material adheres to the outer surface of a drum, wipe that material from the drum, and segregate the paper towel or rag used to remove the material with visibly soiled PPE and disposable sampling equipment. Label all IDW drums and place them on pallets prior to storage.

6.2 Labelling

6.2.1 Containers used to store IDW must be properly labelled. Two general conditions exist: 1) from previous studies or on-site data, waste characteristics are known to be either hazardous or nonhazardous; or 2) waste characteristics are unknown until additional data are obtained.

6.2.2 For situations where the waste characteristics are known, the waste containers should be packaged and labelled in accordance with state regulations and any federal regulations that may govern the labelling of waste.

6.2.3 The following information shall be placed on all non-hazardous waste labels:

- Description of waste (i.e., purge water, soil cuttings);
- Contact information (i.e., contact name and telephone number);
- Date when the waste was first accumulated.

6.2.4 The following information shall be placed on all hazardous waste labels:

- Description of waste (i.e., purge water, soil cuttings);
- Generator information (i.e., name, address, contact telephone number);
- EPA identification number (supplied by on-site client representative);
- Date when the waste was first accumulated.

6.2.5 When the final characterization of a waste is unknown, a notification label should be placed on the drum with the words “waste characterization pending analysis” and the following information included on the label:

- Description of waste (i.e., purge water, soil cuttings);
- Contact information (i.e., contact name and telephone number);
- Date when the waste was first accumulated.

6.2.6 Once the waste has been characterized, the label should be changed as appropriate for a nonhazardous or hazardous waste.

6.2.7 Waste labels should be constructed of a weatherproof material and filled out with a permanent marker to prevent being washed off or becoming faded by sunlight. It is recommended that waste labels be placed on the side of the container, since the top is more subject to weathering. However, when multiple containers are accumulated together, it also may be helpful to include labels on the top of the containers to facilitate organization and disposal.

6.2.8 Each container of waste generated shall be recorded in the field notebook used by the person responsible for labelling the waste. After the waste is disposed of, either by transportation off-site or disposal on-site in an approved disposal area, an appropriate record shall be made in the same field notebook to document proper disposition of IDW.

6.3 Types of Site Investigation Waste

Several types of waste are generated during site investigations that may require special handling. These include solid, liquid, and used PPE, as discussed further below.

Solid Waste

Soil cuttings from boreholes will typically be placed in containers unless site specific requirements allow for soil cuttings to be placed back into the borehole after drilling is complete. Drilling mud generated during investigation activities shall be collected in containers. Covers should be included on the containers and must be secured at all times and only open during filling activities. The containers shall be labelled in accordance with this SOP. An inventory containing the source, volume, and description of material put in the containers shall be logged on prescribed forms and kept in the project file.

Non-hazardous solid waste can be disposed on-site in the designated site landfill or in a designated evaporation pond if it is liquefied. Hazardous wastes must be disposed off-site at an approved hazardous waste landfill.

Liquid Waste

Groundwater generated during monitoring well development, purging, and sampling can be collected in truck-mounted containers and/or other transportable containers (i.e., 55-gallon drums). Lids or bungs on drums must be secured at all times and only open during filling or pumping activities. The containers shall be labelled in accordance with this SOP. Non-hazardous liquid waste can be disposed of in one of the designated lined evaporation ponds on-site. Hazardous wastes must be handled separately and disposed off-site at an approved hazardous waste facility.

Personal Protective Equipment

PPE that is generated throughout investigation activities shall be placed in plastic garbage bags. If the solid or liquid waste that was being handled is characterized as hazardous waste, then the corresponding PPE should also be disposed as hazardous waste. If not, all PPE should be disposed as non-hazardous waste in the designated on-site landfill. Trash that is generated as part of field activities may be disposed of in the landfill as long as the trash was not exposed to hazardous media.

6.4 Waste Accumulation On-Site

6.4.1 Solid, liquid, or PPE waste generated during investigation activities that are classified as nonhazardous or "characterization pending analysis" should be disposed of as soon as possible. Until disposal, such containers should be inventoried, stored as securely as possible, and inspected regularly, as a general good practice.

6.4.2 Solid, liquid, or PPE waste generated during investigation activities that are classified as hazardous shall not be accumulated on-site longer than 90 days. All hazardous waste containers shall be stored in a secured storage area. The following requirements for the hazardous waste storage area must be implemented:

- Proper hazardous waste signs shall be posted as required by any state or federal statutes that may govern the labelling of waste;
- Secondary containment to contain spills;
- Spill containment equipment must be available;
- Fire extinguisher;
- Adequate aisle space for unobstructed movement of personnel.

6.4.3 Weekly storage area inspections shall be performed and documented to ensure compliance with these requirements. Throughout the project, an inventory shall be maintained to itemize the type and quantity of the waste generated.

6.5 **Waste Disposal**

6.5.1 Solid, liquid, and PPE waste will be characterized for disposal through the use of client knowledge, laboratory analytical data created from soil or groundwater samples gathered during the field activities, and/or composite samples from individual containers.

6.5.2 All waste generated during field activities will be stored, transported, and disposed of according to applicable state, federal, and local regulations. All wastes classified as hazardous will be disposed of at a licensed treatment storage and disposal facility or managed in other approved manners.

6.5.3 In general, waste disposal should be carefully coordinated with the facility receiving the waste. Facilities receiving waste have specific requirements that vary even for non-hazardous waste, so characterization should be conducted to support both applicable regulations and facility requirements.

6.6 **Regulatory Requirements**

The following federal and state regulations shall be used as resources for determining waste characteristics and requirements for waste storage, transportation, and disposal:

- Code of Federal Regulations (CFR), Title 40, Part 261;
- CFR, Title 49, Parts 172, 173, 178, and 179.

6.7 **Waste Transport**

A state-certified hazardous waste hauler shall transport all wastes classified as hazardous. Typically, the facility receiving any waste can coordinate a hauler to transport the waste. Shipped hazardous waste shall be disposed of in accordance with all RCRA/USEPA requirements. All waste manifests or bills of lading will be signed either by the client or the client's designee.

7.0 Quality Control and Assurance

7.1 Management of IDW must incorporate quality control measures to ensure conformance to these and the project requirements.

8.0 Records, Data Analysis, Calculations

8.1 Maintain records as required by implanting the procedures in this SOP.

8.2 Deviations from this procedure or the sampling and analysis plan shall be documented in field records. Significant changes shall be approved by the **Program Quality Manager**.

9.0 Attachments or References

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Equipment Decontamination

Procedure 3-06

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes methods of equipment decontamination, to be used for activities where samples for chemical analysis are collected or where equipment will need to be cleaned before leaving the site or before use in subsequent activities.

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

It is the responsibility of the **Site Safety Officer (SSO)** to set up the site zones (i.e., exclusion, transition, and clean) and decontamination areas. Generally the decontamination area is located within the transition zone, upwind of intrusive activities, and serves as the washing area for both personnel and equipment to minimize the spread of contamination into the clean zone. Typically, for equipment, a series of buckets are set up on a visqueen-lined bermed area. Separate spray bottles containing cleaning solvents as described in this procedure or the project Work Plan (WP) and distilled water are used for final rinsing of equipment. Depending on the nature of the hazards and the site location, decontamination of heavy equipment, such as augers, pump drop pipe, and vehicles, may be accomplished using a variety of techniques.

All **Field Personnel** responsible for equipment decontamination must adhere to the site-specific Accident Prevention Plan/Site-specific Safety and Health Plan (APP/SSHP) and must wear the personal protective equipment (PPE) specified in the site-specific APP/SHP. Generally this includes, at a minimum, Tyvek® coveralls, steel-toed boots with boot covers or steel-toed rubber boots, safety glasses, American National Standards Institute-standard hard hats, and hearing protection (if heavy equipment is in operation). Air monitoring by the **SSO** may result in an upgrade to the use of respirators and cartridges in the decontamination area; therefore, this equipment must be available on site. If safe alternatives are not achievable, discontinue site activities immediately.

In addition to the aforementioned precautions, the following sections describe safe work practices that will be employed.

2.1 Chemical Hazards associated with Equipment Decontamination

- Avoid skin contact with and/or incidental ingestion of decontamination solutions and water.
- Utilize PPE as specified in the site-specific APP/SSHP to maximize splash protection.
- Refer to material safety data sheets, safety personnel, and/or consult sampling personnel regarding appropriate safety measures (i.e., handling, PPE including skin and respiratory).
- Take the necessary precautions when handling detergents and reagents.

2.2 Physical Hazards associated with Equipment Decontamination

- To avoid possible back strain, it is recommended to raise the decontamination area 1 to 2 feet above ground level.
- To avoid heat stress, over exertion, and exhaustion, it is recommended to rotate equipment decontamination among all site personnel.
- Take necessary precautions when handling field sampling equipment.

3.0 Terms and Definitions

None.

4.0 Training and Qualifications

4.1 The **Project Manager** is responsible for ensuring that decontamination activities comply with this procedure. The **Project Manager** is responsible for ensuring that all personnel involved in equipment decontamination shall have the appropriate education, experience, and training to perform their assigned tasks.

4.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

4.3 The **Field Manager** is responsible for ensuring that all field equipment is decontaminated according to this procedure.

4.4 All **Field Personnel** are responsible for the implementation of this procedure.

5.0 Procedure

Decontamination of equipment used in soil/sediment sampling, groundwater monitoring, well drilling and well development, as well as equipment used to sample groundwater, surface water, sediment, waste, wipe, asbestos, and unsaturated zone, is necessary to prevent cross-contamination and to maintain the highest integrity possible in collected samples. Planning a decontamination program requires consideration of the following factors:

- Location where the decontamination procedures will be conducted
- Types of equipment requiring decontamination
- Frequency of equipment decontamination
- Cleaning technique and types of cleaning solutions appropriate to the contaminants of concern
- Method for containing the residual contaminants and wash water from the decontamination process
- Use of a quality control measure to determine the effectiveness of the decontamination procedure

The following subsections describe standards for decontamination, including the frequency of decontamination, cleaning solutions and techniques, containment of residual contaminants and cleaning solutions, and effectiveness.

5.1 Decontamination Area

Select an appropriate location for the decontamination area at a site based on the ability to control access to the area, the ability to control residual material removed from equipment, the need to store clean equipment, and the ability to restrict access to the area being investigated.

Locate the decontamination area an adequate distance away and upwind from potential contaminant sources to avoid contamination of clean equipment.

5.2 Types of Equipment

Drilling equipment that must be decontaminated includes drill bits, auger sections, drill-string tools, drill rods, split barrel samplers, tremie pipes, clamps, hand tools, and steel cable. Decontamination of monitoring well development and groundwater sampling equipment includes submersible pumps, bailers, interface probes, water level meters, bladder pumps, airlift pumps, peristaltic pumps, and lysimeters. Other sampling equipment that requires decontamination includes, but is not limited to, hand trowels, hand augers, slide hammer samplers, shovels, stainless-steel spoons and bowls, soil sample liners and caps, wipe sampling templates, composite liquid waste samplers, and dippers. Equipment with a porous surface, such as rope, cloth hoses, and wooden blocks, cannot be thoroughly decontaminated and shall be properly disposed of after one use.

5.3 Frequency of Equipment Decontamination

Decontaminate down-hole drilling equipment and equipment used in monitoring well development and purging prior to initial use and between each borehole or well. Down-hole drilling equipment, however, may require more frequent cleaning to prevent cross-contamination between vertical zones within a single borehole. When drilling through a shallow contaminated zone and installing a surface casing to seal off the contaminated zone, decontaminate the drilling tools prior to drilling deeper. Initiate groundwater sampling by sampling groundwater from the monitoring well where the least contamination is suspected. Decontaminate groundwater, surface water, and soil sampling devices prior to initial use and between collection of each sample to prevent the possible introduction of contaminants into successive samples.

5.4 Cleaning Solutions and Techniques

Decontamination can be accomplished using a variety of techniques and fluids. The preferred method of decontaminating major equipment, such as drill bits, augers, drill string, and pump drop-pipe, is steam cleaning. To steam clean, use a portable, high-pressure steam cleaner equipped with a pressure hose and fittings. For this method, thoroughly steam wash equipment and rinse it with potable tap water to remove particulates and contaminants.

A rinse decontamination procedure is acceptable for equipment such as bailers, water level meters, new and re-used soil sample liners, and hand tools. The decontamination procedure shall consist of the following: (1) wash with a non-phosphate detergent (Alconox®, Liquinox®, or other suitable detergent) and potable water solution; (2) rinse with potable water; (3) spray with laboratory-grade isopropyl alcohol; (4) rinse with deionized or distilled water; and (5) spray with deionized or distilled water. If possible, disassemble equipment prior to cleaning. Add a second wash at the beginning of the process if equipment is very soiled.

Decontaminating submersible pumps requires additional effort because internal surfaces become contaminated during usage. Decontaminate these pumps by washing and rinsing the outside surfaces using the procedure described for small equipment or by steam cleaning. Decontaminate the internal surfaces by recirculating fluids through the pump while it is operating. This recirculation may be done using a relatively long (typically 4 feet) large-diameter pipe (4-inch or greater) equipped with a bottom cap. Fill the pipe with the decontamination fluids, place the pump within the capped pipe, and operate the pump while recirculating the fluids back into the pipe. The decontamination sequence shall include: (1) detergent and potable water; (2) potable water rinse; (3) potable water rinse; and (4) deionized water rinse. Change the decontamination fluids after each decontamination cycle.

Solvents other than isopropyl alcohol may be used, depending upon the contaminants involved. For example, if polychlorinated biphenyls or chlorinated pesticides are contaminants of concern, hexane may be used as the decontamination solvent; however, if samples are also to be analyzed for volatile organics, hexane shall not be used. In addition, some decontamination solvents have health effects that must be considered. Decontamination water shall consist of distilled or deionized water. Steam-distilled water shall not be used in the decontamination process as this type of water usually contains elevated concentrations of metals. Decontamination solvents to be used during field activities will be specified in the project WP or SAP.

Rinse equipment used for measuring field parameters, such as pH (indicates the hydrogen ion concentration – acidity or basicity), temperature, specific conductivity, and turbidity with deionized or distilled water after each measurement. Also wash new, unused soil sample liners and caps with a fresh detergent solution and rinse them with potable water followed by distilled or deionized water to remove any dirt or cutting oils that might be on them prior to use.

5.5 Containment of Residual Contaminants and Cleaning Solutions

A decontamination program for equipment exposed to potentially hazardous materials requires a provision for catchment and disposal of the contaminated material, cleaning solution, and wash water.

When contaminated material and cleaning fluids must be contained from heavy equipment, such as drill rigs and support vehicles, the area must be properly floored, preferably with a concrete pad that slopes toward a sump pit. If a concrete pad is impractical, planking can be used to construct solid flooring that is then covered by a nonporous surface and sloped toward a collection sump. If the decontamination area lacks a collection sump, use plastic sheeting and blocks or other objects to create a bermed area for collection of equipment decontamination water. Situate items, such as auger flights, which can be placed on metal stands or other similar equipment, on this equipment during decontamination to prevent contact with fluids generated by previous equipment decontamination. Store clean equipment in a separate location to prevent recontamination. Collect decontamination fluids contained within the bermed area and store them in secured containers as described below.

Use wash buckets or tubs to catch fluids from the decontamination of lighter-weight drilling equipment and hand-held sampling devices. Collect the decontamination fluids and store them on site in secured containers, such as U.S. Department of Transportation-approved drums, until their disposition is determined by laboratory analytical results. Label containers in accordance with Procedure 3-05, *IDW Management*.

6.0 Quality Control and Assurance

A decontamination program must incorporate quality control measures to determine the effectiveness of cleaning methods. Quality control measures typically include collection of equipment blank samples or wipe testing. Equipment blanks consist of analyte-free water that has been poured over or through the sample collection equipment after its final decontamination rinse. Wipe testing is performed by wiping a cloth over the surface of the equipment after cleaning. These quality control measures provide "after-the fact" information that may be useful in determining whether or not cleaning methods were effective in removing the contaminants of concern.

7.0 Records, Data Analysis, Calculations

Any project where sampling and analysis is performed shall be executed in accordance with an approved sampling and analysis plan. This procedure may be incorporated by reference or may be incorporated with modifications described in the plan.

Deviations from this procedure or the sampling and analysis plan shall be documented in field records. Significant changes shall be approved by the **Program Quality Manager**.

8.0 Attachments or References

8.1 ASTM Standard D5088. 2008. *Standard Practice for Decontamination of Field Equipment Used at Waste Sites.* ASTM International, West Conshohocken, PA. 2008. DOI: 10.1520/D5088-02R08. www.astm.org.

8.1 EM 200-1-6, *Chemical Quality Assurance for HTRW Projects,* October 1997.

8.2 NAVSEA T0300-AZ-PRO-010. *Navy Environmental Compliance Sampling and Field Testing Procedures Manual*. August 2009.

8.3 Procedure 3-05, *IDW Management*.

Monitoring Well Installation

Procedure 3-12

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes the methods to be used during the installation of groundwater monitoring wells. It describes the components of monitoring well design and installation and sets forth the rationale for use of various well installation techniques in specific situations.

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

2.1 The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the project Health and Safety Plan (HASP). In the absence of a HASP, work will be conducted according to the Contract Task Order (CTO) Work Plan (WP) and/or direction from the **Site Safety Officer (SSO)**.

2.2 Before well installation commences, appropriate entities (e.g. DigSafe, local public works departments, company facilities) must be contacted to assure the anticipated well locations are marked for utilities, including electrical, telecommunications, water, sewer, and gas.

2.3 Physical Hazards Associated with Well Installation

- Stay clear of all moving equipment and avoid wearing loose fitting clothing.
- When using an approved retractable-blade knife, always cut away from one self and make sure there are no other people in the cutting path or the retractable-blade knife.
- To avoid slip/trip/fall conditions during drilling activities, keep the area clear of excess soil cuttings and groundwater. Use textured boots/boot cover bottoms in muddy areas.
- To avoid heat/cold stress as a result of exposure to extreme temperatures and personal protective equipment (PPE), drink electrolyte replacement fluids (1 to 2 cups per hour is recommended) and, in cases of extreme cold, wear fitted insulating clothing.
- To avoid hazards associated with subsurface utilities, ensure all sampling locations have been properly surveyed as described in SOP 3-01, Utility Clearance.
- Be aware of restricted mobility caused by PPE.

3.0 Terms and Definitions

3.1 **Annulus:** The annulus is the down-hole space between the borehole wall and the well casing and screen.

3.2 **Bridge:** A bridge is an obstruction in the drill hole or annulus. A bridge is usually formed by caving of the wall of the well bore, by the intrusion of a large boulder, or by the placement of filter pack materials during well completion. Bridging can also occur in the formation during well development.

3.3 **Filter Pack:** Filter pack is sand or gravel that is smooth, uniform, clean, well-rounded, and siliceous. It is placed in the annulus of the well between the borehole wall and the well screen to prevent formation materials from entering the well and to stabilize the adjacent formation.

3.4 **Grout:** Grout is a fluid mixture of cement and water that can be forced through a tremie pipe and emplaced in the annular space between the borehole and casing to form an impermeable seal. Various additives, such as sand, bentonite, and polymers, may be included in the mixture to meet certain requirements.

3.5 **Heaving (Running) Sands:** Loose sands in a confined water-bearing zone or aquifer which tend to rise up into the drill stem when the confining unit is breached by the drill bit. Heaving sands occur when the water in the aquifer has a pressure head great enough to cause upward flow into the drill stem with enough velocity to overcome the weight of the sand.

3.6 **Sieve Analysis:** Sieve analysis is the evaluation of the particle-size distribution of a soil, sediment, or rock by measuring the percentage of the particles that will pass through standard sieves of various sizes.

4.0 Interferences

4.1 Heaving sands may be problematic in unconsolidated sands encountered below the water table.

4.2 Rotary drilling methods requiring bentonite-based drilling fluids should be used with caution to drill boreholes that will be used for monitoring well installation. The bentonite mud builds up on the borehole walls as a filter cake and permeates the adjacent formation, potentially reducing the permeability of the material adjacent to the well screen.

4.3 If water or other drilling fluids have been introduced into the boring during drilling or well installation, samples of these fluids should be obtained and analyzed for chemical constituents that may be of interest at the site. In addition, an attempt should be made to recover the quantity of fluid or water that was introduced, either by flushing the borehole prior to well installation and/or by overpumping the well during development.

4.4 Track-mounted drill rigs are suitable for travelling on many types of landscapes that truck-mounted units cannot access, but may have limitations on extremely uneven or soft terrain.

4.5 Care should be taken to prevent cross-contamination between well locations. All drilling equipment coming in contact with potentially contaminated soil and/or groundwater will be decontaminated by the drilling subcontractor prior to initial drilling activities and between drilling locations in accordance with SOP 3-06, Equipment Decontamination.

5.0 Training and Qualifications

5.1 Qualifications and Training

The individual executing these procedures must have read, and be familiar with, the requirements of this SOP.

5.2 Responsibilities

5.2.1 **Contract Task Order (CTO) Managers** are responsible for issuing sampling and analysis plans (SAPs) that reflect the procedures and specifications presented in this procedure. Individual municipalities, county agencies, and possibly state regulatory agencies enforce regulations that may include well construction and installation requirements. The **CTO Manager** shall be familiar with current local and state regulations, and ensure that these regulations are followed. The **CTO Manager** is responsible for ensuring that all personnel involved in monitoring well installation shall have the appropriate education, experience, and training to perform their assigned tasks.

5.2.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

5.2.3 The **Field Manager** is responsible for direct supervision of the installation of monitoring wells and ensuring that procedures and specifications are implemented in the field in accordance with the approved SAP and well installation permits. The qualifications for the **Field Manager** must be in accordance with local jurisdictions with authority over the operations conducted.

5.2.4 All field personnel are responsible for the implementation of this procedure.

5.2.5 The on-site hydrogeologist/engineer is expected to obtain a description of the lithologic samples obtained during the excavation and construction of a monitoring well. These data are often required to provide guidance regarding the installation of specific components of the monitoring well. Guidance for lithologic sample collection and sample description is contained within SOP 3-16, Soil and Rock Classification.

6.0 Equipment and Supplies

6.1 Materials provided by the drilling contractor may include:

- Drill rig, drill rods, hollow stem augers, etc.
- Decontamination equipment (e.g., steam cleaner, high-pressure washer, brushes, etc.)
- Decontamination pad materials
- Well screen/riser pipe with flush-threaded couplings including riser and bottom caps
- Clean, filter sand
- Bentonite chips or pellets
- Cement grout and tremie pipe
- Portland cement for well pad completion
- Steel protective riser covers and locking caps

- Weighted calibrated tape
- Split-spoon samplers
- 55-gallon drums or containers for drill cuttings, decontamination fluids, etc.

6.2 In addition to those materials provided by the drilling contractor, equipment and materials required by the project geologist/engineer may include, but is not limited to, the following:

- Photoionization Detector (PID)
- Spill kit, including at a minimum sorbent pads and shovel (if not provided by subcontractor)
- Plastic sheeting
- Teaspoon or spatula
- Resealable plastic bags
- Boring Log Records
- Decontamination materials (per SOP No. 3-06 - Equipment Decontamination)
- Weighted measuring tape for depth measurement
- Soil logging materials (e.g. USCS classification field card, millimeter rule, hand lens, etc.)
- Survey lathes or pin flags
- Digital camera
- PPE as required by the HASP
- Planning documents including the site-specific HASP and SAP
- Large indelible ink or paint pen
- Field logbook/field forms/site maps (water proof)

7.0 Procedure

7.1 General Procedures

- Specific drilling, sampling, and installation equipment and methodology will be dictated by the type of well to be installed (e.g., single case (Type II), double case (Type III), bedrock, etc.), geologic characteristics of the site, the type of contaminants being monitored, and local and state regulations.
- For access to locations when travelling over difficult terrain, an appropriate line should be chosen before mobilizing the drill rig or other support vehicles. If clearing of trees or ground cover is required, perform these activities in advance to avoid down time. Avoid wet or soft areas where possible or use ground mats and/or timbers to aid in supporting the rig as it travels. If drilling on soft material, place geomatting and ground mats under the rig tracks or stabilizers prior to drilling.
- A utility locate must be conducted to identify all underground utilities at the site prior to drilling (refer to SOP 3-01, Utility Clearance). Proper clearance procedures for aboveground/overhead utilities must also be followed as specified in the HASP.
- Although new well materials (well screen and riser pipe) generally arrive at the site boxed and sealed within plastic bags, it is sometimes necessary to decontaminate the materials prior to their use. Well materials should be inspected by the project geologist/engineer upon delivery

to check for cleanliness. If the well materials appear dirty, or if local or regional regulatory guidance requires decontamination, then well material decontamination should be performed by the drilling subcontractor in accordance with SOP 3-06, Equipment Decontamination.

- The diameter of the borehole must be a minimum of 2 inches greater than the outside diameter of the well screen or riser pipe used to construct the well. This is necessary so that sufficient annular space is available to install filter packs, bentonite seals, and grout seals, and allow the passage of tremie pipe where grouting at depth is required. Bedrock wells may require reaming after coring in order to provide a large enough borehole diameter for well installation.
- When soil sampling is required (refer to the SAP), soil samples will be collected for visual logging by advancing split-spoon samplers through the augers. The soil will be visually logged by a field geologist and include lithologic characteristics (i.e., soil type, color, density, moisture content, etc.) using the the methods described in SOP 3-16, Soil and Rock Classification. This information will be recorded on a boring/well log form, along with well construction details.

7.2 Drilling Techniques

Drilling of monitoring well boreholes may be accomplished by a variety of methods as described below. Preferred methods include those that temporarily case the borehole during drilling (i.e., hollow stem auger and sonic methods) using an override system. Other methods can be used where specific subsurface conditions or well design criteria dictate.

- <u>Hollow stem auger (HSA)</u> – Borings are advanced by rotating steel hollow stem augers with an attached cutting head. Soil cuttings are displaced by the cutting head and transported to the surface via continuous spiral flights attached to each auger stem. This method is widely used for unconsolidated soils that have a tendency to collapse within the boring. A bottom plug can be placed in the bottom auger to prevent soils from entering and clogging the auger, especially in the case of heaving sands. However, a bottom plug cannot be used when soil samples are to be collected through the augers. Soil plugs that accumulate in the bottom of the auger must be removed or knocked out prior to sampling or well installation.
- <u>Solid stem auger</u> – This type of drilling method is similar to HSA drilling using a solid stem or sealed hollow stem auger flights to advance the boring. Solid stem, continuous flight auger use is limited to semi-consolidated sediments or to cohesive or semi-cohesive unconsolidated sediments that don’t have a tendency to collapse when disturbed.
- <u>Sonic methods</u> – Sonic drilling consists of advancing concentric hollow drill casings (inner and outer) using rotation in conjunction with axial vibration of the drill casing. Once the casings are advanced to the appropriate depth, the inner string is removed with a core of drill cuttings while the outer casing remains in place to keep the borehole open. Cuttings are removed from the inner casing relatively intact for logging or sampling purposes. This drilling method is used for a variety of soil types, from heaving sands to consolidated or indurated formations. Smearing of the formation along the borehole walls is minimal since moderate vibration and rotation techniques are used to advance the casings. Since the total borehole diameter in sonic drilling is only incrementally larger than the inner casing diameter, care should be taken during installation of the monitoring well to ensure the well is centered and adequate space is available for annular materials.
- <u>Rotary methods (water or mud)</u> – Rotary drilling methods consist of drill rods coupled to a drill bit that rotates and cuts through the soils to advance the borehole. Water or drilling fluid (“mud”) is forced through the hollow drill rods and drill bit as the rods are rotated. The soil cuttings are forced up the borehole with the drilling fluids to the surface and the fluids recirculated. The drilling fluid provides a hydrostatic pressure that reduces or prevents the

borehole from collapsing. Clean, potable water must be used for water-rotary drilling to prevent introducing trace contaminants. A sample of the potable water should be collected during the course of well installation for analysis of the same parameters defined for the groundwater samples. If mud-rotary is used to advance boreholes, potable water and bentonite drilling mud should only be used. No chemical additives shall be mixed in the drilling fluid to alter viscosity or lubricating properties. Adequate well development is essential for removal of drilling mud and fluids from the formation materials and ensure collection of representative groundwater samples.

- Rotary methods (Air) – Air rotary methods are similar to water rotary but use high air velocities in place of drilling fluids to rotate the drill bit and carry the soil cuttings up the borehole to the surface. Care must be taken to ensure that contaminants are not introduced into the air stream from compressor oils, etc. Most compressor systems are compatible with a coalescing filter system. Cuttings exiting the borehole under pressure must be controlled, especially when drilling in a zone of potential contamination. This can be accomplished by using an air diverter with hose or pipe to carry the cuttings to a waste container. Letting the cuttings blow uncontrolled from the borehole is not acceptable.

7.3 Well Construction and Installation

- If rotary drilling techniques are used, the borehole should be flushed or blown free of material prior to well installation. If hollow stem augers are used, the soil or bottom plug should be removed and the augers raised approximately six inches above the bottom of the borehole, while slowly rotating the augers to remove cuttings from the bottom of the boring. The depth of the borehole should be confirmed with a weighted, calibrated tape.
- The riser pipe and screen should be connected with flush-threaded joints and assembled wearing clean, disposable gloves. No solvent or anti-seize compound should be used on the connections. The full length of the slotted portion of the well screen and unslotted riser pipe should be measured and these measurements recorded on a well construction form (Attachment 1).
- If placed in an open borehole, the assembled well should be carefully lowered and centered in the borehole so that the well is true, straight, and vertical throughout. Centering can also be accomplished with the use of centralizers, if necessary. However, centralizers should be placed so that they do not inhibit the installation of filter sand, bentonite seal, and annular grout. Wells less than 50 deep generally do not require centralizers.
- If hollow stem augers are used, the well should be lowered through the augers and each auger flight removed incrementally as the filter sand, bentonite seal, and grout are tremmied or poured into the annular space of the well. The well should be temporarily capped before filter sand and other annular materials are installed.
- Clean, silica sand should be placed around the well screen to at least 1 foot above the top of the screen. The filter sand should be appropriately graded and compatible with the selected screen size and surrounding formation materials. In general, the filter pack should not extend more than 3 feet above the top of the screen to limit the thickness of the monitoring zone. As the filter pack is placed, a weighted tape should be lowered in the annular space to verify the depth to the top of the layer. This measurement will be recorded on the well construction form (Attachment 1). If necessary, to eliminate possible bridging or creation of voids, placement of the sand pack may require the use of a tremie pipe. Tremie pipe sandpack installations are generally suggested for deeper wells and for wells which are screened some distance beneath the water table.
- A minimum 2-foot thick layer of bentonite pellets or slurry seal will be installed immediately above the filter sand to prevent vertical flow within the boring from affecting the screened

interval. Bentonite chips/pellets must be hydrated if place above the water table prior to grouting. If bridging is of concern as in the case of deep wells, powdered bentonite may be mixed with water into a very thick slurry and a tremie pipe used to place the seal to the desired depth. Placement of the bentonite seal in the borehole will be recorded on the well construction form (Attachment 1).

- The remaining annular space around the well will be grouted from the top of the bentonite seal to the surface with a grout composed of neat cement, a bentonite cement mixture, or high solids sodium bentonite grout.
- Each well riser will be secured with an expandable, locking cap (vented if possible). Optionally, a hole can be drilled in the upper portion of the riser to allow venting of the well.
- The well will be completed within a concrete well pad consisting of a Portland cement/sand mixture. Well pads are generally 3 feet by 3 feet square but may be larger or smaller depending on site conditions and state-specific well construction standards. Round concrete well pads are also acceptable. A minimum of 1 inch of the finished pad should be below grade to prevent washing and undermining by soil erosion.
- If completed as a flush-mount well, the well riser will be cut off approximately 4 to 6 inches below ground surface and an expandable, locking cap placed on the well riser. The area around the riser is dug out and a steel well vault or manhole cover placed over the riser and set almost flush to the ground to protect the well. The manhole cover should be water-tight and secured with bolts to prevent casual access. The well pad will then be constructed around the well vault and slightly mounded at the center and sloping away to prevent surface water from accumulating in the well vault.
- If completed as a stick-up well, the well riser is cut approximately 2.5 to 3 feet above the ground surface and an expandable, locking cap placed on the well riser. A steel guard pipe with hinged, locking cap is placed over the well riser as a protective casing. The bottom of the guard pipe will be set approximately 2 feet below ground surface and sealed by pouring concrete from the top of the annular grout around the pipe to grade. The concrete well pad should be completed at the same time. Weep holes will be drilled in the base of the guard pipe to facilitate draining of rainwater or purge water from inside the guard pipe.
- Bumper posts or bollards may be necessary for additional well protection, especially in high traffic areas. The bumper posts should be placed around the well pad in a configuration that provides maximum protection to the well and extend a minimum of 3 feet above the ground.

7.4 Double Cased Wells

Under certain site conditions, the use of a double-cased or telescoping (Type III) well may be necessary. Installation of double-cased wells may be required to prevent the interconnection of two separate aquifers, seal off a perched aquifer without creating a vertical hydraulic conduit, prevent cross-contamination during construction of wells in deeper aquifers hydro-stratigraphically below impacted aquifers, or case off highly impacted soils present above the aquifer to prevent potential “dragging down” of contaminants.

Similar to conventional wells, construction of double-cased wells can be accomplished using a varety of drilling methods. Well construction is initiated by “keying” a large diameter, outer casing into a stratigraphic zone of low permeability (clay layer or bedrock). The size of the outer casing should be a minimum of 2 inches greater than the outside diameter of the inner casing to allow installation of annular seal materials during well completion. A pilot borehole should be drilled through the overburden soil and/or contaminated zone into a clay confining layer or bedrock. The borehole for the outer casing should be of sufficient size to contain the outer casing with a minimum of 2 inches around the outside diameter to allow sufficient annular space for tremie or pressure grouting. The boring should extend a minimum of 2 feet into a clay layer and a minimum of 1 foot into bedrock, if possible, to ensure an adequate seal. The boring should never breach a confining layer or keyed zone under any circumstances.

Once the boring is completed, the outer casing can be set in the borehole and sealed with grout. The outer casing can be set two ways, with or without a bottom cap. If no bottom cap is applied, the casing is usually driven approximately 6 inches into the clay confining unit. A grout plug is generally placed in the bottom of the casing and once set, standing water in the casing is evacuated prior to drilling below the casing. As an alternative, a cap can be placed on the bottom of the casing and if set below the water table, the casing can be filled with clean, potable water to hold down the casing in the boring. Grouting should be conducted using tremie-grouting or pressure-grouting methods by pumping grout into the annular space between the outer casing and the borehole wall from the bottom of the casing to the ground surface. Grout around the casing should be allowed to cure at least 24 hours before attempting to drill through the bottom.

Once the grout is cured, a smaller diameter drill pipe/bit is used to bore through the grout plug or bottom cap to the desired well depth. The well is then constructed as described in Section 7.3 above.

7.5 Post Installation Procedures

- Wells should be permanently labelled or marked for identification. Well tags can be used to record the site name, well number, total depth, installation date, etc. At a minimum, the well number will be written in indelible marker or paint on both the outside of the protective casing and inside beneath the casing lid, as well as on the riser pipe.
- A measuring point will be marked on the top of the riser pipe for taking water level measurements. The measuring point can be notched using a knife or saw or can be marked with a waterproof marker or paint. The measuring point will also be the point which will be surveyed for vertical elevation data.
- Upon completion, the following measurements will be taken by the field geologist/engineer and recorded on the well construction diagram.
    - Depth to static water level
    - Depth of non-aqueous phase liquid (NAPL), if present
    - Total depth of well measured from top of casing (TOC)
    - Height of well casing above ground surface
    - Height of protective casing above ground surface
- All monitoring wells will be surveyed for horizontal and vertical control by a licensed surveyor.
- Investigation-derived waste (IDW) including drill cuttings, spent materials (e.g., PPE), and decontamination water should be properly managed in accordance with SOP 3-05, IDW Management.

AECOM

8.0 Quality Control and Assurance

8.1 Field personnel will follow specific quality assurance (QA) guidelines as outlined in the SAP. Certain quality control (QC) measures should be taken to ensure proper well installation and construction in accordance with this SOP, project specific SAP, and applicable well standards.

8.2 The borehole will be checked for total open depth, and extended by further drilling or shortened by backfilling, as required before installation of the well materials.

8.3 Water level and NAPL presence will be checked during well installation to ensure that the positions of well screen, filter sand, and seals relative to water level conform to project requirements

8.4 The depth to top of each layer of annular materials (i.e., filter sand, bentonite, grout) will be verified and adjusted as necessary for proper placement.

9.0 Records, Data Analysis, Calculations

All field information will be recorded in the field logbook and/or standardized field forms by field personnel. Field data recorded will include drilling contractor information, drilling methods, well material and construction information provided on the boring logs and well construction forms, observations or problems encountered during drilling, fluid level data, and any deviations from the procedures in this SOP and other project plans. Well Construction Forms (Attachment 1) will provide visual and descriptive information the monitoring well and are often the most critical form of documentation generated during the installation of a monitoring well. The field logbook is kept as a general log of activities and should not be used in place of the boring log.

10.0 Attachments or References

10.1 Attachment 1 – Monitoring Well Construction Form

10.2 Environmental Protection Agency, United States (EPA). 1987*. A Compendium of Superfund Field Operations Methods*. Office of Solid Waste and Emergency Response. EPA/540/P-87/001.

10.3 EPA. 1990. *Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells*. EPA/600/4-89/034. Office of Research and Development, Washington. March.

10.4 EPA. 1992. *RCRA Groundwater Monitoring Draft Technical Guidance*. EPA/530/R-93/001. Office of Solid Waste. November.

10.5 EPA, 2008. SESD Operating Procedure SESDGUID-101-R0: *Design and Installation of Monitoring Wells*. USEPA, Science and Ecosystem Support Division (SESD), Athens, Georgia. Effective Date February 18, 2008.

10.6 U.S. Army Corps of Engineers. 2008. Manual No. EM 385-1-1. *Safety and Health Requirements*. 15 November 2008. http://140.194.76.129/publications/eng-manuals/em385-1-1/2008_English/toc.html.

10.7 SOP 3-01, *Utility Clearance*.

10.8 SOP 3-05, *IDW Management*

10.9 SOP 3-06, *Equipment Decontamination*.

10.10 SOP 3-16, *Soil and Rock Classification.*

Author	*Reviewer*	*Revisions (Technical or Editorial)*
Mark Kromis Program Chemist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue (May 2012)

Attachment 1
Monitoring Well Construction Form

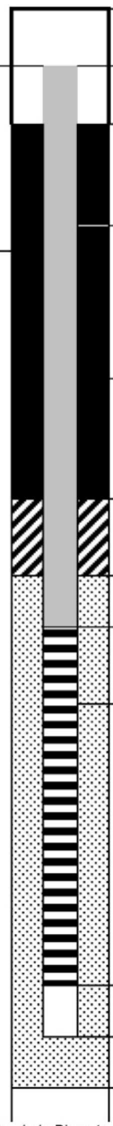
RESOLUTION CONSULTANTS	*Client:*	***WELL ID:***
	Project Number:	
	Site Location:	*Date installed:*
	Well Location: *Coords:*	*Inspector:*
	Method:	*Contractor:*

MONITORING WELL CONSTRUCTION DETAIL

Depth from G.S. (feet)

Elevation(feet)

Datum ________



Top of Steel Guard Pipe ________ ________

Measuring Point for Surveying & Water Levels

Top of Riser Pipe ________ ________

Ground Surface (G.S.) 0.0 ________

Cement, Bentonite, Bentonite Slurry Grout, or Native Materials

Riser Pipe:
Length ________
Inside Diameter (ID) ________
Type of Material ________

____ % Cement

Bottom of Steel Guard Pipe

____ % Bentonite

____ % Native Materials

Top of Bentonite ________ ________

Bentonite Seal Thickness ________

Top of Sand ________ ________

Top of Screen ________ ________

▼ Stabilized Water Level ________ ________

Screen:
Length ________
Inside Diameter (ID) ________
Slot Size ________
Type of Material ________

Type/Size of sand ________
Sand Pack Thickness ________

Bottom of Screen ________ ________

Bottom of Tail Pipe: ________ ________
Length ________
Bottom of Borehole ________ ________

Borehole Diameter ____

Approved:

Describe Measuring Point:

________ Signature ________ Date

____

Monitoring Well Development

Procedure 3-13

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes the procedures used for developing newly installed monitoring wells and/or redeveloping existing wells.

1.2 The purpose of well development is to remove interferences from a well to provide better connection between the well and the formation, to improve pumping performance of the well, and to be able to collect more representative information from the well (e.g., samples, test results, etc.). Proper well development will:

- Remove drilling residuals (e.g., water, mud) from the borehole and surrounding formations;
- Improve or restore hydraulic conductivity of the surrounding formations which may have been disturbed during the drilling process;
- Remove residual fines from the well screen and sand pack (filter pack) materials, thus reducing turbidity of groundwater and permitting the collection of more representative groundwater samples.

1.3 There may be circumstances where well development is not desirable, for example, in the presence of non-aqueous phase liquids (NAPL) or other significant contamination if development could worsen the contaminant impact. If NAPL begins to intrude during development, the development process will be halted. This situation will be considered a cause for sample modification requiring approval by the CTO Manager and other stakeholders, as applicable.

1.4 The applicable well development procedures for a particular site may be subject to State or local regulatory requirements. In all cases, the project team should consult their local regulatory requirements and document the selected well development procedure in the project-specific Sampling and Analysis Plan (SAP). For project-specific information refer to the SAP, which takes precedence over these procedures.

1.5 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

2.1 The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the project Health and Safety Plan (HASP). In the absence of a HASP, work will be conducted according to the Contract Task Order (CTO) SAP and/or direction from the Site Safety Officer (SSO).

2.2 Monitoring well development may involve chemical hazards associated with potential contaminants in the soil or aquifer being characterized and may involve physical hazards associated with use of well development equipment.

3.0 Terms and Definitions

None.

4.0 Interferences

4.1 Equipment/materials used for development may react with the groundwater during development. Appropriate development equipment has been selected for the anticipated condition of the groundwater.

4.2 Appropriate development methods such as using a surge-block to flush suspended fines in the groundwater in and out of the well screen can improve the yield of wells and improve their potential to be developed successfully. However, the effectiveness of development can be significantly reduced in wells that do not yield sufficient water to allow this flushing to take place.

4.3 For formations with a significant content of fine-grained materials (silts and clays), or wells with improperly sized screens, it may not be possible to reduce turbidity to commonly acceptable levels. Possible solutions may include collecting a sample even if excessively turbid, or installing a replacement well.

4.4 Development itself disturbs the surrounding formation and disrupts equilibrium conditions within the well. Groundwater samples will not be collected until a minimum of 24 hours after a well is developed to allow conditions to stabilize. For sites with fine-grained formations (silts and clays) and highly sorptive contamination, a longer time period between development and sampling should be considered.

5.0 Training and Qualifications

5.1 Qualifications and Training

The individual executing these procedures must have read, and be familiar with, the requirements of this SOP.

5.2 Responsibilities

5.2.1 The **CTO Manager** is responsible for ensuring that well development activities comply with this procedure. The **CTO Manager** is responsible for ensuring that all personnel involved in well development shall have the appropriate education, experience, and training to perform their assigned tasks.

5.2.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

5.2.3 The **Field Manager** is responsible for ensuring that all well development activities are conducted according to the either this procedure or the applicable procedure presented in the project-specific SAP.

5.2.4 **Field sampling personnel** are responsible for the implementation of this procedure.

5.2.5 The field sampler and/or task manager is responsible for directly supervising the well development procedures to ensure that they are conducted according to this procedure and for recording all pertinent data collected during sampling.

6.0 Equipment and Supplies

6.1 This equipment list was developed to aid in field organization and should be used in planning and preparation. Depending on the site-specific requirements and the development method selected, additional or alternative material and equipment may be necessary. In addition, for sites where groundwater is expected to be contaminated, the materials to be placed down the well and in contact with groundwater should be evaluated so that they are compatible with the chemical conditions expected in the well.

6.2 Equipment and materials used for well development may include, but is not limited to:

Well development equipment

- Surge block
- Disposable Teflon bailers, appropriate to the diameter of the well(s): 1-inch to 1.5-inch for 2-inch inside diameter (ID) monitoring wells.
- Watterra® footvalve
- Electric submersible pump
- 12-volt power source for electric pump
- High density polyethylene (HDPE) tubing appropriately sized for Watterra® footvalve and/or electric submersible pump
- Drums or containers for storage of purge water
- Nephelometer to measure turbidity
- Multi-parameter water quality meter(s) to measure temperature, pH, conductivity, dissolved oxygen (DO), oxidation reduction potential (ORP)
- Instrument calibration solutions
- Water level meter
- Oil/water interface probe

General equipment

- Project-specific plans including the site-specific HASP and SAP
- Field notebook/field forms/site maps
- Indelible markers/pens
- 5-gallon buckets

Equipment decontamination supplies (refer to SOP 3-06, Equipment Decontamination)

- Health and safety supplies, including personal protective equipment (PPE)
- Appropriate hand tools
- Keys or combinations to access monitoring wells
- Distilled/deionized water supply
- Disposable bailer string (polypropylene)
- Plastic trash bags

7.0 Procedure

Development generally consists of removing water and entrained sediment from the well until the water is clear (to the extent feasible) and the turbidity is reduced, which indicates the well is in good hydraulic connection with the surrounding formation. In addition to simply removing water, development can be improved when flushing through the well screen and gravel pack takes place in both directions, that is, both into the well and into the formation. This action breaks down sediment bridges that can occur in the formation or sand pack, which reduce the connection between the well and the formation

7.1 General Preparation

- All down-well equipment should be decontaminated prior to use and between well locations in accordance with SOP 3-06, Equipment Decontamination
- Although equipment is decontaminated between well locations, if wells are known or suspected to be contaminated based on observations during well installation, it is

recommended that well development be conducted in order from the least contaminated to the most contaminated well to minimize the chances of cross-contamination.

- Management of investigation-derived waste (IDW), including development purge water and miscellaneous expendable materials generated during the development process, will be conducted in accordance with SOP 3-05, IDW Management.
- Prior to accessing the well, the wellhead should be cleared of debris and/or standing water. Nothing from the ground surface should be allowed to enter the well.
- The depth to water and total well depth should be measured with a water level meter and recorded in the field logbook or on a Well Development Record (Attachment 1). This information will be used to calculate the volume of standing water (i.e., the well volume) within the well, and plan the specific details of the well development. If wells are suspected to contain NAPL, an oil/water interface probe should be used to measure liquid levels and depth to bottom of the well.
- Permanent monitoring wells will be developed no sooner than 24 hours after well installation is completed in order to allow well completion materials to set properly.

7.2 Monitoring Well Development Procedures

Generally, development will begin by gently surging the well with a surge block or bailer as described in Sections 7.2.1 and 7.2.2, respectively. Surging can become more vigorous as development progresses but initially the well must be gently surged to allow material blocking the screen to become suspended without damaging the well. Next, a bailer can be used to remove the sediment settled at the base of the well. A bailer, Watterra® pump, or electric submersible pump will then be used to purge the well, per Sections 7.2.2, 7.2.3, or 7.2.4, respectively. The well will be purged until the removed water becomes less turbid or per the requirements of the project-specific SAP, or State or local requirements. At this point the well will be surged again with a surge block or bailer. The well can be surged more vigorously at this point. After surging, the well will be purged again until the turbidity once again decreases. The surge/purge cycle should be completed at least three times during the development process. After the last surge, the well will be purged until the development completion criteria outlined in 7.3.2 or per the project-specific SAP are met.

7.2.1 Surge Block

The default method of well development is the use of a surge block in conjunction with pumping or bailing to remove sediment-laden water.

- The construction of the surge block must be appropriate for the diameter of the well. The surge block must be mounted on rods or other stiff materials to extend it to the appropriate depths and to allow for the surge block to be moved up and down in the well.
- Insert the surge block into the well and lower it slowly to the screened or open interval below the static water level. Start the surge action by slowly and gently moving the surge block up and down in the well. A slow initial surging, using plunger strokes of approximately 1 meter or 3 feet, will allow material which is blocking the screen to separate and become suspended.
- After 5 to 10 plunger strokes, remove water from the well using a separate bailer (Section 7.2.2) or pumping techniques (Sections 7.2.3 or 7.2.4). The returned water should be heavily laden with suspended fines. The water will be discharged to 5-gallon buckets or 55-gallon drums to be managed per the requirements presented in the project-specific SAP.
- In some cases, the bailer or Watterra® foot valve can act as a surge block, flushing water in and out of the well screen as groundwater is removed.

- Repeat the process of surging and pumping/bailing. As development continues, slowly increase the depth of surging to the bottom of the well screen. Surging within the riser portion of the well is neither necessary nor effective.

7.2.2 Bailer

- Tie a string or other cable securely to the bailer. Lower it to the screened or open interval of the monitoring well below the static water level.
- The bailer may be raised and lowered repeatedly within the screened interval to attempt to simulate the action of a surge block by pulling fines through the well screen, and pushing water out into the formation to break down bridging.
- With the bailer full of water, remove it from the well and discharge the water into 5-gallon buckets or 55-gallon drums to be managed per the requirements presented in the project-specific SAP.
- The Watterra® system (Section 7.2.3) or electric submersible pump (Section 7.2.4) may be used as a complementary development method to the bailer, especially when removal of additional water at a faster rate is beneficial.
- Continue alternately surging and bailing, monitoring the purge water periodically (Section 7.3.1) until development completion criteria are met (Section 7.3.2).

7.2.3 Watterra® system

- Attach high-density polyethylene (HDPE) tubing to the decontaminated Watterra® pump foot valve
- Lower the foot valve and tubing assembly near the bottom of the well.
- Lift and lower the tubing to allow water to enter the Watterra® foot valve and travel up the tubing and discharge the water into 5-gallon buckets or 55-gallon drums to be managed per the requirements presented in the project-specific SAP.
- The lifting and lowering action of the Watterra® sysem will cause some surging action to aid in breaking up fine material in the surrounding formation.
- A bailer (Section 7.2.2) may be used as a complementary development method to the Watterra® system, especially during the initial stages of development when a high volume of sediment may be required to be removed.
- An electric submersible pump (Section 7.2.4) may also be used as a complementary development method to the Watterra® system, especially when more volume of water is desired to be pumped or the turbidity criteria cannot be met due to the surging action of the Watterra® system.
- Continue alternately surging and pumping, monitoring the purge water periodically (Section 7.3.1) until well development completion criteria are met (Section 7.3.2).

7.2.4 Electric Submersible Pump

- Attach HDPE tubing to the decontaminated electric submersible pump.
- Lower the pump and tubing assembly near the bottom of the well, at least a few inches above the well total depth.
- Begin pumping, discharging the water into 5-gallon buckets or 55-gallon drums to be managed per the requirements presented in the project-specific SAP.
- Continue alternately surging and pumping, monitoring the purge water discharge periodically (Section 7.3.1) until well development completion criteria are met (Section 7.3.2).

7.3 Discharge Monitoring

7.3.1 Monitoring the Progress of Development

The progress of the development is evaluated through visual observation of the suspended sediment load and measurement of the turbidity and other parameters in the purged diischarge water. As development progresses, the water should become clearer, measured turbidity should decrease, and specific capacity (pumping rate divided by drawdown) should stabilize. Water quality parameters, including DO, conductivity, ORP, pH, temperature, and turbidity may be measured and recorded periodically to determine the progress of development using the criteria outlined in Section 7.3.2 or per the project-specific SAP. Water quality parameters should be measured on each well volume removed.

7.3.2 Completion of Development

The well will be considered developed when the following criteria are met or per the criteria set forth in the project-specific SAP:

- A minimum of three times the standing water volume in a well (to include the well screen and casing plus saturated annulus, assuming 30 percent porosity) is removed.
- Groundwater parameters for three consecutive standing water volumes are within the following:
    - pH – within ± 0.2 units
    - Specific conductivity – within ± 3%
    - ORP – within ± 10 mV
    - Temperature – within ±1 degree Celsius
    - Turbidity – at or below 10 nephelometric turbidity units (NTU) or within ± 10% if above 10 NTU.
- The sediment thickness remaining within the well is less than 1 percent of the screen length or less than 30 millimeters (0.1 ft) for screens equal to or less than 10 feet long.

Dissolved oxygen (DO) readings may be recorded but DO readings will not be used as development completion criteria because DO may not stabilize.

If the well has slow groundwater recharge and is purged dry, the well will be considered developed when bailed or pumped dry three times in succession and the turbidity has decreased, or per the requirements set forth in the project-specific SAP. Water quality parameters may be recorded if feasible using the flow-through cell.

If any water is added to the well's borehole during development or drilling, three times the volume of water added will also be removed during well development, or per the requirements set forth in the project-specific SAP.

7.4 Development of Wells with Low Yield

Water is the primary mechanism to remove fines and flush water through the gravel pack for effective development. Therefore, development can be a challenge in wells that do not yield sufficient water to recharge when water is removed. However, often these wells are the most in need of development to improve their performance as they are typically installed in low permeability formations with a high content of fines. Development of these wells can improve their yield.

The surging portion of the development can be successfully performed in a well with standing water regardless of its yield. It is the subsequent removal of fine materials that is hindered when insufficient water is recharged to the well. When wells go dry or drawdown significantly during development, development can be performed intermittently, allowing sufficient water to recharge prior conducting the next stage of surging. These intermittent procedures can take place hours or even days apart, depending on project-specific time constraints.

7.5 Wells containing NAPL

Additional care should be taken when planning development of wells that contain NAPL. If the NAPL is flammable, there are health and safety as well as handling issues to consider. If NAPL in excess of a persistent sheen is noted, the recharge rate will be evaluated through hand bailing. In most cases, it is generally preferable to remove NAPL by bailing to the extent practical prior to performing development. Groundwater parameters, excluding turbidity, will not be collected during well development if NAPL or excessive sheen is noticed in the purged water during development to ensure the meter probes are not fouled or destroyed. Well development will be halted.

Development by surging or pumping the well dry can result in the spreading of NAPL vertically in the soil column around the well. These methods can be used, if information exists describing the vertical thickness of the NAPL smear zone around the well, and if the methods do not result in mounding or drawdown that exceeds this thickness. Alternate methods such as bailing may also be used, but any method should not allow the well to be pumped dry or result in significant drawdown that would spread the NAPL vertically.

7.6 Temporary Well Points

For certain projects, temporary well points (TWPs) may be installed to collect groundwater samples at a site. Since no sand pack, bentonite chips, or bentonite grout are generally used in the construction of the TWPs, development can proceed as soon as sufficient water has entered the well to static conditions. Due to the small diameter of these wells, generally ¾-inch to 1-inch ID, development will be performed using either a small diameter (0.5-inch) bailer and/or a peristaltic pump with dedicated tubing. The TWPs will have minimal water column and may purge dry during development. However, attempts will be made to remove fines from the well prior to sampling. Purging and sampling may occur as soon as approximately 80% of the static water has re-entered the TWP, or per the requirements set forth in the project-specific SAP.

8.0 Quality Control and Assurance

8.1 Field personnel will follow specific quality assurance (QA) guidelines as outlined in the project-specific SAP.

8.2 Quality control (QC) requirements are dependent on project-specific sampling objectives. The project-specific SAP will provide requirements for equipment decontamination (frequency and materials) and IDW handling.

9.0 Records, Data Analysis, Calculations

9.1 All data and information (e.g., development method used) must be documented on field data sheets (Attachment 1) or within site logbooks with permanent ink. Data recorded may include the following:

- Well Location
- Weather conditions
- Date and Time
- Purge Method
- Reading/measurements obtained

10.0 Attachments or References

Attachment 1 – Well Development Record

SOP 3-05, *IDW Management*.

SOP 3-06, *Equipment Decontamination*.

Author	*Reviewer*	*Revisions (Technical or Editorial)*
Shawn Dolan Senior Scientist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue (June 2012)

Attachment 1
Well Development Record

Well/Piezometer Development Record

RESOLUTION CONSULTANTS

Well ID:

Client: ____________________

Project No: ____________________ Date: __________ Developer: ______________________________

Site Location: ____

Well/Piezometer Data

Well ☐ Piezometer ☐ Diameter ___________ Material ______________

Measuring Point Description ________________

Depth to Top of Screen (ft.) ________________

Depth to Bottom of Screen (ft.) ________________

Total Well Depth (ft.) ________________

Depth to Static Water Level (ft.) ________________

Geology at Screen Interval (if known) ________________

Time of Water Level Measurement __________

Calculate Purge Volume (gal.) __________

Disposal Method ________________

Headspace ________________

Original Well Development ☐ Redevelopment ☐ Date of Original Development __________

DEVELOPMENT METHOD ______________________________

PURGE METHOD ______________________________

Time	Total Volume Purged (gal.)	Flow Rate (gpm)	Turbidity (NTU)	Color	pH	Temp	Other

ACCEPTANCE CRITERIA (from workplan)

Minimum Purge Volume Required _____ gallons

Maximum Turbidity Allowed _____ NTUs

Stabilization of parameters _____%

	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Has parameters stabilized	☐	☐	☐

If no or N/A explain below:

____

____

____

Signature ______________________________ Date: ______________

Monitoring Well Sampling

Procedure 3-14

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes the actions to be used during monitoring well sampling activities and establishes the method for sampling groundwater monitoring wells for water-borne contaminants and general groundwater chemistry. The objective is to obtain groundwater samples that are representative of aquifer conditions with as little alteration to water chemistry as possible.

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

2.1 Depending upon the site-specific contaminants, various protective programs must be implemented prior to sampling the first well. All field sampling personnel responsible for sampling activities must review the project-specific health and safety plan (HASP) paying particular attention to the control measures planned for the well sampling tasks. Conduct preliminary area monitoring of sampling wells to determine the potential hazard to field sampling personnel. If significant contamination is observed, minimize contact with potential contaminants in both the vapor phase and liquid matrix through the use of of appropriate personal protective equipment (PPE).

2.2 Observe standard health and safety practices according to the project-specific HASP. Suggested minimum protection during well sampling activities includes inner disposable vinyl gloves, outer chemical-protective nitrile gloves and rubberized steel-toed boots. Half-face respirators and cartridges and Tyvek® suits may be necessary depending on the contaminant concentrations. Refer to the project-specific HASP for the required PPE.

2.3 Physical Hazards associated with Well Sampling

- To avoid lifting injuries associated with pump and bailers retrieval, use the large muscles of the legs, not the back.
- Stay clear of all moving equipment, and avoid wearing loose fitting clothing.
- When using tools for cutting purposes, cut away from yourself. The use of appropriate, task specific cutting tools is recommended.
- To avoid slip/trip/fall conditions as a result of pump discharge, use textured boots/boot cover bottoms.
- To avoid heat/cold stress as a result of exposure to extreme temperatures and PPE, drink electrolyte replacement fluids (1 to 2 cups per hour is recommended) and, in cases of extreme cold, wear fitted insulating clothing.
- Be aware of restricted mobility due to PPE.

3.0 Terms and Definitions

None.

4.0 Interferences

4.1 Potential interferences could result from cross-contamination between samples or sample locations. Minimization of the cross-contamination will occur through the following:

- The use of clean sampling tools at each location as necessary.
- Avoidance of material that is not representative of the media to be sampled.

5.0 Training and Qualifications

5.1 **Qualifications and Training**

The individual executing these procedures must have read, and be familiar with, the requirements of this SOP.

5.2 **Responsibilities**

5.2.1 The **Project Manager** is responsible for ensuring that monitoring well sampling activities comply with this procedure. The **Project Manager** is responsible for ensuring that all field sampling personnel involved in monitoring well sampling shall have the appropriate education, experience, and training to perform their assigned tasks.

5.2.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

5.2.3 The **Field Manager** is responsible for ensuring that all field sampling personnel follow these procedures.

5.2.4 **Field sampling personnel** are responsible for the implementation of this procedure.

5.2.5 The field sampler and/or task manager is responsible for directly supervising the groundwater sampling procedures to ensure that they are conducted according to this procedure and for recording all pertinent data collected during sampling.

6.0 Equipment and Supplies

6.1 Purging and Sampling Equipment

- Pump (Peristaltic, Portable Bladder, Submersible)
- Polyethylene or Teflon bladders (for portable bladder pumps)
- Bladder pump controller (for portable bladder pumps)
- Air compressor (for portable bladder pumps)
- Nitrogen cylinders (for portable bladder pumps)
- 12-volt power source
- Polyethylene inlet and discharge tubing (except for VOC analysis which requires Teflon tubing)
- Silicone tubing appropriate for peristaltic pump head
- Teflon bailer appropriately sized for well
- Disposable bailer string (polypropylene)

- Individual or multi-parameter water quality meter(s) with flow-through cell to measure temperature, pH, specific conductance, dissolved oxygen (DO), oxidation reduction potential (ORP), and/or turbidity
- Turbidity meter
- Water level meter
- Oil/water interface probe

6.2 General Equipment

- Sample kit (i.e., bottles, labels, preservatives, custody records and tape, cooler, ice)
- Sample Chain-of-Custody (COC) forms
- Sample Collection Records
- Sample packaging and shipping supplies
- Waterproof marker or paint
- Distilled/deionized water supply
- Water dispenser bottles
- Flow measurement cup or bucket
- 5-gallon buckets
- Instrument calibration solutions
- Stopwatch or watch
- Disposable Nitrile gloves
- Paper towels
- Trash bags
- Zipper-lock bags
- Equipment decontamination supplies
- Health and safety supplies (as required by the HASP)
- Approved plans such as: project-specific HASP and Sampling and Analysis Plan (SAP)
- Well keys or combinations
- Monitoring well location map(s)
- Field project logbook/pen

7.0 Calibration or Standardization

7.1 Field instruments will be calibrated daily according to the requirements of the SAP and manufacturer's specifications for each piece of equipment. Equipment will be checked daily with the calibration solutions at the end of use of the equipment. Calibration records shall be recorded in the field logbook or appropriate field form.

7.2 If readings are suspected to be inaccurate, the equipment shall be checked with the calibration solutions and/or re-calibrated.

8.0 Procedure

8.1 Preparation

8.1.1 Site Background Information

Establish a thorough understanding of the purposes of the sampling event prior to field activities. Conduct a review of all available data obtained from the site and pertinent to the water sampling. Review well history data including, but not limited to, well locations, sampling history, purging rates, turbidity problems, previously used purging methods, well installation methods, well completion records, well development methods, previous analytical results, presence of an immiscible phase, historical water levels, and general hydrogeologic conditions.

Previous groundwater development and sampling logs give a good indication of well purging rates and the types of problems that might be encountered during sampling, such as excessive turbidity and low well yield. They may also indicate where dedicated pumps are placed in the water column. To help minimize the potential for cross-contamination, well purging and sampling and water level measurement collection shall proceed from the least contaminated to the most contaminated well as indicated by previous analytical results. This order may be changed in the field if conditions warrant it, particularly if dedicated sampling equipment is used. A review of prior sampling procedures and results may also identify which purging and sampling techniques are appropriate for the parameters to be tested under a given set of field conditions.

8.1.2 Groundwater Analysis Selection

Establish the requisite field and laboratory analyses prior to water sampling. Decide on the types and numbers of quality assurance/quality control (QA/QC) samples to be collected (refer to the project-specific SAP), as well as the type and volume of sample preservatives, the type and number of sample containers, the number of coolers required, and the quantity of ice or other chilling materials. The field sampling personnel shall ensure that the appropriate number and size sample containers are brought to the site, including extras in case of breakage or unexpected field conditions. Refer to the project-specific SAP for the project analytical requirements.

8.2 Groundwater Sampling Procedures

Groundwater sampling procedures at a site shall include:

1) An evaluation of the well security and condition prior to sampling;
2) Decontamination of equipment;
3) Measurement of well depth to groundwater;
4) Assessment of the presence or absence of an immiscible phase;
5) Assessment of purge parameter stabilization;
6) Purging of static water within the well and well bore; and
7) Obtaining a groundwater sample.

Each step is discussed in sequence below. Depending upon specific field conditions, additional steps may be necessary. As a rule, at least 24 hours should separate well development and well sampling events. In all cases, consult the State and local regulations for the site, which may require more stringent time separation between well development and sampling.

8.2.1 **Well Security and Condition**

At each monitoring well location, observe the conditions of the well and surrounding area. The following information may be noted on a Groundwater Sample Collection Record (Attachment 1) or in the field logbook:

- Condition of the well's identification marker.
- Condition of the well lock and associated locking cap.
- Integrity of the well – well pad condition, protective outer casing, obstructions or kinks in the well casing, presence of water in the annular space, and the top of the interior casing.
- Condition of the general area surrounding the well.

8.2.2 **Decontamination of Equipment**

Where possible, dedicated supplies should be used at each well location to minimize the potential for cross-contamination and minimize the amount of investigation derived waste (IDW) fluids resulting from the decontamination process. If decontamination is necessary, establish a decontamination station before beginning sampling. The station shall consist of an area of at least 4 feet by 2 feet covered with plastic sheeting and be located upwind of the well being sampled. The station shall be large enough to fit the appropriate number of wash and rinse buckets, and have sufficient room to place equipment after decontamination. One central cleaning area may be used throughout the entire sampling event. The area around the well being sampled shall also be covered with plastic sheeting to prevent spillage. Further details are presented in SOP 3-06, Equipment Decontamination.

Decontaminate each piece of equipment prior to entering the well. Also, conduct decontamination prior to sampling at a site, even if the equipment has been decontaminated subsequent to its last usage. Additionally, decontaminate each piece of equipment used at the site prior to leaving the site. It is only necessary to decontaminate dedicated sampling equipment prior to installation within the well. Do not place clean sampling equipment directly on the ground or other contaminated surfaces prior to insertion into the well. Dedicated sampling equipment that has been certified by the manufacturer as being decontaminated can be placed in the well without on-site decontamination.

8.2.3 **Measurement of Static Water Level Elevation**

Before purging the well, measure water levels in all of the wells within the zone of influence of the well being purged. The best practice, if possible, is to measure all site wells (or wells within the monitoring well network) prior to sampling. If the well cap is not vented, remove the cap several minutes before measurement to allow water levels to equilibrate to atmospheric pressure.

Measure the depth to standing water and the total depth of the well to the nearest 0.01 foot to provide baseline hydrologic data, to calculate the volume of water in the well, and to provide information on the integrity of the well (e.g., identification of siltation problems). If not already present, mark an easily identified reference point for water level measurements which will become the measuring point for all water level measurements. This location and elevation must be surveyed.

The device used to measure the water level surface and depth of the well shall be sufficiently sensitive and accurate in order to obtain a measurement to the nearest 0.01 foot reliably. An electronic water level meter will usually be appropriate for this measurement; however, when the groundwater within a particular well is highly contaminated, an inexpensive weighted tape measure can be used to determine well depth to prevent adsorption of contaminants onto the meter tape. The presence of light, non-aqueous phase liquids (LNAPLs) and/or dense, non-aqueous phase liquids (DNAPLs) in a well requires measurement of the elevation of the top and the bottom of the product, generally using an interface probe. Water levels in such wells must then be corrected for density effects to accurately determine the elevation of the water table.

At each location, measure water levels several times in quick succession to ensure that the well has equilibrated to atmospheric conditions prior to recording the measurement. As stated above, measure all site wells (or wells within the monitoring well network) prior to sampling whenever possible. This will provide a water level database that describes water levels across the site at one time (a synoptic sampling). Prior to sampling, measure the water level in each well immediately prior to purging the well to ascertain that static conditions have been achieved prior to sampling.

8.2.4 **Detection of Immiscible Phase Layers**

Complete the following steps for detecting the presence of LNAPL and DNAPL before the well is purged for conventional sampling. These procedures may not be required for all wells. Consult the project-specific SAP to determine if assessing the presence of LNAPL and/or DNAPL is necessary.

1) Sample the headspace in the wellhead immediately after the well is opened for organic vapors using either a PID or an organic vapor analyzer, and record the measurements.
2) Lower an interface probe into the well to determine the existence of any immiscible layer(s), LNAPL and/or DNAPL, and record the measurements.
3) Confirm the presence or absence of an immiscible phase by slowly lowering a clear bailer to the appropriate depth, then visually observing the results after sample recovery.
4) In rare instances, such as when very viscous product is present, it may be necessary to utilize hydrocarbon- and water-sensitive pastes for measurement of LNAPL thickness. This is accomplished by smearing adjacent, thin layers of both hydrocarbon- and water-sensitive pastes along a steel measuring tape and inserting the tape into the well. An engineering tape showing tenths and hundredths of feet is required. Record depth to water, as shown by the mark on the water-sensitive paste, and depth to product, as shown by the mark on the product-sensitive paste. In wells where the approximate depth to water and product thickness are not known, it is best to apply both pastes to the tape over a fairly long interval (5 feet or more). Under these conditions, measurements are obtained by trial and error and may require several insertions and retrievals of the tape before the paste-covered interval of the tape encounters product and water. In wells where approximate depths of air-product and product-water interfaces are known, pastes may be applied over shorter intervals. Water depth measurements should not be used in preparation of water table contour maps until they are corrected for depression by the product.
5) If the well contains an immiscible phase, it may be desirable to sample this phase separately. Section 8.2.6 presents immiscible phase sampling procedures. It may not be meaningful to conduct water sample analysis of water obtained from a well containing LNAPLs or DNAPLs. Consult the **Project Manager** and **Program Quality Manager** if this situation is encountered.

8.2.5 **Purging Equipment and Use**

__General Requirements__

The water present in a well prior to sampling may not be representative of in situ groundwater quality and shall be removed prior to sampling. Handle all groundwater removed from potentially contaminated wells in accordance with the IDW handling procedures in SOP 3-05, IDW Management. Purging shall be accomplished by methods as indicated in the project-specific SAP or by those required by State requirements. For the purposes of this SOP, purging methods will be described by removing groundwater from the well using low-flow techniques.

According to the U.S. Environmental Protection Agency (EPA) (EPA, 1996), the rate at which groundwater is removed from the well during purging ideally should be less than 0.2 to 0.3 liters/minute. EPA further states that wells should be purged at rates below those used to develop the well to prevent further development of the well, to prevent damage to the well, and to avoid disturbing accumulated corrosion or reaction products in the well. EPA also indicates that wells should be purged at or below their recovery rate so that migration of water in the formation above the well screen does not occur.

Realistically, the purge rate should be low enough that substantial drawdown in the well does not occur during purging. In addition, a low purge rate will reduce the possibility of stripping volatile organic compounds (VOCs) from the water, and will reduce the likelihood of increasing the turbidity of the sample due to mobilizing colloids in the subsurface that are immobile under natural flow conditions.

The field sampler shall ensure that purging does not cause formation water to cascade down the sides of the well screen. Wells should not be purged to dryness if recharge causes the formation water to cascade down the sides of the screen, as this will cause an accelerated loss of volatiles. This problem should be anticipated based on the results of either the well development task or historical sampling events. In general, place the intake of the purge pump in the middle of the saturated screened interval within the well to allow purging and at the same time minimize disturbance/overdevelopment of the screened interval in the well. Water shall be purged from the well at a rate that does not cause recharge water to be excessively agitated unless an extremely slow recharging well is encountered where complete evacuation is unavoidable. During the well purging procedure, collect water level and/or product level measurements to assess the hydraulic effects of purging. Sample the well when it recovers sufficiently to provide enough water for the analytical parameters specified. If the well is purged dry, allow the well to recover sufficiently to provide enough water for the specified analytical parameters, and then sample it.

Evaluate water samples on a regular basis during well purging and analyze them in the field preferably using in-line devices (i.e., flow through cell) for temperature, pH, specific conductivity, dissolved oxygen (DO), and oxidation-reduction (redox) potential. Turbidity should be measured separately (outside of the flow-through cell) with a nephelometer or similar device.

Readings should be taken every 2 to 5 minutes during the purging process. These parameters are measured to demonstrate that the natural character of the formation waters has been restored.

Purging shall be considered complete per the requirements set forth in the project-specific SAP, State requirements, or when three consecutive field parameter measurements of temperature, pH, specific conductivity, DO and ORP stabilize within approximately 10 percent and the turbidity is at or below 10 nephelometric turbidity units (NTU) or within ± 10% if above 10 NTU. This criterion may not be applicable to temperature if a submersible pump is used during purging due to the heating of the water by the pump motor. Enter all information obtained during the purging and sampling process into a groundwater sampling log. Attachment 1 shows an example of a groundwater sampling log and the information typically included in the form. Whatever form is used, all blanks need to be completed on the field log during field sampling.

Groundwater removed during purging shall be stored according to the project-specific SAP or per SOP 3-05, IDW Management.

Purging Equipment and Methods

Submersible Pump

A stainless steel submersible pump may be utilized for purging both shallow and deep wells prior to sampling the groundwater for semivolatile and non-volatile constituents, but are generally not preferred for VOCs unless there are no other options (e.g., well over 200 feet deep). For wells over 200 feet deep, the submersible pump is one of the few technologies available to feasibly accomplish purging under any yield conditions. For shallow wells with low yields, submersible pumps are generally inappropriate due to overpumpage of the wells (<1 gallon per minute), which causes increased aeration of the water within the well.

Steam clean or otherwise decontaminate the pump and discharge tubing prior to placing the pump in the well. The submersible pump shall be equipped with an anti-backflow check valve to limit the amount of water that will flow back down the drop pipe into the well. Place the pump in the middle of the saturated screened interval within the well and maintain it in that position during purging.

Bladder Pump

A stainless steel bladder pump can be utilized for purging and sampling wells up to 200 feet in depth for volatile, semivolatile, and non-volatile constituents. Use of the bladder pump is most effective in low to moderate yield wells and are often the preferred method for low-flow sampling. When sampling for VOCs and/or SVOCs, Teflon bladders should be used. Polyethylene bladders may be used when sampling for inorganics.

Either compressed dry nitrogen or compressed dry air, depending upon availability, can operate the bladder pump. The driving gas utilized must be dry to avoid damage to the bladder pump control box. Decontaminate the bladder pump prior to use.

Centrifugal, Peristaltic, or Diaphragm Pump

A centrifugal, peristaltic, or diaphragm pump may be utilized to purge a well if the water level is within 20 feet of ground surface. New or dedicated tubing is inserted into the midpoint of the saturated screened interval of the well. Water should be purged at a rate that satisfies low-flow requirements (i.e., does not cause drawdown). Centrifugal, peristaltic, or diaphragm pump are generally discouraged for VOCs sampling; however, follow methods allowed per the project-specific SAP or State requirements.

Air Lift Pump

Airlift pumps are not appropriate for purging or sampling.

Bailer

Avoid using a bailer to purge a well because it can result in overdevelopment of the well and create excessive purge rates. If a bailer must be used, the bailer should either be dedicated or disposable. Teflon-coated cable mounted on a reel is recommended for lowering the bailer in and out of the well.

Lower the bailer below the water level of the well with as little disturbance of the water as possible to minimize aeration of the water in the well. One way to gauge the depth of water on the reel is to mark the depth to water on the bailer wire with a stainless steel clip. In this manner, less time is spent trying to identify the water level in the well.

8.2.6 Monitoring Well Sampling Methodologies

Sampling Light, Non-Aqueous Phase Liquids (LNAPL)

Collect LNAPL, if present, prior to any purging activities. The sampling device shall generally consist of a dedicated or disposable bailer equipped with a bottom-discharging device. Lower the bailer slowly until contact is made with the surface of the LNAPL, and to a depth less than that of the immiscible fluid/water interface depth as determined by measurement with the interface probe. Allow the bailer to fill with LNAPL and retrieve it.

When sampling LNAPLs, never drop bailers into a well and always remove them from the well in a manner that causes as little agitation of the sample as possible. For example, the bailer should not be removed in a jerky fashion or be allowed to continually bang against the well casing as it is raised. Teflon bailers should always be used when sampling LNAPL. The cable used to raise and lower the bailer shall be composed of an inert material (e.g., stainless steel) or coated with an inert material (e.g., Teflon).

Sampling Dense, Non-Aqueous Phase Liquids (DNAPL)

Collect DNAPL prior to any purging activities. The best method for collecting DNAPL is to use a double-check valve, stainless steel bailer, or a Kemmerer (discrete interval) sampler. The sample shall be collected by slow, controlled lowering of the bailer to the bottom of the well, activation of the closing device, and retrieval.

Groundwater Sampling Methodology

The well shall be sampled when groundwater within it is representative of aquifer conditions per the methods described in Section 8.2.5. Prior to sampling the flow-through cell shall be removed and the samples collected directly from the purge tubing. Flow rates shall not be adjusted once aquifer conditions are met. Additionally, a period of no more than 2 hours shall elapse between purging and sampling to prevent groundwater interaction with the casing and atmosphere. This may not be possible with a slowly recharging well. Measure and record the water level prior to sampling in order to monitor drawdown when using low-flow techniques and gauge well volumes removed and recharged when using non-low-flow techniques.

Sampling equipment (e.g., especially bailers) shall never be dropped into the well, as this could cause aeration of the water upon impact. Additionally, the sampling methodology utilized shall allow for the collection of a groundwater sample in as undisturbed a condition as possible, minimizing the potential for volatilization or aeration. This includes minimizing agitation and aeration during transfer to sample containers, minimizing exposure to sunlight, and immediately placing the sample on ice once collected.

Sampling equipment shall be constructed of inert material. Equipment with neoprene fittings, polyvinyl chloride (PVC) bailers, Tygon® tubing, silicon rubber bladders, neoprene impellers, polyethylene, and Viton® are not acceptable when sampling for organics. If bailers are used, an inert cable/chain (e.g., fluorocarbon resin-coated wire or stainless steel wire or cable) shall be used to raise and lower the bailer. Dedicated equipment is highly recommended for all sampling programs.

Submersible Pumps

The submersible pump must be specifically designed for groundwater sampling (i.e., pump composed of stainless steel and Teflon, sample discharge lines composed of Teflon) and must have a controller mechanism allowing the required low-flow rate. Adjust the pump rate so that flow is continuous and does not pulsate to avoid aeration and agitation within the sample discharge lines. Run the pump for several minutes at the low-flow rate used for sampling to ensure that the groundwater in the lines was obtained at the low-flow rate.

Bladder Pumps

A gas-operated stainless steel bladder pump with adjustable flow control and equipped with a Teflon bladder and Teflon-lined tubing can be effectively utilized to collect a groundwater sample and is considered to be the best overall device for sampling inorganic and organic constituents. If only inorganics are being sampled, polyvinyl bladders and tubing may be used. Operate positive gas displacement bladder pumps in a continuous manner so that they minimize discharge pulsation that can aerate samples in the return tube or upon discharge.

When using a compressor, take several precautions. If the compressor is being powered by a gasoline generator, position the generator downwind of the well. Ground fault circuit interrupters (GFCIs) should always be used when using electric powered equipment. Do not connect the compression hose from the compressor to the pump controller until after the engine has been started.

When all precautions are completed and the compressor has been started, connect the compression hose to the pump controller. Slowly adjust the control knobs to discharge water in the shortest amount of time while maintaining a near constant flow. This does not mean that the compressor must be set to discharge the water as hard as possible. The optimal setting is one that produces the largest volume of purge water per minute (not per purge cycle) while maintaining a near constant flow rate.

Prior to sampling, adjust the flow rate (purge rate) to yield 100 to 300 mL/minute. Avoid settings that produce pulsating streams of water instead of a steady stream if possible. Operate the pump at this low flow rate for several minutes to ensure that drawdown is not occurring. At no time shall the sample flow rate exceed the flow rate used while purging.

For those samples requiring filtration, it is recommended to use an in-line high capacity filter after all non-filtered samples have been collected.

***Peristaltic Pumps*:**

A peristaltic pump is a type of positive displacement pump that moves water via the process of peristalsis. The pump uses a flexible hose fitted inside a circular pump casing. A rotor with cams compresses the flexible tube as the rotor turns, which forces the water to be pumped to move through the tube. In peristaltic pumps, no moving parts of the pump are in contact with the water being pumped. Displacement is determined by tube size, so delivery rate can only be changed during operation by varying pump speed. Peristaltic pumps are simple and quite inexpensive for the flow rates they provide.

There are several methods available for transferring the sample into the laboratory containers. The selected method may vary based on State requirements and should be documented in the project-specific SAP. Samples typically can be collected directly from the discharge end of the Teflon tubing, after it has been disconnected from the flow through cell. For volatile analyses, the sampler should make sure that the pump is set such that a smooth laminar flow is achieved. In all cases, the project team should consult their local regulatory requirements and document the selected sample collection procedure in the project-specific SAP.

Bailers

A single- or double-check valve Teflon or stainless steel bailer equipped with a bottom discharging device can be utilized to collect groundwater samples. Bailers have a number of disadvantages, however, including a tendency to alter the chemistry of groundwater samples due to degassing, volatilization, and aeration; the possibility of creating high groundwater entrance velocities; differences in operator techniques resulting in variable samples; and difficulty in determining where in the water column the sample was collected. Therefore, use bailers for groundwater sampling only when other types of sampling devices cannot be utilized for technical, regulatory, or logistical reasons.

Dedicated or disposable bailers should always be used in order to eliminate the need for decontamination and to limit the potential of cross-contamination. Each time the bailer is lowered to the water table, lower it in such a way as to minimize disturbance and aeration of the water column within the well.

8.2.7 **Sample Handling and Preservation**

Many of the chemical constituents and physiochemical parameters to be measured or evaluated during groundwater monitoring programs are chemically unstable and require preservation. The U.S. EPA document entitled, *Test Methods for Evaluating Solid Waste – Physical/Chemical Methods (SW-846)* (EPA 1997)*,* includes a discussion of appropriate sample preservation procedures. In addition, SW-846 provides guidance on the types of sample containers to use for each constituent or common set of parameters. In general, check with specific laboratory or State requirements prior to obtaining field samples. In many cases, the laboratory will supply the necessary sample bottles and required preservatives. In some cases, the field sampling personnel may add preservatives in the field.

Improper sample handling may alter the analytical results of the sample. Therefore, transfer samples in the field from the sampling equipment directly into the container that has been prepared specifically for that analysis or set of compatible parameters as described in the project-specific SAP. It is not an acceptable practice for samples to be composited in a common container in the field and then split in the laboratory, or poured first into a wide mouth container and then transferred into smaller containers.

Collect groundwater samples and place them in their proper containers in the order of decreasing volatility and increasing stability. A preferred collection order for some common groundwater parameters is:

1. VOCs and total organic halogens (TOX)
2. Dissolved gases, total organic carbon (TOC), total fuel hydrocarbons
3. Semivolatile organics, pesticides
4. Total metals, general minerals (unfiltered)
5. Dissolved metals, general minerals (filtered)
6. Phenols
7. Cyanide
8. Sulfate and chloride
9. Nitrate and ammonia
10. Radionuclides

When sampling for VOCs, collect water samples in vials or containers specifically designed to prevent loss of VOCs from the sample. The analytical laboratory performing the analysis shall provide these vials. Collect groundwater from the sampling device in vials by allowing the groundwater to slowly flow along the sides of the vial. Sampling equipment shall not touch the interior of the vial. Fill the vial above the top of the vial to form a positive meniscus with no overflow. No headspace shall be present in the sample container once the container has been capped. This can be checked by inverting the bottle once the sample is collected and tapping the side of the vial to dislodge air bubbles. Sometimes it is not possible to collect a sample without air bubbles, particularly water that has high concentrations of dissolved gasses. In these cases, the field sampling personnel shall document the occurrence in the field logbook and/or sampling worksheet at the time the sample was collected. Likewise, the analytical laboratory shall note in the laboratory analysis reports any headspace in the sample container(s) at the time of receipt by the laboratory.

Special Handling Considerations

In general, samples for organic analyses should not be filtered. However, high turbidity samples for PCB analysis may require filtering. Consult the project-specific SAP for details on filtering requirements. Samples shall not be transferred from one container to another because this could cause aeration or a loss of organic material onto the walls of the container. TOX and TOC samples should be handled in the same manner as VOC samples.

When collecting total and dissolved metals samples, the samples should be collected sequentially. The total metals sample is collected from the pump unfiltered. The dissolved metals sample is collected after filtering with a 0.45-micron membrane in-line filter. Allow at least 500 mL of effluent to flow through the filter prior to sampling to ensure that the filter is thoroughly wetted and seated in the filter capsule. If required by the project-specific SAP, include a filter blank for each lot of filters used and always record the lot number of the filters.

Field Sampling Preservation

Preserve samples immediately upon collection. Ideally, sampling containers will be pre-preserved with a known concentration and volume of preservative. Certain matrices that have alkaline pH (greater than 7) may require more preservative than is typically required. An early assessment of preservation techniques, such as the use of pH strips after initial preservation, may therefore be appropriate. Guidance for the preservation of environmental samples can be found in the U.S. EPA *Handbook for Sampling and Sample Preservation of Water and Wastewater* (EPA 1982). Additional guidance can be found in other U.S. EPA documents (EPA 1992, 1996).

Field Sampling Log

A groundwater sampling log provided as Attachment 1 shall document the following:

- Identification of well
- Well depth
- Static water level depth and measurement technique
- Presence of immiscible layers and detection method
- Well yield
- Purge volume and pumping rate
- Time that the well was purged
- Sample identification numbers
- Well evacuation procedure/equipment
- Sample withdrawal procedure/equipment
- Date and time of collection
- Types of sample containers used
- Preservative(s) used
- Parameters requested for analysis

- Field analysis data
- Field observations on sampling event
- Name of sampler
- Weather conditions

9.0 Quality Control and Assurance

9.1 Field personnel will follow specific quality assurance (QA) guidelines as outlined in the project-specific SAP. The goal of the QA program should be to ensure precision, accuracy, representativeness, completeness, and comparability in the project sampling program.

9.2 Quality control (QC) requirements for sample collection are dependent on project-specific sampling objectives. The project-specific SAP will provide requirements for sample preservation and holding times, container types, sample packaging and shipment, as well as requirements for the collection of various QC samples such as trip blanks, field blanks, equipment rinse blanks, and field duplicate samples.

10.0 Data and records management

10.1 Records will be maintained in accordance with SOP 3-03, Recordkeeping, Sample Labelling, and Chain-of-Custody. Various forms are required to ensure that adequate documentation is made of the sample collection activities. These forms may include:

- Sample Collection Records;
- Field logbook;
- Chain-of-custody forms; and
- Shipping labels.

10.2 Sample collection records (Attachment 1) will provide descriptive information for the purging process and the samples collected at each monitoring well.

10.3 The field logbook is kept as a general log of activities and should not be used in place of the sample collection record.

10.4 Chain-of-custody forms are transmitted with the samples to the laboratory for sample tracking purposes.

10.5 Shipping labels are required is sample coolers are to be transported to a laboratory by a third party (courier service).

11.0 Attachments or References

Attachment 1 – Groundwater Sampling Collection Record

ASTM Standard D5088. 2008. *Standard Practice for Decontamination of Field Equipment Used at Waste Sites.* ASTM International, West Conshohocken, PA. 2008. DOI: 10.1520/D5088-02R08. www.astm.org.

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EPA. 1992. *RCRA Groundwater Monitoring Draft Technical Guidance*. EPA/530/R-93/001. Office of Solid Waste. November.

EPA. 1996. *Ground Water Issue: Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*. EPA/540/S-95/504. Office of Solid Waste and Emergency Response. April.

EPA. 1997. *Test Methods for Evaluating Solid Waste, Physical/Chemical Method (SW-846)*. 3rd ed., Final Update IIIA. Office of Solid Waste. Online updates at: http://www.epa.gov/epaoswer/hazwaste/test/new-meth.htm.

NAVSEA T0300-AZ-PRO-010. *Navy Environmental Compliance Sampling and Field Testing Procedures Manual*. August 2009.

SOP 3-03, *Recordkeeping, Sample Labelling, and Chain-of-Custody*.

SOP 3-05, *IDW Management.*

SOP 3-06, *Equipment Decontamination*.

Author	*Reviewer*	*Revisions (Technical or Editorial)*
Mark Kromis Program Chemist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue (May 2012)

AECOM

Attachment 1
Groundwater Sample Collection Record

Well ID:

RESOLUTION CONSULTANTS

Groundwater Sample Collection Record

Client: ______ Date: ______ Time: Start ______ am/pm
Project No: ______ Finish ______ am/pm
Site Location: ______
Weather Conds: ______ Collector(s): ______

1. WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length ______ c. Length of Water Column ______ (a-b) Casing Diameter/Material ______

b. Water Table Depth ______ d. Calculated Well Volume (see back) ______

2. WELL PURGEABLE DATA

a. Purge Method: ______

b. Acceptance Criteria defined (see SAP or Work Plan)
- Minimum Required Purge Volume (@ ______ well volumes) ______
- Maximum Allowable Turbidity ______ NTUs
- Stabilization of parameters ______ %

c. Field Testing Equipment used: Make Model Serial Number

Time (min)	Volume Removed (gal)	Temp. (°C)	pH s.u.	Spec. Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (m)	Color/Odor/etc.

d. Acceptance criteria pass/fail (continued on back)

	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Have parameters stabilized	☐	☐	☐

If no or N/A - Explain below.

______

3. SAMPLE COLLECTION: Method: ______

Sample ID	Container Type	No. of Containers	Preservation	Analysis Req.	Time

Comments ______

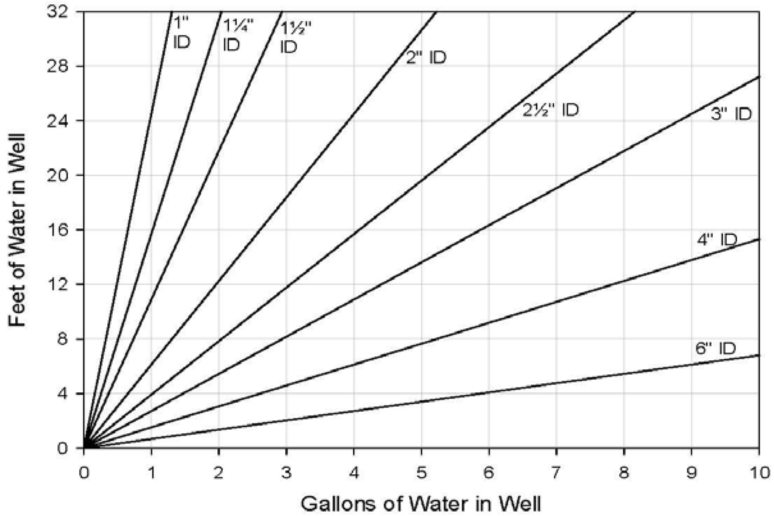
Signature ______ Date ______

Page 1 of 2

RESOLUTION CONSULTANTS

Purge Volume Computation

Well ID:



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
¼	0.0025	0.0097
3/8	0.0057	0.0217
½	0.0102	0.0386
¾	0.0229	0.0869
1	0.0408	0.1544
1¼	0.0637	0.2413
1½	0.0918	0.3475
2	0.1632	0.6178
2½	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600

(continued from front)

Time (min)	Volume Removed (gal)	Temp. (°C)	pH s.u.	Spec. Cond. (μS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (m)	Color/Odor/etc.

Signature______________________________ Date ______________

Direct Push Sampling Techniques

Procedure 3-17

1.0 Purpose and Scope

1.1 This procedure shall serve as management-approved professional guidance for the ER Program and is consistent with protocol in the Uniform Federal Policy-Quality Assurance Project Plan (DoD 2005). As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgment during unforeseen circumstances. Deviations from this procedure while planning or executing planned activities must be approved by both the Project Manager and the Quality Assurance (QA) Manager or Technical Director, and documented.

1.2 If there are procedures whether it be from AECOM, state and/or federal that are not addressed in this SOP and are applicable to direct push sampling then those procedures may be added as an appendix to the project specific SAP.

2.0 Safety

2.1 Field personnel shall perform work in accordance with the site-specific health and safety plan (HASP). During monitoring well installation, subcontractors in direct contact with potentially contaminated media shall wear the proper personal protective equipment (PPE) as outlined in the site-specific health and safety plan. Failure to comply will result in disciplinary action.

2.2 If circumstances warrant, a real-time immediate response instrument, such as a Miniram Dust Monitor, organic vapor analyzer, HNu, Thermo, Draeger or Sensidyne tubes, or explosimeter, should be used to monitor the work area. When real/time instrument response exceeds the permissible exposure limit, personnel shall don the appropriate PPE and alternate control measures to ensure personnel safety. If safe control measures are not achievable, field activities shall be discontinued immediately. Company-specific HASPs offer guidelines on air surveillance and on selection of PPE. In addition, the site-specific HASP includes an air monitoring program and suggested PPE.

2.3 In addition to the aforementioned precautions and depending upon the type of contaminant expected, employ the following safe work practices:

Particulate or Metal Compounds

1. Avoid skin contact and/or incidental ingestion of soil.
2. Wear protective clothing, steel-toed boots, gloves, safety glasses, and hearing protection as warranted.

VOCs

1. Avoid breathing constituents venting from holes by approaching upwind, and/or by use of respiratory protection.
2. Pre-survey the area with a flame ionization detector (FID) or photoionization detector (PID) prior to sampling.
3. If monitoring results indicate organic vapors that exceed action levels as specified in the site-specific HASP, sampling activities may need to be conducted in Level C protection. At a minimum, skin protection will be required by use of gloves and Tyvek or other media that is protective against the media being encountered.

Flammable or Explosive Conditions

1. Monitor explosive gases as continuously as possible using an explosimeter and oxygen meter.
2. Place all ignition sources upwind or crosswind of the borehole.
3. If explosive gases exceed the designated action levels as specified in the site-specific HASP, cease operations and evaluate conditions.

Physical Hazards Associated With Soil Sampling

1. To avoid possible back strain associated with sample collection, use the large muscles of the legs, not the back, when retrieving soil samplers.
2. Stay clear of all moving equipment, and avoid wearing loose fitting clothing.
3. To avoid slip/trip/fall hazards, be wary of open trenches, pits, or holes.
4. Be aware of restricted mobility due to PPE.
5. To avoid hand, wrist, arm, shoulder, and back trauma due to the use of slide hammers or hand augers, rotate sampling among field personnel

3.0 Terms and Definitions

3.1 Direct push techniques are methods for subsurface sampling or monitoring that involve the application of downward pressure (usually supplied through hydraulic means) without the benefit of cutting tool rotation to enter soil. A variety of systems are available under several trade names, such as GeoProbe®. Equipment may be skid-mounted, trailered, or mounted directly on the frame of a vehicle.

4.0 Interferences

4.1 Potential interferences could result from cross-contamination between samples or sample locations. Minimization of the cross contamination will occur through the following:

- The use of clean sampling tools at each location as necessary.
- Avoidance of material that is not representative of the media to be sampled.

5.0 Training and Qualifications

5.1 Qualifications and Training

The individual executing these procedures must have read, and be familiar with, the requirements of this SOP.

5.2 Responsibilities

5.2.1 The **Project Manager** is responsible for ensuring that these standard direct push technique procedures are followed during projects conducted under the ER Program and that a qualified individual conducts or supervises the projects. A qualified individual for subsurface sampling or monitoring using direct push techniques is defined as a person with a degree in geology, hydrogeology, or geotechnical/civil engineering with at least 1 year of experience supervising soil boring construction using conventional drilling or direct push techniques. The Project Manager or designee is responsible for ensuring that all personnel involved in direct push sampling techniques shall have the appropriate education, experience, and training to perform their assigned tasks as specified in Chief of Naval Operations Instruction 5090.1c (DON 2007).

5.2.2 The Program Quality Manager is responsible for ensuring overall compliance with this procedure.

5.2.3 The Field Manager is responsible for ensuring that all field personnel follow these procedures.

5.2.4 All Field Personnel are responsible for the implementation of this procedure.

5.2.5 The Field Personnel and/or Field Manager is responsible for directly supervising the direct push sampling procedures to ensure that they are conducted according to this procedure, and for recording all pertinent data collected during sampling.

6.0 Equipment and Supplies

In addition to those materials provided by the subcontractor, the project **Field Manager/Field Personnel** will require:

- Boring Logs;
- Spoons or scoops;
- Sample kit (bottles, labels, custody records and tape, cooler, ice), if laboratory analysis is required;
- Sample collection pan;
- Folding rule or tape measure;
- Plastic sheeting;
- Utility knife;
- Equipment decontamination materials (as described in SOP 3-06, *Equipment Decontamination*);
- Health and safety equipment (as required by HASP); and
- Field project notebook/pen.

7.0 Procedure

Direct push techniques may be used as a cost-effective alternative to conventional drilling techniques for obtaining subsurface soil and groundwater samples and for monitoring subsurface conditions.

7.1 Method Selection

Base the decision to use direct push techniques on: (1) their ability to achieve the required information at the required level of quality control and (2) their cost-effectiveness compared to conventional drilling methods. Major limitations of direct push techniques are their inability to penetrate rock or cobbles and a shallow maximum depth of penetration. The capabilities of direct push systems vary significantly among vendors. Consider these differences in capabilities when evaluating the method for a subsurface exploration program.

Use direct push techniques to obtain groundwater samples for confirmatory analyses only if the screen placement method protects the screen from clogging during installation and allows the installation of a sand-pack around the exterior of the well screen.

7.2 Inspection of Equipment

Inspect direct push equipment prior to use for signs of fluid leakage, which could introduce contaminants to the soil. If, at any time during equipment operation, fluid is observed leaking from the rig, cease operations and immediately repair or contain the leak. Collect, containerize, and label soil and other materials affected by the leak for proper disposal (see SOP 3-05, *IDW Management*).

7.3 Preparation of Work Site

Inspect the work site prior to commencing operations to ensure that no overhead hazards exist that could impact the direct push equipment, and the work area should cleared and/or marked by the local underground utility locating service (e.g., DigSafe). In addition, clear locations planned for subsurface exploration using either geophysical methods and/or hand excavate locations to a depth of 2 to 3 feet prior to soil penetration, unless it is certain (by virtue of subsurface clearing activities) that no utilities or other hazardous obstructions will be encountered in the first 2 to 3 feet. Hand excavation may be waived when it is not practical.

Locate the direct push rig so that it is downslope from the penetration point, if the work is to be performed on a grade. Locate the rig downwind or crosswind of the penetration point, if possible. Cover the area surrounding, and in the vicinity of, the penetration point with plastic. Establish required exclusion zones using plastic tape or cones to designate the various areas.

7.4 Equipment Decontamination

To avoid cross-contamination, thoroughly decontaminate equipment used for direct push exploration and sampling as described in SOP 3-06, *Equipment Decontamination*. Decontaminate sampling tools and downhole equipment between each sampling event and between penetration points. At a minimum, steam clean or wash and rinse the equipment. Collect, containerize, and label all wash and rinse water for proper disposal. Clean equipment (e.g., drive rods and samplers) shall not come into contact with contaminated soils or other contaminated materials. Keep equipment on plastic or protect it in another suitable fashion. Store push rods and other equipment removed from a hole on plastic sheeting until properly decontaminated.

7.5 Soil Sampling

This SOP assumes that the subcontractor will perform sampling; therefore, detailed procedures regarding sample acquisition are not provided. Vendors of direct push equipment offer a variety of sampling systems designed specifically for their equipment. Both continuous and discreet soil samples may be obtained using sampling equipment similar to that described in Procedure 3-21, *Surface and Subsurface Soil Sampling*. The preferred methods for soil sampling using direct push techniques use brass or stainless steel split-tube samplers that are driven through the horizon to be sampled. Use plastic sample tubes (e.g., Macro-Core Samplers) only for screening purposes or, in the case of confirmatory sampling, if samples will not be analyzed for volatile organic compounds (VOCs) or semivolatile organic compounds (SVOCs).

7.6 Groundwater Sampling

Direct push vendors offer numerous methods for obtaining groundwater samples. Key differences among methods involve: (1) the maximum well diameter achievable; (2) the ability to protect the well screen from exposure to contaminated overburden soils during installation; (3) the ability to install packing around the screen; (4) flexibility in the size, materials of construction, and design of well screens; and (5) the ability to convert sampling points into permanent monitoring wells. The limitations and abilities of a given system must be thoroughly understood and matched to the needs of the project before committing to the collection of groundwater samples using direct push techniques.

Use direct push techniques only to collect screening samples unless it is confirmed that the system:

1. Effectively protects the well screen from exposure to contaminated overburden soils during installation
2. Allows the installation of effective packing around the well screen
3. Allows the well screen to be effectively sealed against the downward infiltration of overlying groundwater or surface precipitation
4. Is constructed of materials compatible with the intended sampling and analysis goals of the project
5. Allows the use of a well screen properly sized and slotted for the needs of the project

Additional information on the collection of groundwater samples can be found in SOP 3-14 Monitoring Well Sampling.

It is the responsibility of the **Project Manager** to evaluate and determine the appropriateness of direct push systems prior to committing to their use on any project involving groundwater sampling. As part of this evaluation, it is recommended to obtain concurrence from regulatory authorities in advance for the method selection.

7.7 Borehole Abandonment

Methods for abandoning boreholes created with direct push systems will vary among vendors. Coordinate the desired method for abandonment with the vendor in the planning stages of the project to ensure proper abandonment.

Some direct push boreholes will close naturally as the drive rods and sampling tools are withdrawn. This may occur in loose, unconsolidated soils, such as sands. Close all boreholes using one of the procedures described in this procedure, unless natural caving precludes such closure.

The three methods for closing direct push boreholes are:

1. Add granulated or pelletized bentonite and hydrate in layers, proceeding from the bottom of the hole to the surface.
2. Pour premixed cement/water (or cement/water/bentonite) mixture into the hole.
3. Fill the entire hole with granular or pelletized bentonite and hydrate by means of a previously emplaced water tube that is gradually withdrawn as water is supplied to the bentonite.

The second method is recommended. For shallow holes less than 10 feet in depth, pour a cement/water/bentonite mix directly into the opening using a funnel. For deeper holes, use a conductor (tremie) pipe to carry the grout mix to the far reaches of the borehole. Lower the conductor pipe to within 2 inches of the bottom and gradually withdraw it as grout is added, keeping the lower end of the pipe submerged in grout at all times.

The recommended grout mixture for well abandonment is 7 to 9 gallons of water per 94-pound bag of Portland cement, with 3 percent to 5 percent by weight of powdered bentonite added to the mixture. Commercial products, such as Volcay are acceptable with pre-approval of the **Project Manager**.

Seal boreholes to within 0.5 to 2.0 feet of the surface. Inspect the abandoned borehole after 24 hours to ensure that grout shrinkage does not occur. If significant shrinkage has occurred, re-grout the borehole. Fill the remaining portion of the hole with local topsoil or appropriate paving materials.

8.0 Quality Control and Assurance

8.1 Collection of representative samples will be ensured through adherence to the procedures in this SOP and the sampling strategy outlined in the SAP. The field quality control samples identified in the SAP must be collected. These samples may include field duplicates, equipment rinsate blanks, trip blanks, and matrix spike/matrix spike duplicates

9.0 Records, Data Analysis, Calculations

9.1 Various forms are required to ensure that adequate documentation is made of the sample collection activities. These forms may include:

- Boring logs;
- Field logbook;
- Sample collection records;
- Chain-of-custody forms; and
- Shipping labels.

9.2 Boring logs (Attachment 1) will provide visual and descriptive information for samples collected at each soil boring and are often the most critical form of documentation generated during a soil sampling program.

9.3 The field logbook is kept as a general log of activities and should not be used in place of the boring log.

9.4 Chain-of-custody forms are transmitted with the samples to the laboratory for sample tracking purposes.

9.5 Shipping labels are required is sample coolers are to be transported to a laboratory by a third party (courier service).

10.0 Attachments or References

10.1 Department of Defense, United States (DoD). 2005. *Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP-QAPP Manual*. Final Version 1. DoD: DTIC ADA 427785, EPA-505-B-04-900A. In conjunction with the U. S. Environmental Protection Agency and the Department of Energy. Washington: Intergovernmental Data Quality Task Force. March. On-line updates available at: http://www.epa.gov/fedfac/pdf/ufp_qapp_v1_0305.pdf.

10.2 SOP 3-05, *IDW Management.*

10.3 SOP 3-06, *Equipment Decontamination.*

10.4 SOP 3-21, *Surface and Subsurface Soil Sampling.*

AECOM

Operation and Calibration of a Photoionization Detector

Procedure 3-20

1.0 Purpose and Scope

1.1 Purpose and Applicability

1.1.1 This standard operating procedure (SOP) describes the procedures that will be followed by field staff for operation and calibration of a photoionization detector (PID). The PID is primarily used by AECOM personnel for safety and survey monitoring of ambient air, determining the presence of volatiles in soil and water, and detecting leakage of volatiles.

1.1.2 PIDs routinely used by field personnel include the Photovac Microtip, Thermoelectron 580EZ, and MiniRAE 2000. Personnel responsible for using the PID should first read and thoroughly familiarize themselves with the instrument instruction manual.

1.2 Principle of Operation

1.2.1 The PID is a non-specific vapor/gas detector. The unit generally consists of a hand-held probe that houses a PID, consisting of an ultraviolet (UV) lamp, two electrodes, and a small fan which pulls ambient air into the probe inlet tube. The probe is connected to a readout/control box that consists of electronic control circuits, a readout display, and the system battery. Units are available with UV lamps having an energy from 9.5 electron volts (eV) to 11.7 eV.

1.2.2 The PID analyzer measures the concentration of trace gas present in the atmosphere by photoionization. Photoionization occurs when an atom or molecule absorbs a photon of sufficient energy to release an electron and become a positive ion. This will occur when the ionization potential of the molecule (in electron volts (eV)) is less than the energy of the photon. The source of photons is an ultraviolet lamp in the probe unit. Lamps are available with energies ranging from 9.5 eV to 11.7 eV. All organic and inorganic vapor/gas compounds having ionization potentials lower than the energy output of the UV lamp are ionized and the resulting potentiometric change is seen as a positive reading on the unit. The reading is proportional to the concentration of organics and/or inorganics in the vapor.

1.2.3 Sample gases enter the probe through the inlet tube and enter the ion chamber where they are exposed to the photons emanating from the UV lamp. Ionization occurs for those molecules having ionization potentials near to or less than that of the lamp. A positive- biased polarizing electrode causes these positive ions to travel to a collector electrode in the chamber. Thus the ions create an electrical current which is amplified and displayed on the meter. This current is proportional to the concentration of trace gas present in the ion chamber and to the sensitivity of that gas to photoionization.

1.2.4 In service, the analyzer is first calibrated with a gas of known composition equal to, close to, or representative of that to be measured. Gases with ionization potentials near to or less than the energy of the lamp will be ionized. These gases will thus be detected and measured by the analyzer. Gases with ionization potentials greater than the energy of the lamp will not be detected. The ionization potentials of the major components of air, i.e., oxygen, nitrogen, and carbon dioxide, range from about 12.0 eV to 15.6 eV and are not ionized by any of the lamps available. Gases with ionization potentials near to or slightly higher than the lamp are partially ionized, with low sensitivity.

1.3 Specifications

1.3.1 Refer to the manufacturer's instructions for the technical specifications of the instrument being used. The operating concentration range is typically 0.1 to 2,000 ppm isobutylene equivalent.

2.0 Safety

2.1 The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the project Health and Safety Plan (HASP). In the absence of a HASP, work will be conducted according to the Contract Task Order (CTO) Work Plan (WP) and/or direction from the **Site Safety Officer (SSO)**.

2.2 Only PIDs stamped Division I Class I may be used in explosive atmospheres. Refer to the project HASP for instructions pertaining to instrument use in explosive atmospheres.

3.0 Terms and Definitions

None.

4.0 Interferences

4.1 Regardless of which gas is used for calibration, the instrument will respond to all analytes present in the sample that can be detected by the type of lamp used in the PID.

4.2 Moisture will generate a positive interference in the concentration measured for a PID and is characterized by a slow increase in the reading as the measurement is made. Care must be taken to minimize uptake of moisture to the extent possible. Refer to the manufacturers' instructions for care, cleaning, and maintenance.

4.3 Uptake of soil into the PID must be avoided as it will compromise instrument performance by blocking the probe, causing a positive interference, or dirtying the PID lamp. Refer to the manufacturers' instructions for care, cleaning, and maintenance.

4.4 The user should listen to the pitch of the sampling pump. Any changes in pitch may indicate a blockage and corrective action should be initiated.

5.0 Training and Qualifications

5.1 Qualifications and Training

The individual executing these procedures must have read, and be familiar with, the requirements of this SOP.

5.2 Responsibilities

5.2.1 The CTO Manager is responsible for ensuring that the operation and calibration activities comply with this procedure. The CTO Manager is responsible for ensuring that all personnel involved in the operation and calibration shall have the appropriate education, experience, and training to perform their assigned tasks.

5.2.2 The Program Quality Manager is responsible for ensuring overall compliance with this procedure.

5.2.3 The Field Manager is responsible for ensuring that all operation and calibration activities are conducted according to this procedure.

5.2.4 All Field Personnel are responsible for the implementation of this procedure.

6.0 Equipment and Supplies

- Calibration Gas: Compressed gas cylinder of isobutylene in air or similar stable gas mixture of known concentration. The selected gas should have an ionization potential similar to that of the vapors to be monitored, if known. The concentration should be at 50-75% of the range in which the instrument is to be calibrated;
- Regulator for calibration gas cylinder;
- Approximately 6 inches of Teflon® tubing;
- Tedlar bag (optional);
- Commercially-supplied zero grade air (optional);
- "Magic Marker" or “Sharpie” or other waterproof marker;
- Battery charger;
- Moisture traps;
- Spare lamps;
- Manufacturer’s instructions; and
- Field data sheets or logbook/pen.

7.0 Procedure

7.1 Preliminary Steps

7.1.1 Preliminary steps (battery charging, check-out, calibration, maintenance) should be conducted in a controlled or non-hazardous environment.

7.2 Calibration

7.2.1 The PID must be calibrated in order to display concentrations in units equivalent to ppm. First a supply of zero air (ambient air or from a supplied source), containing no ionizable gases or vapors is used to set the zero point. A span gas, containing a known concentration of a photoionizable gas or vapor, is then used to set the sensitivity.

7.2.2 Calibrate the instrument according to the manufacturer’s instructions. Record the instrument model and identification number, the initial and adjusted meter readings, the calibration gas composition and concentration, and the date and the time in the field records.

7.2.3 If the calibration cannot be achieved or if the span setting resulting from calibration is 0.0, then the lamp must be cleaned (Section 7.4).

7.3 Operation

7.3.1 Turn on the unit and allow it to warm up (minimum of 5 minutes). Check to see if the intake fan is functioning; if so, the probe will vibrate slightly and a distinct sound will be audible when holding the probe casing next to the ear. Also, verify on the readout display that the UV lamp is lit.

7.3.2 Calibrate the instrument as described in Section 7.2, following the manufacturer’s instructions. Record the calibration information in the field records.

7.3.3 The instrument is now operational. Readings should be recorded in the field records.

7.3.4 When the PID is not being used or between monitoring intervals, the unit may be switched off to conserve battery power and UV lamp life; however, a “bump” test should be performed each time the unit is turned on and prior to taking additional measurements. To perform a bump test, connect the outlet tubing from a Tedlar bag containing a small amount of span gas to the inlet tubing on the unit and record the reading. If the reading is not within the tolerance specified in the project plan, the unit must be recalibrated.

7.3.5 At the end of each day, recheck the calibration. The check will follow the same procedures as the initial calibration (Section 7.2) except that no adjustment will be made to the instrument. Record the information in the field records.

7.3.6 Recharge the battery after each use (Section 7.4).

7.3.7 When transporting, ensure that the instrument is packed in its stored condition in order to prevent damage.

7.4 Routine Maintenance

7.4.1 Routine maintenance associated with the use of the PID includes charging the battery, cleaning the lamp window, replacing the detector UV lamp, replacing the inlet filter, and replacing the sample pump. Refer to the manufacturer's instructions for procedures and frequency.

7.4.2 All routine maintenance should be performed in a non-hazardous environment.

7.5 Troubleshooting Tips

7.5.1 One convenient method for periodically confirming instrument response is to hold the sensor probe next to the tip of a magic marker. A significant reading should readily be observed.

7.5.2 Air currents or drafts in the vicinity of the probe tip may cause fluctuations in readings.

7.5.3 A fogged or dirty lamp, due to operation in a humid or dusty environment, may cause erratic or fluctuating readings. The PID should never be operated without the moisture trap in place.

7.5.4 Moving the instrument from a cool or air-conditioned area to a warmer area may cause moisture to condense on the UV lamp and produce unstable readings.

7.5.5 A zero reading on the meter should not necessarily be interpreted as an absence of air contaminants. The detection capabilities of the PID are limited to those compounds that will be ionized by the particular probe used.

7.5.6 Many volatile compounds have a low odor threshold. A lack of meter response in the presence of odors does not necessarily indicate instrument failure.

7.5.7 When high vapor concentrations enter the ionization chamber in the PID the unit can become saturated or "flooded". Remove the unit to a fresh air environment to allow the vapors to be completely ionized and purged from the unit.

8.0 Quality Control and Assurance

8.1 The end use of the data will determine the quality assurance requirements that are necessary to produce data of acceptable quality. These quality assurance requirements will be defined in the site-specific workplan or Sampling and Analysis Plan (SAP), hereafter referred to as the project plan.

8.2 Calibration of the PID will be conducted at the frequency specified in the project plan. In the absence of project-specific guidance, calibration will be performed at the beginning of each day of sampling and will be checked at the end of the sampling day or whenever instrument operation is suspect. The PID will sample a calibration gas of known concentration. The instrument must agree with the calibration gas within ±10%. If the instrument responds outside this tolerance, it must be recalibrated.

8.3 Checks of the instrument response (Section 7.5) should be conducted periodically and documented in the field records.

9.0 Records, Data Analysis, Calculations

Safety and survey monitoring with the PID will be documented in a bound field logbook, or on standardized forms, and retained in the project files. The following information is to be recorded:

- Project name and number;
- Instrument manufacturer, model, and identification number;
- Operator's signature;
- Date and time of operation;
- Calibration gas used;
- Calibration check at beginning and end of day (meter readings before adjustment);
- Span setting after calibration adjustment;
- Meter readings (monitoring data obtained);
- Instances of erratic or questionable meter readings and corrective actions taken; and
- Instrument checks and response verifications – e.g., battery check, magic marker response (Section 7.5) or similar test.

10.0 Attachments or References

United States Environmental Protection Agency. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM). USEPA, Region 4, SESD, Enforcement and Investigations Branch, Athens, GA. November 2001.

Author	Reviewer	Revisions (Technical or Editorial)
Robert Shoemaker Senior Scientist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue (May 2012)

Surface and Subsurface Soil Sampling Procedures

Procedure 3-21

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes the procedures for soil sampling. The procedure includes surface and subsurface sampling by various methods using hand auguring, test pit, direct-push, and split-spoon equipment.

1.2 The procedure includes soil sampling for volatile organic compounds (VOCs). For project specific information (e.g. sampling depths, equipment to be used, and frequency of sampling), refer to the project-specific planning documents (e.g., Work Plan [WP] or Sampling and Analysis Plan [SAP]), which take precedence over these procedures. Surface soil sampling, typically considered to be up to two feet below ground surface by EPA standards, is typically accomplished using hand tools such as shovels or hand augers. Test pit samples are considered subsurface samples, although normally collected via hand tools similar to surface soil sampling or by excavation machinery. Direct-push and split-spoon sampling offer the benefit of collecting soil samples from a discrete or isolated subsurface interval, without the need of extracting excess material above the target depth. These methods dramatically reduce time and cost associated with disposal of material from soil cuttings when compared to test pit sampling. In addition, direct-push and split-spoon sampling methods can obtain samples at targeted intervals greater than 15 feet in depth, allowing for discrete depth soil sampling while speeding up the sampling process. Direct-push methods work best in medium to fine-grained cohesive materials such as medium to fine sands, silts, and silty clay soils. Split-spoon sampling works well in all types of soil, but is somewhat slower than direct-push methods. Samples are composited so that each sample contains a homogenized representative portion of the sample interval. Due to potential loss of analytes, samples for volatile analysis are not composited. Samples for chemical analysis can be collected by any of the above-mentioned sampling methods, as disturbed soil samples. Undisturbed samples are collected, sealed, and sent directly to the laboratory for analysis. For undisturbed samples, the samples are not homogenized.

2.0 Safety

2.1 The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the project Accident Prevention Plan/Site-specific Safety and Health Plan (APP/SSHP).

2.2 Before soil sampling commences, appropriate entities (e.g. DigSafe, local public works departments, company facilities) must be contacted to assure the anticipated soil sampling locations are marked for utilities, including electrical, telecommunications, water, sewer, and gas.

3.0 Terms and Definitions

None.

4.0 Interferences

4.1 Low recovery of soil from sampling equipment will prevent an adequate representation of the soil profile and sufficient amount of soil sample. If low recovery is a problem, the hole may be offset and re- advanced, terminated, or continued using a larger diameter sampler.

4.2 Asphalt in soil samples can cause false positive results for hydrocarbons. To ensure samples are free of asphalt, do not collect samples that may contain asphalt. If the collection of samples potentially containing asphalt is unavoidable, note the sampling depths at which the presence of asphalt are suspected.

4.3 Instrumentation interferences addressed in SOPs for Calibration of the Photoionization Detector (PID), Headspace Screening for Total Volatile Organics, and Equipment Decontamination must also be considered.

4.4 Cross contamination from sampling equipment must be prevented by using sampling equipment constructed of stainless steel that is adequately decontaminated between samples.

5.0 Training and Qualifications

5.1 **Qualifications and Training**

The individual executing these procedures must have read, and be familiar with, the requirements of this
SOP.

5.2 **Responsibilities**

5.2.1 The **Project Manager** is responsible for ensuring that soil sampling activities comply with this procedure.
The Project Manager is responsible for ensuring that all personnel involved in soil sampling shall have the appropriate education, experience, and training to perform their assigned tasks.

5.2.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

5.2.3 The **Field Manager** is responsible for ensuring that all soil sampling activities are conducted according to this procedure.

5.2.4 All **Field Personnel** are responsible for the implementation of this procedure.

6.0 Equipment and Supplies

The depth at which samples will be collected and the anticipated method of sample collection (direct- push, split-spoon, hand auger, shovel, or test pits) will be presented in the project planning documents. The following details equipment typically needed for soil sampling, based on the various methods.

6.1 Depending on the nature of suspected contamination, field screening instrumentation may be used for direct sampling. Appropriate instrumentation and calibration standards should be available. If volatile organic contaminants are suspected and a PID will be used, refer to the equipment and instrumentation listed in SOP 3-20 Operation and Calibration of a Photoionization Detector. Equipment in this SOP includes but is not limited to:

- PID/FID;
- Calibration gas; and
- Tedlar® gas bags (for calibration).

6.2 If field screening methods include jar headspace screening for volatile organics, refer to the equipment and procedure in SOP 3-19 Headspace Screening for Total VOCs. Equipment in this SOP includes but is not limited to:

- Clean soil (“drillers jars”) jars; and
- Aluminium foil.

6.3 Appropriate decontamination procedures must be followed for sampling equipment. Refer to SOP 3-06 Equipment Decontamination. Equipment in this SOP includes but is not limited to:

- Phosphate-free detergent;
- Isopropyl Alcohol;
- Tap water;
- Deionized Ultra-Filtered (DIUF) Water;
- Plastic buckets or washbasins;
- Brushes; and
- Polyethylene sheeting.

6.4 The following general equipment is needed for all soil sampling, regardless of method:

- Stainless steel bowls;
- Stainless steel trowels;
- Appropriate sample containers for laboratory analysis;
- Personal Protective Equipment (PPE);
- Logbook;
- Cooler and ice for preservation; and
- Stakes and flagging to document sampling location.

6.5 The following additional equipment is needed for volatile organic sampling:

- Electronic pan scale and weights for calibration; and
- Syringes or other discrete soil core samplers.

6.6 The following additional equipment may be needed for surface and test pit soil sampling:

- Hand Auger

6.7 The following additional equipment may be needed for soil sampling from direct push and/or split-spoon equipment:

- Tape measure or folding carpenter’s rule for recording the length of soil recovered.

Note: All subsurface drilling equipment will be provided and maintained by the subcontractor.

7.0 Procedure

7.1 General Soil Sampling Procedure for All Soil Sampling Methods

7.1.1 Record the weather conditions and other relevant on-site conditions.

7.1.2 Select the soil sampling location, clear vegetation if necessary, and record the sampling location identification number and pertinent location details.

7.1.3 Verify that the sampling equipment is properly decontaminated, in working order, and situated at the intended sampling location.

7.1.4 Place polyethylene sheeting on the ground and assemble all necessary sampling equipment on top of it.
Cover surfaces onto which soils or sampling equipment will be placed (i.e. tables with polyethylene sheeting).

7.1.5 Follow the appropriate procedures listed below for either surface, split-spoon, direct push, or test pit sample collection (7.2, 7.3, 7.4, and 7.5 respectively).

7.1.6 Collect soil samples according to procedures listed in Section 7.6 depending on project specific analyses.

7.1.7 Record date/time, sample ID, and sample descriptions in the field logbook or field form. A sketch or description of the location may also be recorded so the sample location can be re-constructed, especially if the location will not be recorded using global positioning satellite (GPS) equipment.

7.1.8 Immediately label the sample containers and place them on ice, if required for preservation. Complete the chain-of-custody form(s) as soon as possible.

7.1.9 Dispose of all excess excavated soil in accordance with the WP/SAP.

7.1.10 If required, mark the sample location with a clearly labelled wooden stake or pin flag. If the location is on a paved surface, the location may be marked with spray paint.

7.1.11 Decontaminate the sampling equipment according to SOP 3-06 Equipment Decontamination.

7.2 Surface Sampling

7.2.1 The criteria used for selecting surface soil locations for sampling may include the following:

- Visual observations (soil staining, fill materials);
- Other relevant soil characteristics;
- Site features;
- Screening results;
- Predetermined sampling approach (i.e. grid or random); and
- Sampling objectives as provided in the WP/SAP.

7.2.2 The following procedures are to be used to collect surface soil samples. Surface soils are considered to be soils that are up to two feet below ground surface, though state regulations and project objectives may define surface soils differently; therefore, the WP/SAP should be consulted for direction on the depth from which to collect the surface soil samples. Sampling and other pertinent data and information will be recorded in the field logbook and/or on field forms. Photographs may be taken as needed or as specified in the WP/SAP.

1. Gently scrape any vegetative covering until soil is exposed. Completely remove any pavement.

2. Remove soil from the exposed sampling area with a trowel, hand auger, or shovel. Put soils within the sampling interval in a stainless steel bowl for homogenizing. Monitor the breathing zone and sampling area as required in the APP/SSHP.

3. For VOC analyses, collect representative soil samples directly from the recently-exposed soil using a syringe or other soil coring device (e.g., TerraCore®, EnCore®). Follow procedures in Section 7.6.1 for VOC sampling.

4. Collect sufficient soil to fill all remaining sample jars into a stainless steel bowl. Homogenize the soil samples to obtain a uniform soil composition which is representative of the total soil sample collected according to the following procedure:

   a) Remove all rocks and non-soil objects using a stainless steel spoon or scoop.

   b) Form a cone shaped mound with the sample material, then flatten the cone and split the sample into quarters.

   c) Use the stainless steel spoon/scoop to mix the quarter samples that are opposite. d) After mixing the opposite quarters, reform the cone shaped mound.

   e) Repeat this procedure a minimum of five (5) times, removing any non-soil objects and breaking apart any clumps.

7.3 Split-Spoon Sampling

7.3.1 At each boring location, the frequency and depth of split-spoon samples will be determined from the WP/SAP. Split-spoon samples may be collected continuously, intermittently, or from predetermined depths.

7.3.2 Split-spoon samplers shall be driven into undisturbed soil by driving the spoon ahead of the drill augers/casing. In cohesive soils, or soils where the borehole remains open (does not collapse), two split-spoon samples may be taken prior to advancing the augers/casing.

7.3.3 After split-spoons are retrieved, open the split-spoon and measure the recovery of soil. If a PID will be used for screening, immediately scan the recovered sample for VOCs using the PID. Scan the recovered soil boring by making a hole in the soil with a decontaminated trowel and placing the PID inlet very close to the hole. Be very careful not to get soil on the tip of the PID. Take PID readings every 6 inches along the split-spoon and/or in any areas of stained or disturbed soil. Record the highest PID reading and the depth at which it was observed along with all other pertinent observations. If required in the WP/SAP, VOC and headspace samples should be collected (see Section 7.6.1) prior to logging the sample.

7.3.4 If headspace screening for VOCs is required in the WP/SAP, collect a soil sample (as defined in the SAP) and perform headspace screening according to SOP 3-19 Headspace Screening for Total VOCs.

7.3.5 Soils collected using the split-spoon sampler will be logged by the field representative using the procedure required in the WP/SAP.

7.3.6 Collect the remainder of the sample volume required into a stainless steel bowl. Homogenize the soil so the material is uniform in composition and representative of the total soil sample collected. Follow homogenizing techniques as described in Section 7.2.

7.3.7 The SAP may specify that intervals to be sent to the laboratory be determined by visual observation and/or highest PID screening or headspace results, which can only be determined once the boring is complete. In this instance, a VOC sample should be collected at each interval. The remainder of the soil from that interval will be set aside in a clearly labelled stainless steel bowl covered with aluminium foil. Once the boring has been completed and the sample interval has been determined, the remainder of the soil can be homogenized according to Section 7.2 and submitted for laboratory analysis.

7.3.8 Once a boring is complete and all required samples have been collected, the boring must be completed as specified in the WP/SAP (e.g., completed as a monitoring well, backfilled with bentonite, etc).

7.4 Direct Push Sampling

At each boring location, the frequency of direct-push samples will be determined from the WP/SAP. Typically, samples with direct-push equipment are collected in 4 foot (ft) intervals, but smaller (e.g., 2 ft) and larger (e.g., 5 ft) intervals are also possible.

1. Sample using Macro-Core samplers with acetate liners to obtain discrete soil samples at the depths specified in the WP/SAP.
2. Cut open the acetate liner. If required in the WP/SAP, immediately scan the recovered soil boring for VOCs using a PID by making a hole in the soil with a decontaminated trowel and placing the PID inlet very close to the hole. Be very careful not to get soil on the tip of the PID. Take PID readings every 6 inches along the split-spoon and/or in any areas of stained or disturbed soil. Record the highest PID reading and the depth at which it was observed along with all other pertinent observations. VOC and headspace samples, if required in the WP/SAP should be collected (see Section 7.6.1) prior to logging the sample.
3. If required in the WP/SAP, collect a soil sample (as defined in the WP/SAP) and perform headspace screening according to SOP 3-19 Headspace Screening for Total VOCs.
4. Soils collected using the direct-push sampler will be logged by the by the field representative using the procedure required in the WP/SAP.
5. Collect the remainder of the sample into a stainless steel bowl. Homogenize the soil collected so that the material is uniform in composition and representative of the total soil sample collected. Follow homogenizing techniques as described in Section 7.2.
6. Once a boring is complete and all required samples have been collected, the boring must be completed as specified in the WP/SAP (e.g., completed as a monitoring well, backfilled with bentonite, etc).

7.5 Test Pit Sampling

7.5.1 Excavate the test pit to the desired depth.

7.5.2 Using the excavator bucket, collect soil samples as specified in the WP/SAP. Collect a sample and perform screening analyses as required by the WP/SAP. If VOCs contamination is suspected, perform headspace screening according to SOP 3-19 Headspace Screening for Total VOCs.

7.5.3 Collect the sample from center of the bucket to avoid potential contamination from the bucket.

7.5.4 VOC samples should also be collected from an undisturbed section soil in the excavator bucket. The top layer of exposed soil should be scraped away just prior to collecting the VOC samples.

7.5.5 Collect the remainder of the sample volume required into a stainless steel bowl. Homogenize the soil so the material is uniform in composition and representative of the total soil sample collected. Follow homogenizing techniques as described in Section 7.2.

7.5.6 Dispose of all excavated soil according to the WP/SAP.

7.6 **Sample Collection Methods**

7.6.1 Volatile Organics Sampling

For soils collected for analyses of volatile organics, including Volatile Petroleum Hydrocarbons (VPH) or other purgable compounds, a closed system is maintained. From collection through analysis, the sample bottles are not opened. The bottle kit for a routine field sample for these analyses will typically include three 40-mL VOA vials and one soil jar. Two 40-mL VOA vials will contain either 5 mL reagent water or 5 mL sodium bisulfate and magnetic stir bars (i.e., low level vials). The third VOA vial will contain 15 mL methanol with no magnetic stir bar (i.e., high level vial). These vials are usually provided by the laboratory and are pre-weighed, with the tare weight recorded on the affixed sample label. No additional sample labels are affixed to the VOA vials, as addition of a label would alter the vial weight. All information is recorded directly on the sample label using an indelible marker. The soil jar is provided for percent solids determination. For VOC or VPH analyses, samples are collected prior to sample homogenization. Collect the VOC sample in accordance with the procedure described below.

1. Determine the soil volume necessary for the required sample weight, typically 5 grams:

   a) Prepare a 5 mL sampling corer (e.g., Terra Core®) or cut-off plastic

   syringe. b) Tare the sampler by placing it on the scale, and zeroing the

   scale.

   c) Draw back the plunger to the 5 gram mark or 5mL (5cc) mark on cut-off syringe, and insert the open end of the sampler into an undisturbed area of soil with a twisting motion, filling the sampler with soil. Note the location of the plunger with respect to the milliliter (cc) or other graduation printed on the sampler.

   d) Weigh the filled sampler, and remove or add soil until the desired weight is obtained. Note the location of the plunger which corresponds to this weight. Do not use this sample for laboratory analysis.

2. Once the required soil volume has been determined, pull the plunger back to this mark and hold it there while filling the syringe for each sample.

3. Collect 5 grams of soil using the cut-off syringe or Terra Core® sample device. Extrude the 5- grams of soil into one of the low level 40-mL VOA vials. Quickly wipe any soil from the threads of the VOA vial with a clean Kimwipe® and immediately close the vial. It is imperative that the threads be free from soil or other debris prior to replacing the cap on the vial in order to maintain the closed system necessary for the analysis.

4. Gently swirl the vial so that all of the soil is fully wetted with the preservative.

5. Fill the other low level 40 mL VOA vial in this manner.

6. Repeat the process for the high level VOA vials, only for the high level VOA vial

three 5 gram aliquots (i.e., 15 grams total) should be extruded into the high level VOA vial.

NOTE: Depending on the laboratory, some high level VOA vials only contain 5 mL or 10 mL of methanol. If this is the case, either 5 grams total or 10 grams total, respectively, should be extruded into the high level VOA vial. In other words, the mass of soil in grams should be identical to the volume of methanol in mL (i.e., 1:1 ratio of soil to methanol).

7. Collect any additional QC sample collected (e.g., field duplicate, MS, and MSD) in the same manner as above.

8. Fill the 4-oz glass jar with soil from the same area for percent moisture determination.

7.6.2 Soil Sampling Method (All other analyses except VOC/VPH)

When all the required soil for a sampling location has been obtained, the soil can be homogenized as described in section 7.2. Collect sufficient volume to fill all of the remaining sample containers at least
¾ full for all other analyses. Homogenize the soil in a decontaminated stainless steel bowl, removing rocks, sticks, or other non-soil objects and breaking apart any lumps of soil prior to filling the remaining sample containers.

NOTE: Soil samples must contain greater than 30% solids for the data to be considered valid.

8.0 Quality Control and Assurance

8.1 Sampling personnel should follow specific quality assurance guidelines as outlined in the WP/SAP. Proper quality assurance requirements should be provided which will allow for collection of representative samples from representative sampling points. Quality assurance requirements outlined in the WP/SAP typically suggest the collection of a sufficient quantity of field duplicate, field blank, and other samples.

8.2 Quality control requirements are dependent on project-specific sampling objectives. The WP/SAP will provide requirements for equipment decontamination (frequency and materials), sample preservation and
holding times, sample container types, sample packaging and shipment, as well as requirements for the collection of various quality assurance samples such as trip blanks, field blanks, equipment blanks, and field duplicate samples.

9.0 Records, Data Analysis, Calculations

All data and information (e.g., sample collection method used) must be documented on field data sheets, boring logs, or within site logbooks with permanent ink. Data recorded may include the following:

- Weather conditions;
- Arrival and departure time of persons on site;
- Instrument type, lamp (PID), make, model and serial number;
- Calibration gas used;
- Date, time and results of instrument calibration and calibration checks;
- Sampling date and time;

- Sampling location;
- Samples collected;
- Sampling depth and soil type;
- Deviations from the procedure as written; and
- Readings obtained.

10.0 Attachments or References

SOP 3-06, Equipment Decontamination

SOP 3-20, Operation and Calibration of a Photoionization Detector

Grab Groundwater Sampling Techniques

Procedure 3-37

1.0 Purpose and Scope

1.1 As guidance for specific activities, this procedure is not intended to obviate the need for professional judgment during unforeseen circumstances. Deviations from this procedure while planning or executing planned activities must be approved by both the Project Manager and the Quality Assurance (QA) Manager or Technical Director, and documented.

1.2 If there are procedures whether it be from AECOM, state and/or federal that are not addressed in this SOP and are applicable to direct push sampling then those procedures may be added as an appendix to the project specific SAP.

2.0 Safety

2.1 Field personnel shall perform work in accordance with the site-specific health and safety plan (HASP). During grab groundwater collection, subcontractors in direct contact with potentially contaminated media shall wear the proper personal protective equipment (PPE) as outlined in the site-specific health and safety plan. Failure to comply will result in disciplinary action.

3.0 Terms and Definitions

3.1 Grab groundwater collection techniques are designed to collect screening-level groundwater data in an efficient manner such that informed field decisions can be made when delineating contaminant plumes, inferring source areas, and identifying other potential soil sample locations and/or locations for permanent monitoring well installation.

4.0 Interferences

4.1 Contaminants that are known to adsorb to particulates, such as metals, PCBs, etc., will be impacted by elevated turbidity (i.e., >25 NTU). For grab groundwater samples with turbidity above 25 NTU, AECOM will collect filtered and unfiltered samples using a 0.45 micron filter.

4.2 Gas bubbles present in discharge tubing during purging and sampling are a problem: Their presence indicates off-gassing from groundwater or poor purging connections in the airline or groundwater tubing. Sunlight can exacerbate this problem when low pumping rates are used. Check connections at the surface. If bubbles persist, check connections at the pump. During purging and sampling, observe the flow of groundwater in the sample tubing and keep the tubing filled with groundwater, removing all air pockets and bubbles, to the extent possible. Gas bubbles may be reduced by increasing flow, if possible, and keeping tubing shaded.

4.3 Pump tubing lengths above the top of well casing should be kept as short as possible to minimize heating the groundwater in the tubing by exposure to sun light and ambient air temperatures. Heating may cause the groundwater to degas, which is unacceptable for the collection of samples for VOC and dissolved gases analyses.

5.0 Training and Qualifications

5.1 **Qualifications and Training**

The individual executing these procedures must have read, and be familiar with, the requirements of this SOP.

5.2 **Responsibilities**

5.2.1 The **Project Manager** is responsible for ensuring that these standard grab groundwater collection procedures are followed during projects conducted under the ER Program and that a qualified individual conducts or supervises the projects.

5.2.2 The **Program Quality Manage**r is responsible for ensuring overall compliance with this procedure.

5.2.3 The **Field Manager** is responsible for ensuring that all field personnel follow these procedures.

5.2.4 All **Field Personnel** are responsible for the implementation of this procedure.

5.2.5 The Field Personnel and/or Field Manager is responsible for directly supervising the grab groundwater collection procedures to ensure that they are conducted according to this procedure, and for recording all pertinent data collected during sampling.

6.0 Equipment and Supplies

6.1 **Bladder Pump**

The bladder pump system contains the following components: a pressurized cylinder of inert gas (typically nitrogen), a pump controller, air intake and discharge lines, and bladder pumps. The controller regulates total flow of nitrogen from the pressurized nitrogen cylinder to the pump assembly located in the well. AECOM typically samples one well per nitrogen cylinder. Note that if the bladder pumps are placed at the same depth in each well, multiple wells may be sampled simultaneously with one nitrogen cylinder or air compressor. In this case, a three-way cross splitter with quick-connect air line fittings is attached to the tubing connected to the nitrogen cylinder. Up to three controllers can then be connected to the nitrogen cylinder. If nitrogen cylinders are not available, air compressors may be used to power the bladder pumps.

The tubing bundle connected to the pump has three components: an air line with fittings to the pump and the controller, a sample line, and a support cable. For pumps that use nipple tubing connectors, the support cable may not be necessary. The sample line, through which the purge water is removed, may need to be composed entirely of Teflon or Teflon-lined if samples for VOCs are to be collected, depending on the project data quality objectives.

Temporary well points installed using direct push or other drilling methods are typically 1.5" or 1" in diameter. The diameter of the bladder pump should be sufficiently small (e.g., 0.850", 0.675", etc.) to allow for the easy deployment of the pump, associated tubing, and water level indicator.

6.2 **Peristaltic Pump**

Peristaltic pumps are not submerged in the well, but remain outside of the well and function by pulling water to the surface. A peristaltic pump has a rotating pump head with stepless variable speed that compresses a short stretch of flexible Pharmaceutical-grade (e.g. Pharmed) silicone tubing to pull water up from the well using mechanical peristalsis. The sample water does not come into direct contact with the pump. Teflon tubing is connected to either end of the silicone tubing. The pumps typically used, the GeoPump or GeoPump II by GeoTech, operate off an external 12 V battery or 120 V AC power source. Commercially available "JumpStart" 12 volt batteries are typically preferred since electrical hookup is typically not available; since they are safe, easy to carry, and easy to recharge; and since the potential contamination issues associated with use of a generator are avoided. Peristaltic pumps cannot be used when the depth to water is greater than 27 feet.

6.3 Tubing

Teflon or Teflon-lined polyethylene tubing are preferred for all parameters. Pharmaceutical-grade (e.g. Pharmed) silicon tubing may be required to be used around the rotor head of the peristaltic pump, and if necessary as a connecting tubing to the flow-through cells. Inner tubing diameter should be kept to the smallest size possible to reduce the generation of air pockets during low flow. Tubing typically used with the peristaltic pumps is Teflon of 1/4-inch outside diameter, and 3/16-inch inner diameter.

6.4 Electronic water level indicator: Solinst Model 101 or similar

Inner casing diameter and pump diameter should be considered in selecting a water level indicator that will fit into the well with the pump. A smaller diameter probe will be required for temporary well points.

6.5 Flow controllers and compressed inert gases for submersible bladder pumps

QED Model MP-10 Flow controller and nitrogen gas are typically used unless nitrogen is an analyte of interest. Portable air compressors may be used in place of compressed gas (e.g., QED Well Wizard).

6.6 Power Source

Marine battery, battery pack, compressed gas, portable air compressor, and a flow-controller are typically used.

6.6.1 Bladder Pumps

For bladder pump operation, the cylinders of inert compressed gas or portable air compressors function with the flow controller as the power source, although the flow controller does require batteries.

6.6.2 Peristaltic Pumps

The peristaltic pumps typically used by AECOM require an external 12 volt battery or 120 volt AC power source. Commercially available 12 volt batteries designed for jump-starting a car battery (“JumpStart” or similar) are preferred since electrical hookup is typically not available; since they are safe, easy to carry, and easily rechargeable; and since the potential contamination issues associated with use of a generator are avoided.

6.7 Turbidity Meter

LaMotte 2020 turbidity meter, or similar model.

7.0 Procedure

7.1 Pre-Sampling Activities

Place polyethylene sheeting on the ground and assemble all necessary sampling equipment on top of it. This helps to prevent contamination of the sampling equipment by the ground surface, reduces wear on the sampling equipment, and reduces the likelihood that contaminated purge water will spill onto the ground surface.

Prior to beginning sampling activities, measure the depth to water and total depth using the water level indicator and determine the amount of water in the temporary well point. Record this information in the field logbook. If the depth to water is greater than 27 feet, a bladder pump will have to be used.

Wells should be inspected for the presence of LNAPL. Wells with LNAPL cannot be sampled using bladder pumps or peristaltic pumps, and must be sampled with a bailer.

All non-dedicated down-well measuring devices will be thoroughly decontaminated before sampling and between monitoring locations.

7.2 **Purging the Temporary Well Point**

Connect all the lines to the pump. Carefully lower the pump (bladder pump) or tubing (peristaltic pump) to the desired sampling depth. Take care to minimize disturbance and contact with the well walls. Secure the pump or tubing once the desired depth is achieved, typically the midpoint of the screened interval. Attach the water discharge line to a 5-gallon purge bucket or carboy using a squeeze clamp or similar device. Connect the pump the power source (i.e., battery, pump controller and compressed gas cylinder or air compressor).

Start the flow controller and begin purging at the slowest rate possible.

- Note the purge start time.
- Collect all purge water in a bucket or carboy.
- Slowly increase the flow rate until discharge begins. The pump controller should be set to allow for adequate recharge such that a maximum flow rate with no drawdown is achieved and a smooth, laminar discharge flow is achieved.
- Measure the flow rate using a graduated cylinder and time piece and monitor the water level and pumping rate.

Once drawdown has stabilized and an acceptable flow rate established, begin monitoring turbidity every five minutes and continue monitoring flow rate and water level.

- If drawdown cannot be controlled during purging, collect the samples immediately.
- Purge the temporary well until a turbidity reading of 25 nephelometric turbidity units (NTU) is achieved or for 20 minutes, whichever occurs first.

7.3 **Sampling**

In keeping with convention, samples should be collected in order of decreasing volatility and reactivity so that the most volatile or reactive samples are collected first. The following are general guidelines.

- Gases (methane/ethane/ethene/hydrogen/CO2)
- Volatile Organic Compounds
- Semivolatile Organic Compounds
- Pesticide/PCBs
- Dioxins
- Metals

During sample collection, allow the water to flow directly into and down the side of the sample container without allowing the tubing to touch the inside of the sample container or lid, in order to minimize aeration and maintain sample integrity.

- If groundwater turbidity is above 25 NTU at the time of sampling, collect filtered and unfiltered samples using a 0.45 micron filter for analyses that may be impacted by the elevated turbidity (e.g., metals, PCBs).

8.0 Quality Control and Assurance

8.1 Collection of representative samples will be ensured through adherence to the procedures in this SOP and the sampling strategy outlined in the SAP. The field quality control samples identified in the SAP must be collected. These samples may include field duplicates, equipment rinsate blanks, trip blanks, and matrix spike/matrix spike duplicates

9.0 Records, Data Analysis, Calculations

9.1 Various forms are required to ensure that adequate documentation is made of the sample collection activities. These forms may include:

- Field logbook;
- Sample collection records;
- Chain-of-custody forms; and
- Shipping labels.

9.2 The field logbook is kept as a general log of activities and should not be used in place of the boring log.

9.3 Chain-of-custody forms are transmitted with the samples to the laboratory for sample tracking purposes.

9.4 Shipping labels are required is sample coolers are to be transported to a laboratory by a third party (courier service).

Appendix E

Laboratory Accreditation Certificate

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CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board/ACLASS
500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

TriMatrix Laboratories, Inc.
5560 Corporate Exchange Court, SE
Grand Rapids, MI 49512

has been assessed by ACLASS
and meets the requirements of

ISO/IEC 17025:2005 and DoD-ELAP

while demonstrating technical competence in the field(s) of

TESTING

Refer to the accompanying Scope(s) of Accreditation for information regarding the types of tests to which this accreditation applies.

ADE-1542
Certificate Number

ACLASS Approval

Certificate Valid: 4/30/2013-04/30/2015
Version No. 003 Issued: 05/30/2013

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated January 2009*).

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005 & DoD-ELAP

TriMatrix Laboratories, Inc

5560 Corporate Exchange Court, SE, Grand Rapids, MI 49512
Rick Wilburn Phone: 616-975-4500

TESTING

Valid to: April 30, 2015 Certificate Number: ADE - 1542

I. Environmental

MATRIX	SPECIFIC TEST or ANALYTE GROUP**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY
Water	Metals Digestion	200.2	Block Digestion
Water	Metals Digestion	3010A	Block Digestion
Water	Metals Digestion	3020A	Block Digestion
Solid	Metals Digestion	3050B	Block Digestion
Water	Metals	200.7 / 6010C	ICP
Water	Calcium Hardness (as $CaCO_3$)	SM 2340B	ICP
Solid	Metals	6010C	ICP
Water	Total Hardness (as $CaCO_3$)	SM 2340B	ICP
Water	Metals	200.8 / 6020A	ICP MS
Solid	Metals	6020A	ICP MS
Water	Mercury	245.1 / 7470A	CVAA
Solid	Mercury	7471B	CVAA

MATRIX	SPECIFIC TEST or ANALYTE GROUP**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY
Water	Mercury, Low-Level	1631E	CVAF
Water	1,2-Dibromo-3-Chloropropane & 1,2-Dibromoethane	8011	GC-ECD
Water / Solid	Carbonyl Compounds	8315A	HPLC-UV
Water / Solid	Nitroaromatics and Nitramines	8330A	HPLC-UV
Water / Solid	Nitroglycerine and PETN	8332	HPLC-UV
Water / Solid	Chlorinated Herbicides	8151A	GC-ECD
Water	Methoxychlor	608.2	GC-ECD
Water	Organochlorine Pesticides	608 / 8081B	GC-ECD
Solid	Organochlorine Pesticides	8081B	GC-ECD
Water	PCBs	608 / 8082A	GC-ECD
Solid	PCBs	8082A	GC-ECD
Water / Solid	Diesel Range Organics (DRO)	Wisconsin DRO / 8015C	GC-FID
Water / Solid	Oil Range Organics	8015C	GC-FID
Water	Dissolved Gas Analysis	RSK-175	GC-FID
Water / Solid	Nonhalogenated Organics	8015C	GC-FID
Water	Semivolatile Organic Compounds	625 / 8270C	GCMS
Solid	Semivolatile Organic Compounds	8270C	GCMS
Water / Solid	Semivolatile Organic Compounds	8270C SIM	GCMS

MATRIX	SPECIFIC TEST or ANALYTE GROUP**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY
Solid	Semivolatile Extraction	3545A	Pressurized Fluid Ext
Water	Semivolatile Extraction	3510C	Separatory Funnel Ext
Solid	Semivolatile Extraction	3550C	Ultrasonic Extraction
Water / Solid	Chlorinated Hydrocarbons	8121 / 612	GC-ECD
Water / Solid	Gasoline Range Organics (GRO)	Wisconsin GRO / 8015C	GC-FID
Solid	Volatile Organics	8021B	GC-PID; HECD
Water	Volatiles Organics	601 / 602 / 8021B	GC-PID; HECD
Water	Volatile Organics	524.2 / 624 / 8260B	GCMS
Solid	Volatile Organics	8260B	GCMS
Solid	Volatiles Extraction	5035A	Purge & Trap
Water	Volatiles Extraction	5030B	Purge & Trap/Water
Water / Solid	SPLP	1312	Acetic Acid Leaching
Water / Solid	TCLP	1311	Acetic Acid Leaching
Solid	Ignitability	1020A	Closed-Cup
Solid	Acid Volatile Sulfide and Selected Simultaneously Extractable Metals	821-R-91-100	Distillation/ Spectrophotometric
Solid	Paint Filter Test	9095B	Filtration
Water	HEM Oil and Grease / SGT-HEM Non-Polar Material	1664A / 9070A	Gravimetric

MATRIX	SPECIFIC TEST or ANALYTE GROUP**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY
Solid	HEM Oil and Grease / SGT-HEM Non-Polar Material	9071B	Gravimetric
Water	Filterable Residue (TDS)	SM 2540C	Gravimetric
Water	Non-Filterable Residue (TSS)	SM 2540D	Gravimetric
Water	Total Residue / Solids (TS)	SM 2540B	Gravimetric
Solid	Total Residue / Solids (TS)	SM 3550C	Gravimetric
Water	Volatile Residue (VS)	SM 2540E	Gravimetric
Solid	Volatile Residue (VS)	SM 2540G	Gravimetric
Water	Settleable Residue / Solids	SM 2540 F	Imhoff cone
Water	Anions	300.0/9056A	Ion Chromatographic
Solid	Anions	9056A	Ion Chromatographic
Water	Bromide	ASTM D1246	ISE
Water / Solid	Fluoride	SM 4500-F C	ISE
Water	BOD and CBOD	SM 5210B	Luminescence
Water	Turbidity	SM 2130B	Nephelometric
Water	Color	SM 2120B	Platinum-Cobalt Color
Water	pH and Corrosivity	SM 4500-H^+ B / 9040C	Potentiometric
Solid	pH and Corrosivity	9045D	Potentiometric
Water	Conductivity	SM 2510B / 9050A	Specific Conductance

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MATRIX	SPECIFIC TEST or ANALYTE GROUP**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY
Water / Solid	Ammonia-N	SM 4500-NH_3 B	Distillation
Water / Solid	Ammonia-N	SM 4500-NH_3 G	Spectrophotometric
Water	Chloride	SM 4500-Cl E / 9251	Spectrophotometric
Solid	Chromium (VI) Cr^{+6}	3060A	Digestion
Water	Chromium (VI) Cr^{+6}	SM 3500-Cr B / 7196A	Spectrophotometric
Solid	Chromium (VI) Cr^{+6}	7196A	Spectrophotometric
Water	COD	SM 5220D	Spectrophotometric
Water / Solid	Cyanide Available	OIA-1677	Amperometry
Solid	Cyanide	9010C	Distillation
Water	Cyanide	SM 4500-CN C / 9010C	Distillation
Solid	Cyanide Extraction	9013A	Extraction
Solid	Cyanide Amenable	9014	Spectrophotometric
Water	Cyanide Amenable	SM 4500-CN G / 9014	Spectrophotometric
Solid	Cyanide, Total	9014	Spectrophotometric
Water	Cyanide, Total	SM 4500-CN E / 9014	Spectrophotometric
Water	Ferrous Iron	SM 3500-Fe B	Spectrophotometric
Water / Solid	Nitrate-N	SM 4500-NO_3 F	Spectrophotometric
Water	Nitrate+Nitrite-N	SM 4500-NO_3 F	Spectrophotometric

MATRIX	SPECIFIC TEST or ANALYTE GROUP**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY
Water	Nitrite-N	SM 4500-NO_2 B / NO_3 F	Spectrophotometric
Water	o-Phosphate	SM 4500-P E	Spectrophotometric
Water / Solid	Phosphorus Total	SM 4500-P E	Spectrophotometric
Water	Silica as SiO_2	SM 4500-SiO_2 D	Spectrophotometric
Water	Surfactants (MBAS)	SM 5540C	Spectrophotometric
Water / Solid	TKN	SM 4500-N_{org} D	Spectrophotometric
Solid	Total Phenolics	9065	Spectrophotometric
Water	Total Phenolics	420.4 / 9065	Spectrophotometric
Water	Acidity	SM 2310B	Titrimetric
Water	Calcium Hardness (as $CaCO_3$)	SM 2340 C	Titrimetric
Water / Solid	Sulfide	9030B	Distillation
Water	Sulfide	SM 4500-S_2 D	Spectrophotometric
Water	Sulfide	SM 4500-S_2 F	Titrimetric
Water / Solid	Sulfide	9034	Titrimetric
Water / Solid	Reactive Sulfide	7.3.4.2	Titrimetric
Water	Sulfite	SM 4500-SO_3^{2-} B	Titrimetric
Water	Total Alkalinity (as $CaCO_3$)	SM 2320B	Titrimetric
Water	Total Hardness (as $CaCO_3$)	SM 2340C	Titrimetric

MATRIX	SPECIFIC TEST or ANALYTE GROUP**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY
Water	Sulfate	ASTM D516 / 9038	Turbidimetric
Solid	Total Organic Carbon (TOC)	Lloyd Kahn	Infrared
Water	Total Organic Carbon (TOC)	SM 5310C / 9060A	Oxidation/CO_2 Det
Solid	Total Organic Carbon (TOC)	WALKLEY BLACK	Titrimetric
Solid	Extractable Organic Halides	9023	Coulometric Titration
Water	Dissolved Organic Carbon	SM 5310C	Titrimetric
Solid	Fractional Organic Carbon	ASTM D2974	Gravimetric
Solid	Grain Size	ASTM D422	Size Exclusion
Water	Total Organic Halides (TOX)	9020B	Coulometric Titration
Solid	% Moisture in Soil and Rock	ASTM D2216	Gravimetric
Solid	Shake Extraction	ASTM D3987	Water Leaching

II. Microbiological

MATRIX	SPECIFIC TEST or ANALYTE GROUP**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY
Water	Fecal Coliform	SM 9222D	Microbiological
Water	Heterotrophic Bacteria (Std Plate)	SM 9215B	Microbiological
Water	Total Coliform / *E. coli*	SM 9223B	Microbiological

Notes:

1. ** = As Applicable*
2. *** = Refer to Accredited Analyte Listing for specific analytes in which the laboratory is accredited.*
3. *This scope is part of and must be included with the Certificate of Accreditation No. ADE-1542*

Vice President

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Accredited Analytes/Methods (by matrix)

TriMatrix Laboratoires, Inc.

Grand Rapids, MI

Analyte	**Matrix**								
	Aqueous						**Solid**		
Trace Metals									
Aluminum	200.7	200.8	6010C	6020A			6010C		
Antimony	200.7	200.8	6010C	6020A			6010C	6020A	
Arsenic	200.7	200.8	6010C	6020A			6010C	6020A	
Barium	200.7	200.8	6010C	6020A			6010C	6020A	
Beryllium	200.7	200.8	6010C	6020A			6010C	6020A	
Boron	200.7	200.8	6010C	6020A			6010C	6020A	
Cadmium	200.7	200.8	6010C	6020A			6010C	6020A	
Calcium	200.7		6010C				6010C		
Chromium, total	200.7	200.8	6010C	6020A			6010C	6020A	
Chromium VI	SM3500Cr B				7196A				7196A
Cobalt	200.7	200.8	6010C	6020A			6010C	6020A	
Copper	200.7	200.8	6010C	6020A			6010C	6020A	
Iron	200.7		6010C				6010C		
Lead	200.7	200.8	6010C	6020A			6010C	6020A	
Lithium	200.7		6010C				6010C		
Magnesium	200.7		6010C				6010C		
Manganese	200.7	200.8	6010C	6020A			6010C	6020A	
Mercury	245.1				7470A				7471B
Mercury (Low Level)					1631E				
Molybdenum	200.7	200.8	6010C	6020A			6010C	6020A	
Nickel	200.7	200.8	6010C	6020A			6010C	6020A	
Potassium	200.7		6010C				6010C		
Selenium	200.7	200.8	6010C	6020A			6010C	6020A	
Silver	200.7	200.8	6010C	6020A			6010C	6020A	
Sodium	200.7		6010C				6010C		
Strontium	200.7	200.8	6010C	6020A			6010C		
Thallium	200.7	200.8	6010C	6020A			6010C	6020A	
Tin	200.7	200.8	6010C	6020A			6010C	6020A	
Titanium	200.7		6010C				6010C		
Vanadium	200.7	200.8	6010C	6020A			6010C	6020A	
Zinc	200.7	200.8	6010C	6020A			6010C	6020A	
Demands									
TOC	SM5310C	9060A					Walkley Black	Lloyd Kahn	
COD			SM5220D						
DOC-Dissolved Organic Carbon							SM5310C		

Accredited Analytes/Methods (by matrix)

TriMatrix Laboratoires, Inc.

Grand Rapids, MI

Analyte	Matrix								
	Aqueous						Solid		
BOD and CBOD	SM5210B								
Misc Analytes									
Total Alkalinity (as $CaCO_3$)	SM2320B								
Calcium Hardness as $CaCO_3$	SM2340B								
Total Hardness as $CaCO_3$	SM2340B	SM2340C							
% Moisture in Soil and Rock							ASTM D2216		
Total Residue/Solids (TS)	SM2540B						3550C		
Filterable Residue (TDS)		SM2540C							
Ignitability							1020A		
Non-Filterable Residue (TSS)	SM2540D								
Volatile Residue (VS)		SM2540E					SM2540G		
Settleable Residue	SM2540F								
pH			9040C	SM4500H^+ B			9045D		
Sulfide	SM4500S^{2-} D	SM4500S^{2-} F	9034				9034		
Total Cyanide	SM4500CN E	9014					9014		
Cyanide, Amenable	SM4500CN G	9014					9014		
Ammonia	SM4500NH_3 G						SM4500NH_3 G		
Conductivity	SM2510B	9050A							
Nitrogen, Total Kjeldahl (TKN)	SM4500N_{org} D						SM4500N_{org} D		
Total Phenolics	420.4	9065					9065		
Total Organic Halides (TOX)	9020B								
Bromide	ASTM D1246		300.0	9056A					
Chloride	SM4500Cl E	9251	300.0	9056A			9056A		
Fluoride	SM4500F C		300.0	9056A			9056A		
Nitrate as N	SM4500NO_3 F		300.0	9056A			9056A	SM4500NO_3 F	
Nitrite as N	SM4500NO_2 B	SM4500NO_3 F	300.0	9056A			9056A		
Nitrate + Nitrite as N	SM4500NO_3 F		300.0	9056A			9056A		
ortho-phosphate	SM4500P E								
Total Phosphorus	SM4500P E						SM4500P E		
Silica as SiO_2	SM4500SiO_2 D								
Sulfate	ASTM D516	9038	300.0	9056A			9056A		
Surfactants - MBAS	SM5540C								
Fecal Coliform	SM9222D								
Heterotrophic Bacteria (Std Plate)	SM9215B								
Total Coliform, E. Coli	SM9223B								

Accredited Analytes/Methods (by matrix)

TriMatrix Laboratoires, Inc.

Grand Rapids, MI

Analyte	Matrix								
	Aqueous						Solid		
Turbidity		SM2130B							
EOX-Extractable Organic Halides							9023		
FOC-Fractional Organic Carbon							ASTM D2974		
Petroleum Hydrocarbons									
SGT-HEM; Non-Polar Material	1664A	9070A					9071B		
HEM; Oil and Grease	1664A	9070A					9071B		
Gasoline Range Organics (GRO)	8015C	Wisconsin GRO					8015C	Wisconsin GRO	
Diesel Range Organics (DRO)	8015C	Wisconsin DRO					8015C	Wisconsin DRO	
Oil Range Organics (ORO)	8015C						8015C		
VOCs									
Acetone		624	8260B					8260B	
Acetonitrile		624	8260B					8260B	
Acrolein		624	8260B					8260B	
Acrylonitrile		624	8260B					8260B	
Benzene	524.2	624	8260B		602	8021B	8021B	8260B	
Bromobenzene	524.2		8260B					8260B	
Bromochloromethane	524.2		8260B					8260B	
Bromodichloromethane	524.2	624	8260B	601		8021B	8021B	8260B	
Bromoform	524.2	624	8260B	601		8021B	8021B	8260B	
Bromomethane	524.2	624	8260B	601		8021B	8021B	8260B	
2-Butanone (MEK)		624	8260B					8260B	
n-Butylbenzene	524.2		8260B					8260B	
sec-Butylbenzene	524.2		8260B					8260B	
tert-Butylbenzene	524.2		8260B					8260B	
Carbon disulfide		624	8260B					8260B	
Carbon Tetrachloride	524.2	624	8260B	601		8021B	8021B	8260B	
Chlorobenzene	524.2	624	8260B	601	602	8021B	8021B	8260B	
Chlorodibromomethane	524.2	624	8260B	601		8021B	8021B	8260B	
Chloroethane	524.2	624	8260B	601		8021B	8021B	8260B	
2-Chloroethylvinylether		624	8260B	601		8021B	8021B	8260B	
Chloroform	524.2	624	8260B	601		8021B	8021B	8260B	
Chloromethane	524.2	624	8260B	601		8021B	8021B	8260B	
2-Chlorotoluene	524.2		8260B					8260B	
4-Chlorotoluene	524.2		8260B					8260B	
1,2-Dibromo-3-chloropropane (DBCP)		624	8260B					8260B	

Accredited Analytes/Methods (by matrix)

TriMatrix Laboratoires, Inc.

Grand Rapids, MI

Analyte	Matrix								
	Aqueous						Solid		
1,2-Dibromoethane (EDB)		624	8260B					8260B	
Dibromomethane	524.2	624	8260B					8260B	
1,2-Dichlorobenzene	524.2	624	8260B	601	602	8021B	8021B	8260B	
1,3-Dichlorobenzene	524.2	624	8260B	601	602	8021B	8021B	8260B	
1,4-Dichlorobenzene	524.2	624	8260B	601	602	8021B	8021B	8260B	
Dichlorodifluoromethane	524.2	624	8260B	601		8021B	8021B	8260B	
1,1-Dichloroethane	524.2	624	8260B	601		8021B	8021B	8260B	
1,2-Dichloroethane	524.2	624	8260B	601		8021B	8021B	8260B	
1,1-Dichloroethene	524.2	624	8260B	601		8021B	8021B	8260B	
cis -1,2-Dichloroethene	524.2	624	8260B	601		8021B	8021B	8260B	
trans -1,2-Dichloroethene	524.2	624	8260B	601		8021B	8021B	8260B	
Dichloromethane (Methylene Chloride)	524.2	624	8260B	601		8021B	8021B	8260B	
1,2-Dichloropropane	524.2	624	8260B	601		8021B	8021B	8260B	
1,3-Dichloropropane	524.2		8260B					8260B	
2,2-Dichloropropane	524.2		8260B					8260B	
1,1-Dichloropropene	524.2		8260B					8260B	
cis -1,3-Dichloropropene	524.2	624	8260B	601		8021B	8021B	8260B	
trans -1,3-Dichloropropene	524.2	624	8260B	601		8021B	8021B	8260B	
Di-isopropylether (DIPE)			8260B					8260B	
Ethylbenzene	524.2	624	8260B		602	8021B	8021B	8260B	
Ethanol			8260B			8015C	8015C	8260B	
1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)			8260B					8260B	
Hexachlorobutadiene	524.2	624	8260B					8260B	
2-Hexanone		624	8260B					8260B	
Isopropylbenzene	524.2	624	8260B					8260B	
4-Isopropyltoluene	524.2		8260B					8260B	
4-Methyl-2-pentanone (MIBK)		624	8260B					8260B	
Methyl-tert-butylether (MTBE)	524.2	624	8260B					8260B	
Naphthalene	524.2	624	8260B					8260B	
n-Propylbenzene	524.2		8260B					8260B	
Styrene	524.2	624	8260B					8260B	
tert-amylmethylether (TAME)			8260B					8260B	
1,1,1,2-Tetrachloroethane	524.2	624	8260B					8260B	
1,1,2,2-Tetrachloroethane	524.2	624	8260B	601		8021B	8021B	8260B	
Tetrachloroethene	524.2	624	8260B	601		8021B	8021B	8260B	
Toluene	524.2	624	8260B		602	8021B	8021B	8260B	
1,2,3-Trichlorobenzene	524.2		8260B					8260B	

Accredited Analytes/Methods (by matrix)

TriMatrix Laboratoires, Inc.

Grand Rapids, MI

Analyte	Matrix								
	Aqueous						Solid		
1,2,4-Trichlorobenzene	524.2	624	8260B					8260B	
1,1,1-Trichloroethane	524.2	624	8260B	601		8021B	8021B	8260B	
1,1,2-Trichloroethane	524.2	624	8260B	601		8021B	8021B	8260B	
Trichloroethene	524.2	624	8260B	601		8021B	8021B	8260B	
Trichlorofluoromethane (Freon 11)	524.2	624	8260B	601		8021B	8021B	8260B	
1,2,3-Trichloropropane	524.2	624	8260B					8260B	
1,2,4-Trimethylbenzene	524.2		8260B					8260B	
1,3,5-Trimethylbenzene	524.2		8260B					8260B	
Vinyl acetate		624	8260B					8260B	
Vinyl chloride	524.2	624	8260B	601		8021B	8021B	8260B	
o-Xylene		624	8260B		602			8260B	
m+p-Xylene		624	8260B		602			8260B	
Xylenes, total	524.2	624	8260B		602	8021B	8021B	8260B	
SVOCs - Base/Neutrals/Acids									
Acenaphthene	8270C SIM	625	8270C				8270C	8270C SIM	
Acenaphthylene	8270C SiM	625	8270C				8270C	8270C SIM	
Aniline		625	8270C				8270C		
Anthracene	8270C SIM	625	8270C				8270C	8270C SIM	
Benzo(a)anthracene	8270C SIM	625	8270C				8270C	8270C SIM	
Benzo(b)fluoranthene	8270C SIM	625	8270C				8270C	8270C SIM	
Benzo(k)fluoranthene	8270C SIM	625	8270C				8270C	8270C SIM	
Benzo(g,h,i)perylene	8270C SIM	625	8270C				8270C	8270C SIM	
Benzo(a)pyrene	8270C SIM	625	8270C				8270C	8270C SIM	
Benzidine		625	8270C				8270C		
Benzoic acid		625	8270C				8270C		
Benzyl alcohol		625	8270C				8270C		
4-Bromophenyl-phenylether		625	8270C				8270C		
Butyl benzyl phthalate		625	8270C				8270C		
Carbazole			8270C				8270C		
4-Chloroaniline		625	8270C				8270C		
bis(2-Chloroethoxy)methane		625	8270C				8270C		
bis(2-Chloroethyl)ether		625	8270C				8270C		
bis(2-Chloroiospropyl) ether		625	8270C				8270C		
4-Chloro-3-methylphenol		625	8270C				8270C		
2-Chloronaphthalene		625	8270C	612		8121	8270C	8121	
4-Chlorophenyl-phenylether		625	8270C				8270C		

Accredited Analytes/Methods (by matrix)

TriMatrix Laboratoires, Inc.

Grand Rapids, MI

Analyte	Matrix								
	Aqueous						Solid		
2-Chlorophenol		625	8270C				8270C		
Chrysene	8270C SIM	625	8270C				8270C	8270C SIM	
Dibenzo(a,h)anthracene	8270C SIM	625	8270C				8270C	8270C SIM	
Dibenzofuran		625	8270C				8270C		
Di-n-butylphthalate		625	8270C				8270C		
1,2-Dichlorobenzene		625	8270C	612		8121	8270C	8121	
1,3-Dichlorobenzene		625	8270C	612		8121	8270C	8121	
1,4-Dichlorobenzene		625	8270C	612		8121	8270C	8121	
3,3'-Dichlorobenzidine		625	8270C				8270C		
2,4-Dichlorophenol		625	8270C				8270C		
2,6-Dichlorophenol		625	8270C				8270C		
Diethyl phthalate		625	8270C				8270C		
2,4-Dimethylphenol		625	8270C				8270C		
Dimethylphthalate		625	8270C				8270C		
Diphenylamine			8270C				8270C		
2,4-Dinitrophenol		625	8270C				8270C		
2,4-Dinitrotoluene		625	8270C				8270C		
2,6-Dinitrotoluene		625	8270C				8270C		
Di-n-octylphthalate		625	8270C				8270C		
Dinoseb			8270C				8270C		
1,4-Dioxane			8270C						
bis(2-ethylhexyl) phthalate		625	8270C				8270C		
Fluoranthene	8270C SIM	625	8270C				8270C	8270C SIM	
Fluorene	8270C SIM	625	8270C				8270C	8270C SIM	
Hexachlorobenzene		625	8270C	612		8121	8270C	8121	
Hexachlorobutadiene		625	8270C	612		8121	8270C	8121	
Hexachlorocyclopentadiene		625	8270C	612		8121	8270C	8121	
Hexachloroethane		625	8270C	612		8121	8270C	8121	
Indeno(1,2,3, cd)pyrene	8270C SIM	625	8270C				8270C	8270C SIM	
Isophorone		625	8270C				8270C		
2-Methyl-4,6-Dinitrophenol		625	8270C				8270C		
2-Methylphenol		625	8270C				8270C		
4-Methylphenol (and/or 3-Methylphenol)		625	8270C				8270C		
2-Methylnaphthalene	8270C SIM	625	8270C				8270C	8270C SIM	
Naphthalene	8270C SIM	625	8270C				8270C	8270C SIM	
2-Nitroaniline		625	8270C				8270C		
3-Nitroaniline		625	8270C				8270C		

Accredited Analytes/Methods (by matrix)

TriMatrix Laboratoires, Inc.

Grand Rapids, MI

Analyte	Matrix								
	Aqueous						Solid		
4-Nitroaniline		625	8270C				8270C		
Nitrobenzene		625	8270C				8270C		
2-Nitrophenol		625	8270C				8270C		
4-Nitrophenol		625	8270C				8270C		
4-nitroquinoline-1-oxide			8270C				8270C		
N-Nitrosodiethylamine		625	8270C				8270C		
N-Nitrosodimethylamine		625	8270C				8270C		
N-Nitrosodiphenylamine		625	8270C				8270C		
N-Nitroso-di-n-propylamine		625	8270C				8270C		
Pentachlorobenzene		625	8270C				8270C		
Pentachlorophenol		625	8270C				8270C		
Phenanthrene	8270C SIM	625	8270C				8270C	8270C SIM	
Phenol		625	8270C				8270C		
Pyrene	8270C SIM	625	8270C				8270C	8270C SIM	
Pyridine		625	8270C				8270C		
1,2,4,5-Tetrachlorobenzene		625	8270C				8270C		
2,3,4,6-Tetrachlorophenol		625	8270C				8270C		
o-Toluidine		625	8270C				8270C		
1,2,4-Trichlorobenzene		625	8270C	612		8121	8270C	8121	
2,4,5-Trichlorophenol		625	8270C				8270C		
2,4,6-Trichlorophenol		625	8270C				8270C		
Nitroaromatic and Nitramines									
4-Amino-2,6-dinitrotoluene	8330A						8330A		
2-Amino-4,6-dinitrotoluene	8330A						8330A		
1,3-Dinitrobenzene	8330A						8330A		
2,4-Dinitrotoluene	8330A						8330A		
2,6-Dinitrotoluene	8330A						8330A		
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	8330A						8330A		
Nitrobenzene	8330A						8330A		
Nitroglycerin	8330A	8332					8330A	8332	
2-Nitrotoluene	8330A						8330A		
3-Nitrotoluene	8330A						8330A		
4-Nitrotoluene	8330A						8330A		
Pentaerythritoltetranitrate	8330A	8332					8330A	8332	
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	8330A						8330A		
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	8330A						8330A		

Accredited Analytes/Methods (by matrix)									
TriMatrix Laboratoires, Inc.									
Grand Rapids, MI									
Analyte	**Matrix**								
	Aqueous						**Solid**		
1,3,5-Trinitrobenzene	8330A						8330A		
2,4,6-Trinitrotoluene	8330A						8330A		
Pesticides									
Aldrin	608	8081B					8081B		
alpha-BHC	608	8081B					8081B		
beta-BHC	608	8081B					8081B		
delta-BHC	608	8081B					8081B		
gamma-BHC (Lindane)	608	8081B					8081B		
alpha-Chlordane	608	8081B					8081B		
gamma-Chlordane	608	8081B					8081B		
Chlordane (technical)	608	8081B					8081B		
DDD (4,4)	608	8081B					8081B		
DDE (4,4)	608	8081B					8081B		
DDT (4,4)	608	8081B					8081B		
Dieldrin	608	8081B					8081B		
Endosulfan I	608	8081B					8081B		
Endosulfan II	608	8081B					8081B		
Endosulfan sulfate	608	8081B					8081B		
Endrin	608	8081B					8081B		
Endrin aldehyde	608	8081B					8081B		
Endrin ketone	608	8081B					8081B		
Heptachlor	608	8081B					8081B		
Heptachlor Epoxide (beta)	608	8081B					8081B		
Methoxychlor	608.2	8081B					8081B		
Toxaphene (total)	608	8081B					8081B		
Organophoshorus Pesticides									
Dimethoate		8270C					8270C		
Dichlorvos		8270C					8270C		
Disulfoton		8270C					8270C		
Parathion, ethyl		8270C					8270C		
Parathion, methyl		8270C					8270C		
Phorate		8270C					8270C		
Sulfotepp		8270C					8270C		
Herbicides									

Accredited Analytes/Methods (by matrix)

TriMatrix Laboratoires, Inc.

Grand Rapids, MI

Analyte	Matrix								
	Aqueous						Solid		
2,4,5-T	8151A						8151A		
2,4,5-TP (Silvex)	8151A						8151A		
2,4-D	8151A						8151A		
2,4-DB	8151A						8151A		
Dalapon	8151A						8151A		
Dicamba	8151A						8151A		
Dichloroprop	8151A						8151A		
Dinoseb	8151A						8151A		
MCPA	8151A						8151A		
MCPP	8151A						8151A		
Pentachlorophenol	8151A						8151A		
Picloram	8151A						8151A		
PCBs									
Aroclor 1016	608	8082A					8082A		
Aroclor 1221	608	8082A					8082A		
Aroclor 1232	608	8082A					8082A		
Aroclor 1242	608	8082A					8082A		
Aroclor 1248	608	8082A					8082A		
Aroclor 1254	608	8082A					8082A		
Aroclor 1260	608	8082A					8082A		
Misc. Analytes -Additional									
Iron, Ferrous	SM 3500Fe B								
Cyanide, Available	OIA-1677						OIA-1677		
Acidity	SM 2310 B								
Sulfite	SM 4500SO_3^{2-} B								
Paint Filter Liquids Test							9095B		
Color	SM 2120 B								
Acid Volatile Sulfides (AVS/SEM)							EPA-821-R-91-100		
Grain Size							ASTM D422-63		
Reactive Sulfide	7.3.4.2						7.4.3.2		
PCBs - Additional Aroclors									
Aroclor 1262	608	8082A					8082A		
Aroclor 1268	608	8082A					8082A		

Accredited Analytes/Methods (by matrix)

TriMatrix Laboratoires, Inc.

Grand Rapids, MI

Analyte	Matrix								
	Aqueous						Solid		
Misc. Organics									
Ethane	RSK-175								
Ethylene	RSK-175								
Methane	RSK-175								
Additional Compounds									
Volatiles									
1,2-dibromo-3-chloropropane	8011								
1,2-dibromoethane	8011								
1,2,3-Trimethylbenzene			8260B					8260B	
1,4-dioxane			8260B					8260B	
1-chlorohexane			8260B					8260B	
sec-butanol		8015C	8260B				8015C	8260B	
2-chloro-1,3-butadiene (Chloroprene)			8260B					8260B	
2-methylnaphthalene			8260B					8260B	
2-nitropropane			8260B					8260B	
allyl chloride			8260B					8260B	
cyclohexane			8260B					8260B	
ETBE			8260B					8260B	
ethanol		8015C					8015C		
ethyl acetate			8260B					8260B	
ethyl ether			8260B					8260B	
ethyl methacrylate			8260B					8260B	
hexachloroethane			8260B					8260B	
hexane			8260B					8260B	
iodomethane			8260B					8260B	
isobutanol		8015C	8260B				8015C	8260B	
isopropanol		8015C	8260B				8015C	8260B	
methacrylonitrile			8260B					8260B	
methanol		8015C					8015C		
methyl acetate			8260B					8260B	
methyl methacrylate			8260B					8260B	
methylcyclohexane			8260B					8260B	
n-butanol		8015C	8260B				8015C	8260B	
n-butyl acetate			8260B					8260B	
n-propanol		8015C	8260B				8015C	8260B	

Analyte	**Matrix**								
	Aqueous						**Solid**		
propionitrile			8260B					8260B	
t-butanol		8015C	8260B				8015C	8260B	
tetrahydrofuran			8260B					8260B	
trans -1,4,dichloro-2-butene			8260B					8260B	
trichlorotrifluoromethane			8260B					8260B	
SVOCs - Base/Neutrals/Acids									
1,1'-Biphenyl			8270C				8270C		
1,2-Bis(2-chloroethoxy)ethane			8270C				8270C		
1,2-Diphenylhydrazine			8270C				8270C		
1,3 Dinitrobenzene			8270C				8270C		
1,4-Naphthoquinone			8270C				8270C		
1,4-Phenylenediamine			8270C				8270C		
1-Methylnaphthalene			8270C				8270C		
1-Naphthylamine			8270C				8270C		
1-Nitrosopyrrolidine			8270C				8270C		
2-Acetylaminofluorene			8270C				8270C		
2-Chloroaniline			8270C				8270C		
2-Naphthylamine			8270C				8270C		
2-Picoline			8270C				8270C		
3,3'-Dimethylbenzidine			8270C				8270C		
3-Methylchloanthrene			8270C				8270C		
4-Aminobiphenyl			8270C				8270C		
5-Nitro-o-toluidine			8270C				8270C		
7,12-Dimethylbenz(a)anthracene			8270C				8270C		
a,a-Dimethylphenethylamine			8270C				8270C		
Acetophenone			8270C				8270C		
Aramite			8270C				8270C		
Atrazine			8270C				8270C		
Benzaldehyde			8270C				8270C		
Bis(2-ethylhexyl) adipate			8270C				8270C		
Caprolactam			8270C				8270C		
Chlorobenzilate			8270C				8270C		
Diallate			8270C				8270C		
Dicyclohexyl Phthalate			8270C				8270C		
Ethyl Methacrylate			8270C				8270C		
Ethyl Methansulfonate			8270C				8270C		

Accredited Analytes/Methods (by matrix)

TriMatrix Laboratoires, Inc.

Grand Rapids, MI

Analyte	**Matrix**								
	Aqueous						**Solid**		
Famphur			8270C				8270C		
Hexachlorophene			8270C				8270C		
Hexachloropropene			8270C				8270C		
Isodrin			8270C				8270C		
Isosafrole			8270C				8270C		
Kepone			8270C				8270C		
Methapyrilene			8270C				8270C		
Methyl Methacrylate			8270C				8270C		
Methyl Methanesulfonate			8270C				8270C		
N-Nitroso-di-n-butylamine			8270C				8270C		
N-Nitrosomethylethylamine			8270C				8270C		
N-Nitrosomorpholine			8270C				8270C		
N-Nitrosopiperidine			8270C				8270C		
o,o,o-Triethylphosphorothioate			8270C				8270C		
p-Dimethylaminoazobenzene			8270C				8270C		
Phenacetin			8270C				8270C		
Pentachloroethane			8270C				8270C		
Pentachloronitrobenzene			8270C				8270C		
Pronamide			8270C				8270C		
Safrole			8270C				8270C		
Thionazin			8270C				8270C		
1,3,5-Trinitrobenzene			8270C				8270C		
Carbonyls									
Formaldehyde	8315A						8315A		
Acetaldehyde	8315A						8315A		
Propanal	8315A						8315A		
Crotonaldehyde	8315A						8315A		
Butanal	8315A						8315A		
Pentanal	8315A						8315A		
Cyclohexanone	8315A						8315A		
m-Tolualdehyde	8315A						8315A		
Hexanal	8315A						8315A		
Heptanal	8315A						8315A		
Octanal	8315A						8315A		
Nonanal	8315A						8315A		
Decanal	8315A						8315A		

NEW YORK STATE DEPARTMENT OF HEALTH
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Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. TOM C. BOOCHER
TRIMATRIX LABORATORIES, INC
5560 CORPORATE EXCHANGE CT SE
GRAND RAPIDS, MI 49512-5503

NY Lab Id No: 11776

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category

ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Acrylates	
Acrolein (Propenal)	EPA 624
	EPA 8260C
Acrylonitrile	EPA 624
	EPA 8260C
Ethyl methacrylate	EPA 8260C
Methyl acrylonitrile	EPA 8260C
Methyl methacrylate	EPA 8260C
Amines	
1,4-Phenylenediamine	EPA 8270D
1-Naphthylamine	EPA 8270D
2-Naphthylamine	EPA 8270D
4-Chloroaniline	EPA 8270D
4-Nitroaniline	EPA 8270D
5-Nitro-o-toluidine	EPA 8270D
Aniline	EPA 8270D
Carbazole	EPA 8270D
Methapyrilene	EPA 8270D
Pronamide	EPA 8270D
Propionitrile	EPA 8260C
Pyridine	EPA 8270D
Benzidines	
3,3'-Dichlorobenzidine	EPA 625
	EPA 8270D
3,3'-Dimethylbenzidine	EPA 8270D
Benzidine	EPA 625
Benzidines	
Benzidine	EPA 8270D
Chlorinated Hydrocarbon Pesticides	
4,4'-DDD	EPA 608
	EPA 8081B
4,4'-DDE	EPA 608
	EPA 8081B
4,4'-DDT	EPA 608
	EPA 8081B
Aldrin	EPA 608
	EPA 8081B
alpha-BHC	EPA 608
	EPA 8081B
alpha-Chlordane	EPA 8081B
beta-BHC	EPA 608
	EPA 8081B
Chlordane Total	EPA 608
	EPA 8081B
Chlorobenzilate	EPA 8270D
delta-BHC	EPA 608
	EPA 8081B
Diallate	EPA 8270D
Dieldrin	EPA 608
	EPA 8081B
Endosulfan I	EPA 608
	EPA 8081B

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Chlorinated Hydrocarbon Pesticides	
Endosulfan II	EPA 608
	EPA 8081B
Endosulfan sulfate	EPA 608
	EPA 8081B
Endrin	EPA 608
	EPA 8081B
Endrin aldehyde	EPA 608
	EPA 8081B
Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 608
	EPA 8081B
Heptachlor epoxide	EPA 608
	EPA 8081B
Lindane	EPA 608
	EPA 8081B
Methoxychlor	EPA 8081B
Toxaphene	EPA 608
	EPA 8081B
Chlorinated Hydrocarbons	
1,2,3-Trichlorobenzene	EPA 8260C
1,2,4,5-Tetrachlorobenzene	EPA 8270D
1,2,4-Trichlorobenzene	EPA 625
	EPA 8270D
2-Chloronaphthalene	EPA 625
Chlorinated Hydrocarbons	
2-Chloronaphthalene	EPA 8270D
Hexachlorobenzene	EPA 625
	EPA 8270D
Hexachlorobutadiene	EPA 625
	EPA 8270D
Hexachlorocyclopentadiene	EPA 625
	EPA 8270D
Hexachloroethane	EPA 625
	EPA 8260C
	EPA 8270D
Hexachloropropene	EPA 8270D
Pentachlorobenzene	EPA 8270D
Chlorophenoxy Acid Pesticides	
2,4,5-T	EPA 8151A
2,4,5-TP (Silvex)	EPA 8151A
2,4-D	EPA 8151A
2,4-DB	EPA 8151A
Dalapon	EPA 8151A
Dicamba	EPA 8151A
Dichloroprop	EPA 8151A
Dinoseb	EPA 8151A
Demand	
Biochemical Oxygen Demand	SM 18-21 5210B (01)
Carbonaceous BOD	SM 18-21 5210B (01)
Chemical Oxygen Demand	SM 18-21 5220D (97)

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Dissolved Gases	
Ethane	RSK-175
Ethene (Ethylene)	RSK-175
Methane	RSK-175
Fuel Oxygenates	
Di-isopropyl ether	EPA 8260C
Ethanol	EPA 8260C
Methyl tert-butyl ether	EPA 8260C
tert-butyl alcohol	EPA 8260C
Haloethers	
4-Bromophenylphenyl ether	EPA 625
	EPA 8270D
4-Chlorophenylphenyl ether	EPA 625
	EPA 8270D
Bis(2-chloroethoxy)methane	EPA 625
	EPA 8270D
Bis(2-chloroethyl)ether	EPA 625
	EPA 8270D
Bis(2-chloroisopropyl) ether	EPA 625
	EPA 8270D
Mineral	
Acidity	SM 18-21 2310B.4a (97)
Alkalinity	SM 18-21 2320B (97)
Chloride	EPA 300.0 Rev. 2.1
	EPA 9056A

Mineral	
Chloride	SM 18-21 4500-Cl- E (97)
Fluoride, Total	EPA 300.0 Rev. 2.1
	EPA 9056A
	SM 18-21 4500-F C (97)
Hardness, Total	SM 18-21 2340B (97)
	SM 18-21 2340C (97)
Sulfate (as SO4)	ASTM D516-90 02 & 07
	EPA 300.0 Rev. 2.1
	EPA 9056A
Nitroaromatics and Isophorone	
1,3,5-Trinitrobenzene	EPA 8330A
1,3-Dinitrobenzene	EPA 8330A
2,4,6-Trinitrotoluene	EPA 8330A
2,4-Dinitrotoluene	EPA 625
	EPA 8270D
	EPA 8330A
2,6-Dinitrotoluene	EPA 625
	EPA 8270D
	EPA 8330A
2-Amino-4,6-dinitrotoluene	EPA 8330A
2-Nitrotoluene	EPA 8330A
3-Nitrotoluene	EPA 8330A
4-Amino-2,6-dinitrotoluene	EPA 8330A
4-Nitrotoluene	EPA 8330A
Hexahydro-1,3,5-trinitro-1,3,5-triazine	EPA 8330A

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All approved analytes are listed below:

Nitroaromatics and Isophorone

Isophorone	EPA 625
	EPA 8270D
Methyl-2,4,6-trinitrophenylnitramine	EPA 8330A
Nitrobenzene	EPA 625
	EPA 8270D
	EPA 8330A
Octahydro-tetranitro-tetrazocine	EPA 8330A

Nitrosoamines

N-Nitrosodiethylamine	EPA 8270D
N-Nitrosodimethylamine	EPA 625
	EPA 8270D
N-Nitrosodi-n-butylamine	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 625
	EPA 8270D
N-Nitrosodiphenylamine	EPA 625
	EPA 8270D
N-nitrosomethylethylamine	EPA 8270D
N-nitrosopiperidine	EPA 8270D
N-Nitrosopyrrolidine	EPA 8270D

Nutrient

Ammonia (as N)	SM 18 4500-NH3 F or G
Kjeldahl Nitrogen, Total	EPA 351.2 Rev. 2.0
Nitrate (as N)	EPA 300.0 Rev. 2.1
	EPA 9056A
	SM 18-21 4500-NO3 F (00)

Nutrient

Nitrite (as N)	EPA 300.0 Rev. 2.1
	EPA 9056A
	SM 18-21 4500-NO2 B (00)
	SM 18-21 4500-NO3 F (00)
Orthophosphate (as P)	SM 18-21 4500-P E
Phosphorus, Total	SM 18-21 4500-P E

Petroleum Hydrocarbons

Diesel Range Organics	EPA 8015C
Gasoline Range Organics	EPA 8015C

Phthalate Esters

Benzyl butyl phthalate	EPA 625
	EPA 8270D
Bis(2-ethylhexyl) phthalate	EPA 625
	EPA 8270D
Diethyl phthalate	EPA 625
	EPA 8270D
Dimethyl phthalate	EPA 625
	EPA 8270D
Di-n-butyl phthalate	EPA 625
	EPA 8270D
Di-n-octyl phthalate	EPA 625
	EPA 8270D

Polychlorinated Biphenyls

PCB-1016	EPA 608

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ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Polychlorinated Biphenyls	
PCB-1016	EPA 8082A
PCB-1221	EPA 608
	EPA 8082A
PCB-1232	EPA 608
	EPA 8082A
PCB-1242	EPA 608
	EPA 8082A
PCB-1248	EPA 608
	EPA 8082A
	EPA 8270D
PCB-1254	EPA 608
	EPA 8082A
PCB-1260	EPA 608
	EPA 8082A
Polynuclear Aromatics	
Acenaphthene	EPA 625
	EPA 8270D
Acenaphthylene	EPA 625
	EPA 8270D
Anthracene	EPA 625
	EPA 8270D
Benzo(a)anthracene	EPA 625
	EPA 8270D
Benzo(a)pyrene	EPA 625
	EPA 8270D
Polynuclear Aromatics	
Benzo(b)fluoranthene	EPA 625
	EPA 8270D
Benzo(ghi)perylene	EPA 625
	EPA 8270D
Benzo(k)fluoranthene	EPA 625
	EPA 8270D
Chrysene	EPA 625
	EPA 8270D
Dibenzo(a,h)anthracene	EPA 625
	EPA 8270D
Fluoranthene	EPA 625
	EPA 8270D
Fluorene	EPA 625
	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 625
	EPA 8270D
Naphthalene	EPA 625
	EPA 8270D
Phenanthrene	EPA 625
	EPA 8270D
Pyrene	EPA 625
	EPA 8270D
Priority Pollutant Phenols	
2,3,4,6 Tetrachlorophenol	EPA 8270D
2,4,5-Trichlorophenol	EPA 8270D

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ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Priority Pollutant Phenols

2,4,6-Trichlorophenol	EPA 625
	EPA 8270D
2,4-Dichlorophenol	EPA 625
	EPA 8270D
2,4-Dimethylphenol	EPA 625
	EPA 8270D
2,4-Dinitrophenol	EPA 625
	EPA 8270D
2,6-Dichlorophenol	EPA 8270D
2-Chlorophenol	EPA 625
	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 625
	EPA 8270D
2-Methylphenol	EPA 8270D
2-Nitrophenol	EPA 625
	EPA 8270D
3-Methylphenol	EPA 8270D
4-Chloro-3-methylphenol	EPA 625
	EPA 8270D
4-Methylphenol	EPA 8270D
4-Nitrophenol	EPA 625
	EPA 8270D
Pentachlorophenol	EPA 625
	EPA 8270D
Phenol	EPA 625

Priority Pollutant Phenols

Phenol	EPA 8270D

Residue

Settleable Solids	SM 18-21 2540 F (97)
Solids, Total	SM 18-21 2540B (97)
Solids, Total Dissolved	SM 18-21 2540C (97)
Solids, Total Suspended	SM 18-21 2540D (97)

Semi-Volatile Organics

1,2-Dichlorobenzene, Semi-volatile	EPA 8270D
1,3-Dichlorobenzene, Semi-volatile	EPA 8270D
1,4-Dichlorobenzene, Semi-volatile	EPA 8270D
2-Methylnaphthalene	EPA 8270D
Acetophenone	EPA 8270D
Dibenzofuran	EPA 8270D

Volatile Aromatics

1,2,4-Trichlorobenzene, Volatile	EPA 8260C
1,2,4-Trimethylbenzene	EPA 8260C
1,2-Dichlorobenzene	EPA 624
	EPA 8260C
1,3,5-Trimethylbenzene	EPA 8260C
1,3-Dichlorobenzene	EPA 624
	EPA 8260C
1,4-Dichlorobenzene	EPA 624
	EPA 8260C
4-Chlorotoluene	EPA 8260C

Serial No.: 49624

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
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Revised October 03, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. TOM C. BOOCHER
TRIMATRIX LABORATORIES, INC
5560 CORPORATE EXCHANGE CT SE
GRAND RAPIDS, MI 49512-5503

NY Lab Id No: 11776

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category

ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Volatile Aromatics	
Benzene	EPA 624
	EPA 8260C
Bromobenzene	EPA 8260C
Chlorobenzene	EPA 624
	EPA 8260C
Ethyl benzene	EPA 624
	EPA 8260C
Isopropylbenzene	EPA 8260C
Naphthalene, Volatile	EPA 8260C
n-Butylbenzene	EPA 8260C
n-Propylbenzene	EPA 8260C
p-Isopropyltoluene (P-Cymene)	EPA 8260C
sec-Butylbenzene	EPA 8260C
Styrene	EPA 8260C
tert-Butylbenzene	EPA 8260C
Toluene	EPA 624
	EPA 8260C
Total Xylenes	EPA 624
	EPA 8260C

Volatile Halocarbons	
1,1,1,2-Tetrachloroethane	EPA 8260C
1,1,1-Trichloroethane	EPA 624
	EPA 8260C
1,1,2,2-Tetrachloroethane	EPA 624
	EPA 8260C

Volatile Halocarbons	
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C
1,1,2-Trichloroethane	EPA 624
	EPA 8260C
1,1-Dichloroethane	EPA 624
	EPA 8260C
1,1-Dichloroethene	EPA 624
	EPA 8260C
1,1-Dichloropropene	EPA 8260C
1,2,3-Trichloropropane	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8260C
1,2-Dibromoethane	EPA 8260C
1,2-Dichloroethane	EPA 624
	EPA 8260C
1,2-Dichloropropane	EPA 624
	EPA 8260C
1,3-Dichloropropane	EPA 8260C
2,2-Dichloropropane	EPA 8260C
2-Chloro-1,3-butadiene (Chloroprene)	EPA 8260C
2-Chloroethylvinyl ether	EPA 624
	EPA 8260C
3-Chloropropene (Allyl chloride)	EPA 8260C
Bromochloromethane	EPA 8260C
Bromodichloromethane	EPA 624
	EPA 8260C
Bromoform	EPA 624

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Volatile Halocarbons

Bromoform	EPA 8260C
Bromomethane	EPA 624
	EPA 8260C
Carbon tetrachloride	EPA 624
	EPA 8260C
Chloroethane	EPA 624
	EPA 8260C
Chloroform	EPA 624
	EPA 8260C
Chloromethane	EPA 624
	EPA 8260C
cis-1,2-Dichloroethene	EPA 8260C
cis-1,3-Dichloropropene	EPA 624
	EPA 8260C
Dibromochloromethane	EPA 624
	EPA 8260C
Dibromomethane	EPA 8260C
Dichlorodifluoromethane	EPA 8260C
Hexachlorobutadiene, Volatile	EPA 8260C
Methyl iodide	EPA 8260C
Methylene chloride	EPA 624
	EPA 8260C
Tetrachloroethene	EPA 624
	EPA 8260C
trans-1,2-Dichloroethene	EPA 624

Volatile Halocarbons

trans-1,2-Dichloroethene	EPA 8260C
trans-1,3-Dichloropropene	EPA 624
	EPA 8260C
trans-1,4-Dichloro-2-butene	EPA 8260C
Trichloroethene	EPA 624
	EPA 8260C
Trichlorofluoromethane	EPA 624
	EPA 8260C
Vinyl chloride	EPA 624
	EPA 8260C

Volatiles Organics

1,4-Dioxane	EPA 8260C
2-Butanone (Methylethyl ketone)	EPA 8260C
2-Hexanone	EPA 8260C
2-Nitropropane	EPA 8260C
4-Methyl-2-Pentanone	EPA 8260C
Acetone	EPA 8260C
Acetonitrile	EPA 8260C
Carbon Disulfide	EPA 8260C
Di-ethyl ether	EPA 8260C
Ethyl Acetate	EPA 8260C
Isobutyl alcohol	EPA 8260C
Isopropanol	EPA 8260C
n-Butanol	EPA 8260C
o-Toluidine	EPA 8270D

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Volatiles Organics	
Vinyl acetate	EPA 8260C
Wastewater Metals I	
Barium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Cadmium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Calcium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
Chromium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Copper, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Iron, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	SM 20-21 3500-Fe B (97)
Lead, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

Wastewater Metals I	
Lead, Total	EPA 6010C
	EPA 6020A
Magnesium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
Manganese, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Nickel, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Potassium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
Silver, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Sodium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
Strontium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
Wastewater Metals II	
Aluminum, Total	EPA 200.7 Rev. 4.4
	EPA 6010C

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Wastewater Metals II	
Antimony, Total	EPA 200.8 Rev. 5.4
	EPA 6020A
Arsenic, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Beryllium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Chromium VI	EPA 7196A
	SM 20-21 3500-Cr B (01)
Mercury, Low Level	EPA 1631E
Mercury, Total	EPA 245.1 Rev. 3.0
	EPA 7470A
Selenium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Vanadium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Zinc, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Wastewater Metals II	
Zinc, Total	EPA 6010C
	EPA 6020A
Wastewater Metals III	
Cobalt, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Molybdenum, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Thallium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Tin, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
Titanium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
Wastewater Miscellaneous	
Boron, Total	EPA 200.7 Rev. 4.4
Bromide	EPA 300.0 Rev. 2.1
	EPA 9056A
Color	SM 18-21 2120B (01)

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Wastewater Miscellaneous	
Cyanide, Available	OIA-1677
Cyanide, Total	EPA 9014
	SM 18-21 4500-CN E (99)
Oil and Grease Total Recoverable (HEM	EPA 1664A
Organic Carbon, Total	EPA 9060A
	SM 18-21 5310C (00)
Phenols	EPA 420.4 Rev. 1.0
	EPA 9065
Silica, Dissolved	SM 18-19 4500-Si D
Specific Conductance	SM 18-21 2510B (97)
Sulfide (as S)	SM 18-21 4500-S D (00)
	SM 19-21 4500-S F (00)
Surfactant (MBAS)	SM 18-21 5540C (00)
Total Organic Halides	EPA 9020B
Total Petroleum Hydrocarbons	EPA 1664A
Turbidity	SM 18-21 2130 B (01)
Sample Preparation Methods	
	EPA 200.2
	EPA 3010A
	EPA 3020A
	EPA 3510C
	EPA 5030C
	SM 18-20 4500-CN C

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ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved subcategories and/or analytes are listed below:

Amines

2-Nitroaniline	EPA 8270D
3-Nitroaniline	EPA 8270D

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ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Acrylates

Acrolein (Propenal)	EPA 8260C
Acrylonitrile	EPA 8260C
Ethyl methacrylate	EPA 8260C
Methyl acrylonitrile	EPA 8260C
Methyl methacrylate	EPA 8260C

Amines

1,2-Diphenylhydrazine	EPA 8270D
2-Nitroaniline	EPA 8270D
3-Nitroaniline	EPA 8270D
4-Chloroaniline	EPA 8270D
4-Nitroaniline	EPA 8270D
Aniline	EPA 8270D
Carbazole	EPA 8270D

Benzidines

3,3'-Dichlorobenzidine	EPA 8270D
Benzidine	EPA 8270D

Characteristic Testing

Ignitability	EPA 1020
Synthetic Precipitation Leaching Proc.	EPA 1312
TCLP	EPA 1311

Chlorinated Hydrocarbon Pesticides

4,4'-DDD	EPA 8081B
4,4'-DDE	EPA 8081B
4,4'-DDT	EPA 8081B

Chlorinated Hydrocarbon Pesticides

Aldrin	EPA 8081B
alpha-BHC	EPA 8081B
alpha-Chlordane	EPA 8081B
beta-BHC	EPA 8081B
Chlordane Total	EPA 8081B
delta-BHC	EPA 8081B
Dieldrin	EPA 8081B
Endosulfan I	EPA 8081B
Endosulfan II	EPA 8081B
Endosulfan sulfate	EPA 8081B
Endrin	EPA 8081B
Endrin aldehyde	EPA 8081B
Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 8081B
Heptachlor epoxide	EPA 8081B
Lindane	EPA 8081B
Methoxychlor	EPA 8081B
Toxaphene	EPA 8081B

Chlorinated Hydrocarbons

1,2,4,5-Tetrachlorobenzene	EPA 8270D
1,2,4-Trichlorobenzene	EPA 8270D
2-Chloronaphthalene	EPA 8270D
Hexachlorobenzene	EPA 8270D
Hexachlorobutadiene	EPA 8270D

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Chlorinated Hydrocarbons	
Hexachloroethane	EPA 8270D
Hexachloropropene	EPA 8270D
Chlorophenoxy Acid Pesticides	
2,4,5-T	EPA 8151A
2,4,5-TP (Silvex)	EPA 8151A
2,4-D	EPA 8151A
2,4-DB	EPA 8151A
Dalapon	EPA 8151A
Dicamba	EPA 8151A
Dichloroprop	EPA 8151A
Dinoseb	EPA 8151A
MCPA	EPA 8151A
MCPP	EPA 8151A
Haloethers	
4-Bromophenylphenyl ether	EPA 8270D
4-Chlorophenylphenyl ether	EPA 8270D
Bis(2-chloroethoxy)methane	EPA 8270D
Bis(2-chloroethyl)ether	EPA 8270D
Bis(2-chloroisopropyl) ether	EPA 8270D
Metals I	
Barium, Total	EPA 6010C
	EPA 6020A
Cadmium, Total	EPA 6010C
	EPA 6020A
Metals I	
Calcium, Total	EPA 6010C
Chromium, Total	EPA 6010C
	EPA 6020A
Copper, Total	EPA 6010C
	EPA 6020A
Iron, Total	EPA 6010C
Lead, Total	EPA 6010C
	EPA 6020A
Magnesium, Total	EPA 6010C
Manganese, Total	EPA 6010C
	EPA 6020A
Nickel, Total	EPA 6010C
	EPA 6020A
Potassium, Total	EPA 6010C
Silver, Total	EPA 6010C
	EPA 6020A
Sodium, Total	EPA 6010C
Strontium, Total	EPA 6010C
Metals II	
Aluminum, Total	EPA 6010C
Antimony, Total	EPA 6020A
Arsenic, Total	EPA 6010C
	EPA 6020A
Beryllium, Total	EPA 6010C
	EPA 6020A

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Metals II	
Chromium VI	EPA 7196A
Lithium, Total	EPA 6010C
Mercury, Total	EPA 7471B
Selenium, Total	EPA 6010C
	EPA 6020A
Vanadium, Total	EPA 6010C
	EPA 6020A
Zinc, Total	EPA 6010C
	EPA 6020A
Metals III	
Cobalt, Total	EPA 6010C
	EPA 6020A
Molybdenum, Total	EPA 6010C
	EPA 6020A
Thallium, Total	EPA 6010C
	EPA 6020A
Tin, Total	EPA 6010C
	EPA 6020A
Titanium, Total	EPA 6010C
Minerals	
Chloride	EPA 9056A
Fluoride, Total	EPA 9056A
Sulfate (as SO4)	EPA 9056A

Miscellaneous	
Boron, Total	EPA 6010C
Cyanide, Total	EPA 9014
Phenols	EPA 9065
Sulfide (as S)	EPA 9034
Nitroaromatics and Isophorone	
1,3,5-Trinitrobenzene	EPA 8330A
1,3-Dinitrobenzene	EPA 8330A
2,4,6-Trinitrotoluene	EPA 8330A
2,4-Dinitrotoluene	EPA 8270D
	EPA 8330A
2,6-Dinitrotoluene	EPA 8270D
	EPA 8330A
2-Amino-4,6-dinitrotoluene	EPA 8330A
2-Nitrotoluene	EPA 8330A
3-Nitrotoluene	EPA 8330A
4-Amino-2,6-dinitrotoluene	EPA 8330A
4-Nitrotoluene	EPA 8330A
Hexahydro-1,3,5-trinitro-1,3,5-triazine	EPA 8330A
Isophorone	EPA 8270D
Methyl-2,4,6-trinitrophenylnitramine	EPA 8330A
Nitrobenzene	EPA 8270D
	EPA 8330A
Octahydro-tetranitro-tetrazocine	EPA 8330A
Pyridine	EPA 8270D

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Nitrosoamines

N-Nitrosodiethylamine	EPA 8270D
N-Nitrosodimethylamine	EPA 8270D
N-Nitrosodi-n-butylamine	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 8270D
N-Nitrosodiphenylamine	EPA 8270D
N-nitrosomethylethylamine	EPA 8270D
N-nitrosomorpholine	EPA 8270D
N-nitrosopiperidine	EPA 8270D
N-Nitrosopyrrolidine	EPA 8270D

Nutrients

Nitrate (as N)	EPA 9056A
Nitrite (as N)	EPA 9056A

Petroleum Hydrocarbons

Diesel Range Organics	EPA 8015C
Gasoline Range Organics	EPA 8015C

Phthalate Esters

Benzyl butyl phthalate	EPA 8270D
Bis(2-ethylhexyl) phthalate	EPA 8270D
Diethyl phthalate	EPA 8270D
Dimethyl phthalate	EPA 8270D
Di-n-butyl phthalate	EPA 8270D
Di-n-octyl phthalate	EPA 8270D

Polychlorinated Biphenyls

PCB-1016	EPA 8082A

Polychlorinated Biphenyls

PCB-1221	EPA 8082A
PCB-1232	EPA 8082A
PCB-1242	EPA 8082A
PCB-1248	EPA 8082A
PCB-1254	EPA 8082A
PCB-1260	EPA 8082A

Polynuclear Aromatic Hydrocarbons

Acenaphthene	EPA 8270D
Acenaphthylene	EPA 8270D
Anthracene	EPA 8270D
Benzo(a)anthracene	EPA 8270D
Benzo(a)pyrene	EPA 8270D
Benzo(b)fluoranthene	EPA 8270D
Benzo(ghi)perylene	EPA 8270D
Benzo(k)fluoranthene	EPA 8270D
Chrysene	EPA 8270D
Dibenzo(a,h)anthracene	EPA 8270D
Fluoranthene	EPA 8270D
Fluorene	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 8270D
Naphthalene	EPA 8270D
Phenanthrene	EPA 8270D
Pyrene	EPA 8270D

Priority Pollutant Phenols

2,4,5-Trichlorophenol	EPA 8270D

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Priority Pollutant Phenols

2,4,6-Trichlorophenol	EPA 8270D
2,4-Dichlorophenol	EPA 8270D
2,4-Dimethylphenol	EPA 8270D
2,4-Dinitrophenol	EPA 8270D
2,6-Dichlorophenol	EPA 8270D
2-Chlorophenol	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 8270D
2-Methylphenol	EPA 8270D
2-Nitrophenol	EPA 8270D
3-Methylphenol	EPA 8270D
4-Chloro-3-methylphenol	EPA 8270D
4-Methylphenol	EPA 8270D
4-Nitrophenol	EPA 8270D
Pentachlorophenol	EPA 8270D
Phenol	EPA 8270D

Semi-Volatile Organics

1,2-Dichlorobenzene, Semi-volatile	EPA 8270D
1,3-Dichlorobenzene, Semi-volatile	EPA 8270D
1,4-Dichlorobenzene, Semi-volatile	EPA 8270D
2-Methylnaphthalene	EPA 8270D
Benzoic Acid	EPA 8270D
Benzyl alcohol	EPA 8270D
Dibenzofuran	EPA 8270D

Volatile Aromatics

1,2,4-Trichlorobenzene, Volatile	EPA 8260C
1,2,4-Trimethylbenzene	EPA 8260C
1,2-Dichlorobenzene	EPA 8260C
1,3,5-Trimethylbenzene	EPA 8260C
1,3-Dichlorobenzene	EPA 8260C
1,4-Dichlorobenzene	EPA 8260C
2-Chlorotoluene	EPA 8260C
4-Chlorotoluene	EPA 8260C
Benzene	EPA 8260C
Bromobenzene	EPA 8260C
Chlorobenzene	EPA 8260C
Ethyl benzene	EPA 8260C
Isopropylbenzene	EPA 8260C
Naphthalene, Volatile	EPA 8260C
n-Butylbenzene	EPA 8260C
n-Propylbenzene	EPA 8260C
p-Isopropyltoluene (P-Cymene)	EPA 8260C
sec-Butylbenzene	EPA 8260C
Styrene	EPA 8260C
tert-Butylbenzene	EPA 8260C
Toluene	EPA 8260C
Total Xylenes	EPA 8260C

Volatile Halocarbons

1,1,1,2-Tetrachloroethane	EPA 8260C
1,1,1-Trichloroethane	EPA 8260C
1,1,2,2-Tetrachloroethane	EPA 8260C

Serial No.: 49626

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013
Revised October 03, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. TOM C. BOOCHER
TRIMATRIX LABORATORIES, INC
5560 CORPORATE EXCHANGE CT SE
GRAND RAPIDS, MI 49512-5503

NY Lab Id No: 11776

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category

ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Volatile Halocarbons

1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C
1,1,2-Trichloroethane	EPA 8260C
1,1-Dichloroethane	EPA 8260C
1,1-Dichloroethene	EPA 8260C
1,1-Dichloropropene	EPA 8260C
1,2,3-Trichloropropane	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8260C
1,2-Dibromoethane	EPA 8260C
1,2-Dichloroethane	EPA 8260C
1,2-Dichloropropane	EPA 8260C
1,3-Dichloropropane	EPA 8260C
2,2-Dichloropropane	EPA 8260C
2-Chloro-1,3-butadiene (Chloroprene)	EPA 8260C
2-Chloroethylvinyl ether	EPA 8260C
3-Chloropropene (Allyl chloride)	EPA 8260C
Bromochloromethane	EPA 8260C
Bromodichloromethane	EPA 8260C
Bromoform	EPA 8260C
Bromomethane	EPA 8260C
Carbon tetrachloride	EPA 8260C
Chloroethane	EPA 8260C
Chloroform	EPA 8260C
Chloromethane	EPA 8260C
cis-1,2-Dichloroethene	EPA 8260C
cis-1,3-Dichloropropene	EPA 8260C

Volatile Halocarbons

Dibromochloromethane	EPA 8260C
Dibromomethane	EPA 8260C
Dichlorodifluoromethane	EPA 8260C
Hexachlorobutadiene, Volatile	EPA 8260C
Methylene chloride	EPA 8260C
Tetrachloroethene	EPA 8260C
trans-1,2-Dichloroethene	EPA 8260C
trans-1,3-Dichloropropene	EPA 8260C
trans-1,4-Dichloro-2-butene	EPA 8260C
Trichloroethene	EPA 8260C
Trichlorofluoromethane	EPA 8260C
Vinyl chloride	EPA 8260C

Volatile Organics

1,4-Dioxane	EPA 8260C
2-Butanone (Methylethyl ketone)	EPA 8260C
2-Hexanone	EPA 8260C
2-Nitropropane	EPA 8260C
4-Methyl-2-Pentanone	EPA 8260C
Acetone	EPA 8260C
Acetonitrile	EPA 8260C
Carbon Disulfide	EPA 8260C
Ethyl Acetate	EPA 8260C
Isobutyl alcohol	EPA 8260C
Isopropanol	EPA 8260C
Methyl tert-butyl ether	EPA 8260C

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Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

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Volatile Organics

o-Toluidine	EPA 8270D
Propionitrile	EPA 8260C
tert-butyl alcohol	EPA 8260C
Vinyl acetate	EPA 8260C

Sample Preparation Methods

	EPA 3010A
	EPA 3020A
	EPA 3050B
	EPA 3545A
	EPA 3550C
	EPA 3580A
	EPA 3585
	EPA 5035A-H
	EPA 5035A-L
	EPA 9030B

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